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Temporary migration decisions and effects on household income and diets in rural Bangladesh

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Abstract

Temporary migration is a widely observed phenomenon among poor rural households, mostly related to agricultural seasonality. However, household preferences for temporary migration in comparison to longer-term migration, and the differential effects of these migrations on household livelihoods are not yet well understood. Here, we use survey data collected in northern rural Bangladesh to analyze determinants of households' choice between temporary and longer-term migration, and their comparative effects on various livelihood indicators, with a particular focus on agricultural lean periods. Issues of selection bias and endogeneity are addressed with Heckman selection models and instrumental variables. We show that temporary migration is more common than longer-term migration, partly determined by family demographic and farm-labor constraints. Although longer-term migration has larger positive effects on household income, temporary migration has larger positive effects on food consumption and dietary quality during lean periods. These results suggest that temporary migration is an important mechanism for the rural poor to smooth consumption and deserves more attention by researchers and policy-makers.

Keywords: Temporary migration; Agricultural lean periods; Food security; Nutrition; Bangladesh.

JEL Codes: R23, J43, Q18

1. Introduction

Severe labor market imperfections often induce migration among poor rural households in order to increase and diversify income, and mitigate risks (Mishra, 2016; Murrugarra et al., 2011; Stark & Bloom, 1985). In-country migration can be temporary, longer term, or permanent. Temporary migration is a more common risk-coping strategy for the rural poor, and much bigger in size in developing economies, yet largely under-researched (Coffey et al., 2014; Keshri & Bhagat, 2013; Khandker & Mahmud 2012; Lucas, 2015; Sucharita 2020). In fact, temporary migration often remains 'invisible' in poverty economics, as it is seldom properly accounted for in household surveys and censuses due to its transient nature. In this paper, we analyze household-level determinants and effects of temporary migration with primary survey data.

Specifically, we examine household decisions for short-term temporary migration and longer-term migration, and compare their effects on households' dietary quality and income during agricultural lean periods. During these periods, many poor households in agrarian societies experience income constraints and nutrition shortfalls (Khandker et al., 2012; Lomborg 2016; Raihan, 2022; Zug, 2006). Our study focuses on northern Bangladesh, a region with strong agricultural seasonality and recurrent temporary migration (Khandker et al., 2012).

Existing studies on the determinants and effects of migration mostly focus on longer-term migration, which differs from temporary migration in many ways (Chen et al., 2019; Keshri & Bhagat, 2013; Shahriar et al., 2006). For example, while neoclassical theories of migration predict that the rural poor would migrate to urban areas with higher mean wages, in Bangladesh, majority of temporary migrants migrate to other rural areas to work in agriculture (Meghir et al., 2022), although mean wages in urban areas are almost twice as high as those in the countryside (Lagakos et al., 2023). Furthermore, Lucas (2015) found that – unlike longer-term migration – temporary migration is primarily driven by job availability at the destination rather than wage differentials between the origin and destination.

Several studies have analyzed determinants of temporary migration (Asefawu & Nedessa, 2022; Dodd et al., 2016; Keshri & Bhagat, 2013; Khandker et al., 2012; Shahriar et al., 2006; Sucharita, 2020), and a few have also looked at effects (Bryan et al., 2014; de Brauw & Harigaya, 2007; Gibson & McKenzie, 2014; Khandker et al., 2012). However, these studies mainly compare temporary migration with non-migration, leaving a conceptual gap in understanding the choice of temporary migration as opposed to longer-term migration, which is also important to comprehend the behavior and effects of migration (Chen et al., 2019). Research suggests that – unlike longer-term migration – temporary migration typically cannot lift households out of poverty (Dash, 2023; Mishra, 2016). This raises a question about why many poor rural households still choose temporary over longer-term migration, when they opt for migration.

In their research in Bangladesh, Bryan et al. (2014) show that temporary migration can mitigate hunger by increasing caloric intake during lean periods. However, caloric intake is

only one dimension of nutrition and not necessarily a good indicator of dietary quality. Poor households heavily rely on cheap staple foods to obtain sufficient calories but lack important nutrients, such as proteins, vitamins, and minerals (Ritchie, 2021). Protein and micronutrient deficiencies are particularly pronounced during agricultural lean periods and can have long-term negative health consequences (Lomborg, 2016; Raihan, 2022). To our knowledge, effects of temporary migration on dietary quality have not been analyzed before. Nor are we aware of studies comparing the livelihood effects of temporary migration with those of longer-term migration, as we do here.

We pursue two research objectives: First, we identify factors explaining why rural households choose temporary over longer-term migration. Second, we investigate and compare the effects of temporary migration and longer-term migration on households' dietary quality and income during lean periods. The results can advance the research direction on the economics of migration. In addition, they can be interesting and relevant from a policy perspective. The phenomenon of temporary migration is often overlooked by policy-makers. In Bangladesh, for instance, policy-makers suddenly realized during the COVID-19 shutdown that the rice in some parts of the country could not be harvested due to the shortage of migrant laborers. Temporary migration was then allowed sporadically to help in the harvest (Rahman et al., 2022), but the perspectives of the temporary migrants themselves are still disregarded in national policies.

The rest of this paper is organized as follows: Section 2 elaborates the conceptual framework. Section 3 explains the data collection and the econometric models used for the empirical analysis. Section 4 presents and discusses the results, while section 5 concludes the study.

2. Conceptual framework

Our study is embedded in the theory of the 'new economics of labor migration' (NELM). Moving beyond traditional economic models that portray migration as an individual decision based on wage differentials (Todaro, 1969), NELM considers migration as a collective decision made by the household (Abreu, 2012; Stark & Bloom, 1985). We conceptualize three fundamental factors that explain households' migration decisions. Firstly, NELM suggests that incomplete labor markets at the origin can lead to relative deprivation, motivating households to send migrants to improve their economic well-being. Secondly, migrant networks are a form of social capital, providing information and support, thus facilitating households' migration decisions. Thirdly, households are risk-averse and mutually interdependent units that make migration decisions collectively based on risks and constraints (Stark & Bloom, 1985).

While NELM can explain the migration behavior of poor rural households in general, we investigate whether its fundamental factors can also explain temporary migration decisions. Accordingly, we analyze if market incompleteness (e.g., seasonal shortfalls of employment and wages), the size of personal migrant networks, and family constraints motivate households to choose temporary over longer-term migration.

Intuitively, the effects of family constraining factors for temporary and longer-term migration may differ. For instance, a small household with demographic or farm-labor constraints may be less likely to send migrants than a large household in general (cf. Konseiga, 2005). Nevertheless, if the small household still opts for migration, it may prefer sending temporary migrants, to maximize utility without exacerbating its constraints at the origin. Similarly, trust among neighbors can be another important factor in migration decisions (Konseiga, 2005), as neighbors can look after the family during migration, alleviating the migrant's anxiety about leaving family behind. While distrust among neighbors can discourage participation in migration in general, we can anticipate it encouraging short-durational temporary over longer-term migration.

A few previous studies examined how such constraining factors influence temporary migration decisions, yielding mixed results (Coffey et al., 2014; Dodd et al., 2016; Konseiga, 2005; Shonchoy, 2015; Sucharita, 2020). These studies mainly compared temporary migration to non-migration. Also, while defining temporary migration, some of these studies excluded migration for less than 30 days, while others included migration of more than six months, which is beyond the typical lean period of 2-3 months in most agrarian regions.

To avoid ambiguity, we make two key adjustments. Firstly, we align the definition of temporary migration with the lean period duration of 2-3 months in northern Bangladesh, and clearly differentiate between temporary and longer-term migration. We define temporary migration as an income-driven movement of individuals outside of their own village for up to three months, after which they return to their village and engage actively in the local labor market. In contrast, longer-term migration is made for more than three months

period. Longer-term migrants may sporadically visit their family at the origin villages, yet without actively participating in the local labor market during those visits. Secondly, we contrast temporary migration with longer-term migration decisions.

We broadly consider two groups of households: those sending migrants in search of income (i.e., 'economic migration'), and those sending no migrants (Figure 1). Economic migration can be for skilled labor (e.g., a household member with higher education migrating to the capital city or going abroad) and for unskilled labor (not requiring specific formal education). Both types of migration can be quite different in terms of their determinants and effects. Here, we focus on unskilled economic migration (blue circles in Figure 1), which is more widely observed in rural Bangladesh, and is applicable for both longer-term and temporary migration.

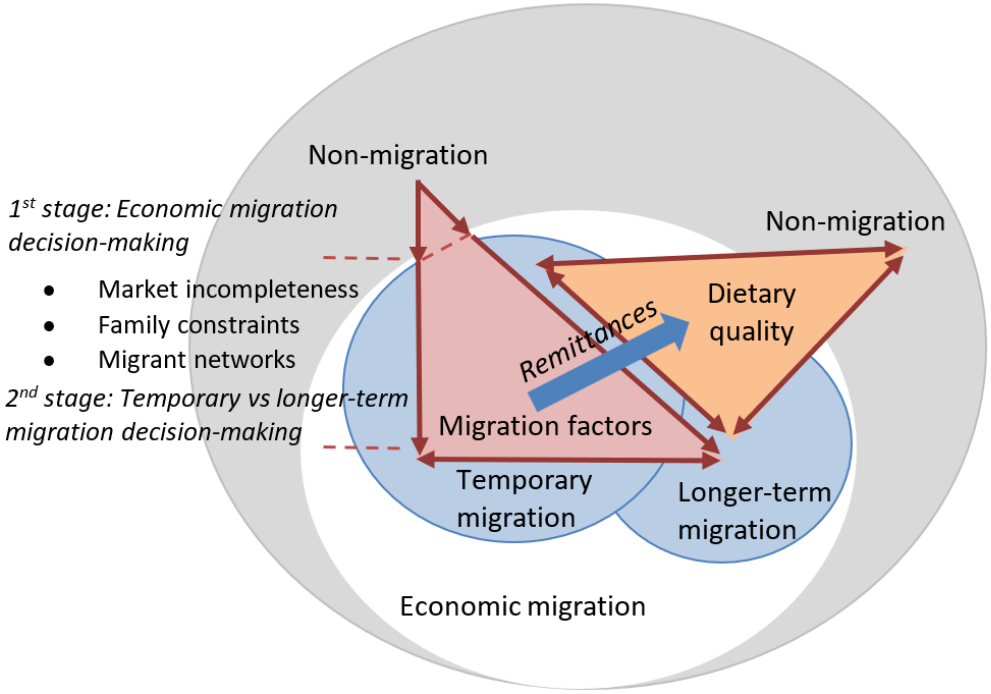

Figure 1: Conceptual framework

We further conceptualize economic migration as a two-stage decision-making process (Figure 1). In the first stage, a household decides whether to participate in economic migration at all, regardless of the type of migration. In the second stage, depending on the first stage being positive, the household may evaluate their capabilities, opportunities, and risks to decide whether to participate in longer-term or temporary migration.

We expect that seasonality in income, wages, and job opportunities at the origin is an important factor for economic migration decisions, especially for temporary migration, as this type of migration is primarily responsive to earning prospects and changing opportunity costs at home (Coffey et al., 2014; Chen et al., 2019). Agrarian communities often experience pronounced lean periods between planting and harvesting crops, leading to temporary income and employment shortages for agriculture-dependent households (Khandker &

Mahmud, 2012; Khandker et al., 2012; Zug, 2006). In northern Bangladesh, such lean period occurs twice a year, each lasting 2-3 months (Bryan et al., 2014; Gill et al., 2003), when temporary migration becomes a major coping strategy (Khandker & Mahmud, 2012). However, lean periods may also get prolonged beyond three months due to weather extremes – such as droughts or heavy rains and floods, which may possibly lead to the preference for longer-term migration.

Migrant networks constitute another cornerstone of NELM in explaining migration decisions. This network can either be family or friends at the destination to help with finding jobs or also persons from the origin to join the individual for group migration. In line with the existing literature (de Brauw & Harigaya, 2007; Khandker et al., 2012; Stark & Bloom, 1985), we hypothesize that the size of such networks influences migration decisions. We also investigate whether migrant networks influence the decision to participate in temporary versus longer-term migration.

In terms of the effects of migration, we hypothesize that economic migration has positive effects on household income and nutrition. Previous research suggests that temporary migration may smoothen food consumption and improve caloric intake during lean periods (Bryan et al., 2014; Khandker et al., 2012). We investigate whether positive effects are also observed for household's dietary quality in terms of consuming nutrient-rich foods during lean periods. An interesting question in this regard is whether temporary migration has different effects than longer-term migration. Longer-term migration may be a household strategy to increase income in general, independent of seasonality, whereas temporary migration is primarily a household strategy to cope with seasonality (Khandker et al., 2012; Coffey et al., 2014). Against this background, the lean-period dietary effects of temporary migration may possibly be larger than those of longer-term migration.

3. Materials and methods

3.1 Data

We use primary household survey data collected in northern Bangladesh in 2023 employing a multi-stage sampling procedure. We collected data in Rangpur Division, the so-called northern Bangladesh, holding the highest proportion of agricultural labor-dependent households that are more vulnerable to agricultural lean periods (BBS, 2022; Khandker & Mahmud, 2012). Non-agricultural job opportunities in Rangpur are meagre, so temporary migration during agricultural lean periods is common (Khandker et al., 2012). This makes Rangpur a compelling area for investigating temporary migration decisions and effects.

Rangpur comprises eight districts, among which, we purposively chose Dinajpur and Kurigram, the two poorest districts with the highest proportion of agricultural labor-dependent households in the division (BBS, 2022; Hossain & Hossen, 2020). Dinajpur has a total of 2,131 villages, from which we randomly selected 16 for our survey, whereas Kurigram has a total of 1,872 villages, from which we randomly selected 14, resulting in a total of 30 survey villages (Figure 2).

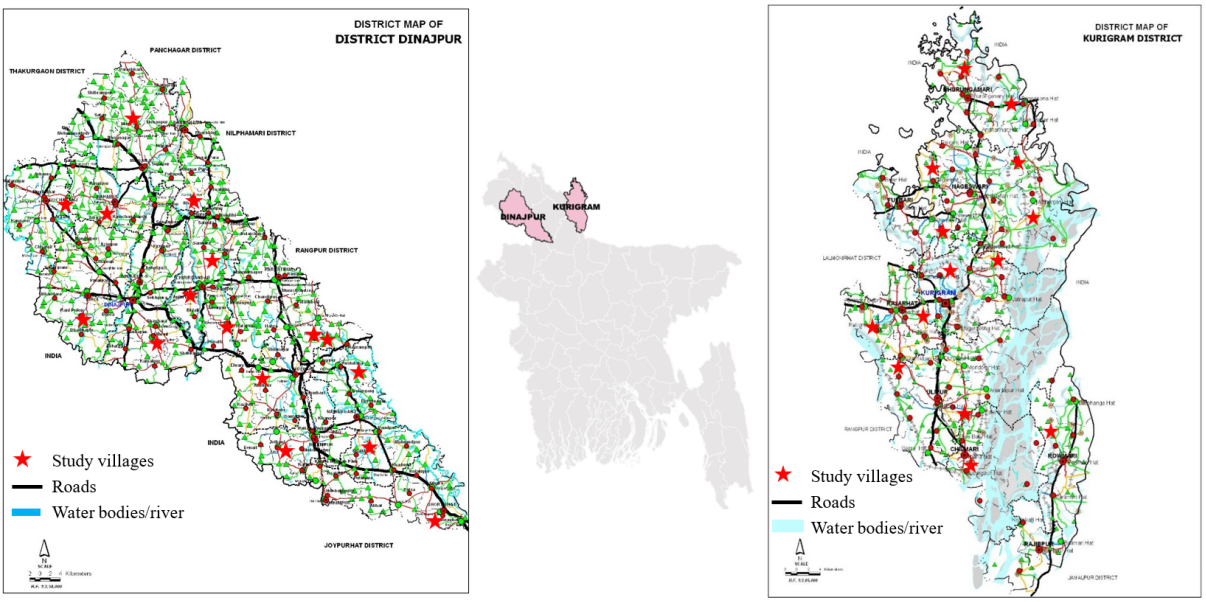

Figure 2: Geographic locations of study villages (Map sources: LGED Bangladesh)

In all 30 villages, we obtained complete household lists from the local government offices, known as the *union parishad* offices. According to these lists, 7,441 households reside in the 30 survey villages. Power calculations with a 99% confidence level and a 5% margin of error suggested that we should survey a minimum of 612 households. To be on the safe side, we randomly selected 10% of the households in each village plus some replacement households in the case of non-responses or missing data. We surveyed a total of 878 households.

The interviews were carried out in the local language using a structured questionnaire developed for this purpose and programmed in surveyCTO. Our questionnaire captured data

on household assets, socio-demographic details, farming and labor participation for the last 12 months, household members' migration details for the last 12 months, migrant networks, and households' employment, income and food consumption during normal and lean periods of the preceding year.

There are two dominant lean periods in the study region: the *Aman* lean from September through November, occurring between planting and harvesting of the *Aman* crop, and the *Boro* lean from February through April, transpiring between planting and harvesting of the *Boro* crop (Gill et al., 2003; Zug, 2006). The survey was conducted during the *Aman* planting period (June-August 2023), known as the 'normal period,' when most temporary migrants are in their home villages to harvest *Boro* and plant *Aman* crops. The interviews were conducted mostly with the migrant member or household heads. However, the questions on food consumption were asked to a person present in the household during all periods of the year, often the spouse of the household head.

In the full household sample (n=878), 27 households were involved in migration by sending skilled migrants. As this is different from unskilled migration, we excluded these households for this analysis. Moreover, there were 19 households in the sample that simultaneously sent temporary and longer-term unskilled migrants during the last 12 months. These households were also excluded, as we want to compare the decisions for and effects of temporary and longer-term migration. We use the remaining 832 households for our analysis, including 461 households with unskilled migrants (either temporary or longer-term) and 371 households without migrants during the preceding 12 months.

3.2 Modeling migration decisions

We want to explain households' migration decisions, which – as discussed earlier – we conceptualize as a two-stage process. In the first stage, a household decides whether to participate in any type of economic migration, whereas in the second stage, conditional on a positive first-stage decision, it decides whether to participate either in longer-term or in temporary migration. As both stages are not independent, we employ a Heckman selection model for estimation. In the first-stage selection equation (equation 1), we use the full sample (n=832) with any unskilled economic migration of household *i* (M_i) as the binary dependent variable. In the second stage outcome equation (equation 2), we use the subsample of households participating in migration (n=461), where the binary dependent variable is the household *i*'s participation in temporary migration (TM_i) versus longer-term. The selection effect (inverse Mills ratio- IMR) generated from the selection equation is included on the right-hand side of the outcome equation (Heckman, 1979). The explanatory variables in both equations build on NELM and our conceptual framework.

$$M_i = \beta_0 + \beta_1 ES_i + \beta_2 FDC_i + \beta_3 FLC_i + \beta_4 MN_i + \beta_x X_i + \beta_e EV_i + e_i \quad (1)$$

$$TM_i = \delta_0 + \delta_1 ES_i + \delta_2 FDC_i + \delta_3 FLC_i + \delta_4 MN_i + \delta_x X_i + \delta_\lambda \lambda_i + \varepsilon_i \quad (2)$$

where ES_i is a vector of variables indicating employment seasonality for household i, MN_i is the size of the migrant network, FDC_i is a vector of family demographic constraints, and FLC_i represents possible farm labor constraints. These variables and their expected effects on M_i and TM_i are explained in more detail in Table 1. Moreover, we control for other relevant household- and village-level factors, X_i, including household head's age and education, household wealth, access to microcredit and safety nets, and the size of village, among others.

Table 1: Key explanatory variables and their expected effects on migration decisions

Variable	Definition	Expected sign
Employment seasonality (ES_i)		
Seasonal employment shortfall	Finding daily wage opportunities is 'easy' during normal period but 'difficult' during lean periods† (0/1)	+ for M and TM
Wage gap	Difference in daily wage experienced between normal and lean period (Bangladeshi Taka, BDT)	+ for M and TM
Flood vulnerability	Household is located in flood-prone village (0/1)	+ for M, - for TM
Family demographic constraints (FDC_i)		
Small household	Household has up to four members (0/1)	- for M, + for TM
Elderly member	Household has at least one member above 60 years (0/1)	- for M, + for TM
Children	Household has a child below 10 years (0/1)	- for M, + for TM
Adolescent girl	Household has a female member aged 10-19 years (0/1)	- for M, + for TM
Distrust in neighbors	Household distrusts neighbors for looking after their family (0/1)	- for M, + for TM
Farm labor constraints (FLC_i)		
Crop farming	Household is engaged in crop farming (0/1)	- for M, + for TM
Livestock farming	Household has livestock (0/1)	- for M, + for TM
Migration networks (MN_i)		
Migrant networks	Number of relatives/friends that the household can get support from during migration	+ for M and TM

Notes: M, any unskilled migration; TM, temporary migration. †For each household, we asked whether they found daily labor opportunities locally in the origin village during the time of the survey (normal period) and during the preceding lean periods. Responses were recorded on a scale of 1 to 10, where 1 indicates 'very difficult,' and 10 'very easy.' Response above 5 were categorized as 'easy', and up to 5 as 'difficult'.

EV_i in equation (1) is an exclusion variable, which is required for the correct specification of the Heckman model. It should influence the migration decision in equation (1), but not the decision for the type of migration in equation (2). In rural Bangladesh, membership in local community institutions (e.g., mosques/temple, educational institutions) depends primarily on the individual's integrity and the households' social respect in the community. Such membership bestows social status, which may discourage households to participate in unskilled migration (equation 1), as such migration is sometimes associated with social stigma in the local context. However, the social stigma applies to both temporary and longer-term migration. Therefore, the membership in community institutions is not expected to play a significant role in equation (2). Table A1 in the Appendix confirms that membership differs significantly between migrant and non-migrant households, but not between households participating in temporary and longer-term migration. λ_i in equation (2) is the IMR.

Due to the relatively large number of explanatory variables included in the two-step Heckman model, we tested for multicollinearity by calculating variance inflation factors. These are shown in Table A2 in the Appendix. They do not indicate a high correlation among our explanatory variables.

3.3 Modeling effects of migration on income and dietary quality

We want to estimate and compare the effects of temporary migration (TM_i) and longer-term migration (LM_i) on income and dietary quality. The general idea is captured in the following regression model:

$$Y_{il} = \theta_0 + \theta_1 TM_i + \theta_2 LM_i + \theta_z Z_i + \mu_i \quad (3)$$

where Y_{il} is income or dietary quality of household *i* during lean period *l*. As mentioned, we are particularly interested in the lean-period outcomes, as temporary migration is primarily a strategy of seasonal income and consumption smoothing. Z_i is a vector of control variables, and μ_i is a random error term.

The problem with equation (3) is that TM_i and LM_i are endogenous. Migration decisions may be influenced by unobserved characteristics, such as individual motivation or risk attitudes, which may also be correlated with the outcome variables. Such endogeneity would lead to biased estimates. We address this issue by using a multinomial endogenous switching regression (MESR) model (Khonje et al., 2018; Kumar et al., 2019; Manda et al., 2021). In the first stage, we estimate a multinomial logit selection (MNLS) model to explain the household's participation in different types of migration (Dubin & McFadden, 1984). In the second stage, the effects of participating in temporary and longer-term migration on lean-period income and dietary quality are estimated by including the IMR from the first-stage MNLS.

For a more robust estimate, we use an instrumental variable (IV) in the first-stage equation. We use the village proportion of unskilled economic migrant-sending households as our IV. Similar IVs were also used in numerous other migration studies (Hossain et al., 2023; Mendola, 2008; Mishra et al., 2022; Rahman, 2022). The village proportion of migrant-sending households is expected to influence individual migration decisions through local networking effects. At the same time, the IV is not expected to influence individual households' income or diets through other channels.

In principle, it is possible that the exclusion restriction would not hold, because it could be that villages with higher migration proportions are generally better off due to regional conditions, past remittances, or increased off-farm wages because of labor shortages. However, in our regressions we control for regional conditions. Moreover, comparing population growth projections and migration rates in Bangladesh, the wage effects of migration in origin villages seem to be very small (Hossain et al., 2023). Given that much of the unskilled migration is temporary, with migrants returning to their origin villages during labor peaks, significant local labor shortages should not be expected.

We also tested the validity of our IV. Table A3 in the Appendix shows the first-stage MNLS

results, confirming the relevance of the IV. Table A4 in the Appendix shows results from a falsification test (Khonje et al., 2018; Manda et al., 2021), confirming that the IV is not correlated with the outcome variables for the subsample of non-migrants. This suggests that the only possible effect of the IV on the outcomes would be through households' own migration decisions, pointing to the validity of the IV.

The MESR model that we estimate is specified as follows:

Fist stage: $M_i = \omega_0 + \omega_1 S_j + \vartheta_i$ (4)

Second stage: $Y_{il} = \theta_0 + \theta_1 M_{il} + \theta_z Z_i + \theta_\lambda \lambda_i + \mu_i$ (5)

where M_i denotes household *i's* participation in temporary or longer-term migration, S_i is a vector or variables explaining migration, including the IV, and λ_i is the IMR from the MNLS.

The MESR model simultaneously estimates the expected actual outcomes for participating in temporary and longer-term migration, and the counterfactual predicted outcomes without migration. The difference between these two outcomes (actual-counterfactual) indicates the average treatment effect of that type of migration (ATT), denoted by θ_1 in equation (5). We report and compare the ATT for temporary and longer-term migration.

Rigorous causal identification is difficult with cross-section observational data, because the validity of the IV cannot be proven with certainty. Therefore, we carry out a robustness check with an alternative method. We employ the inverse probability weighting with regression adjustment (IPWRA) method. While this method does not rely on the validity of an IV, it cannot fully control for all sources of endogeneity. Hence, the IPWRA approach is not better than the MESR. Nevertheless, obtaining consistent results with two different methods would provide further trust in the reliability of the findings.

3.4 Measuring income and dietary quality

We expect that the main effect of temporary or longer-term migration on household income will be through remittances, including money sent home and brought home by the migrant household members. In the evaluation of the effects, we are particularly interested in the income earned during the lean periods. During the survey, we collected information on all sources of income (farm, off-farm and self-employment income, remittances, transfers, and other income) and their magnitude during the normal and lean periods of the preceding year. For our evaluation, we look at the total household income earned during the last two lean periods combined, the *Boro* and the *Aman* lean. As mentioned, the lean periods are those during which most of the temporary migration occurs. The income is measured in 1000 Bangladeshi Taka (BDT).

To measure dietary quality, we use data collected on household-level food consumption over 7-day recall periods. First, we collected data on the frequency of consuming various food groups during the last 7 days prior to the interview, which serves to represent household diets during the normal period. Second, we collected recall data on the frequency of food group

consumption during a typical week in the last lean period[1]. Using these data and following WFP (2009) guidelines, we calculate three concrete dietary quality indicators, namely the food consumption score (FCS), the protein consumption score (PCS), and the temporary protein shortfall (TPS), all three referring to household consumption during the lean period[2]. These three indicators are explained in more detail below.

The FCS is a composite dietary quality indicator based on the weekly consumption frequency of nine food groups which are weighted by their nutritional importance. The nine food groups and their weighting factors are shown in Table 2. The weighting puts particular emphasis on the nutrient density of food groups, with nutrient-dense animal-sourced foods receiving higher weights and nutrient-poor foods receiving lower or zero weights. The FCS for each household is calculated by multiplying the weekly consumption frequency of a food group by the weighting factor and adding these products up for all nine food groups. Thus, the possible values of the FCS range between 0 and 112 (when all food groups are consumed on 7 days per week). The PCS is calculated in the same way but only considering the protein-rich food groups 1-3 in Table 2. Possible values of the PCS therefore range between 0 and 77.

Table 2: Food groups for calculating the food consumption score (FCS)

	Food group	Frequency of weekly consumption	Weighting factor
1	Meat, fish, eggs	0-7	4
2	Milk, dairy products	0-7	4
3	Legumes, pulses	0-7	3
4	Staples (grains, roots, tubers)	0-7	2
5	Vegetables	0-7	1
6	Fruits	0-7	1
7	Oils, fats	0-7	0.5
8	Sugar, sweets	0-7	0.5
9	Condiments	0-7	0

Source: Based on WFP (2009).

While FCS and PCS are useful for analyzing the effects of migration on dietary quality during the lean period, we are also interested in understanding the effects of migration on possible consumption shortfalls during lean periods in relation to normal consumption in the local context. This is expressed by the TPS, which we calculate as follows (Kafle et al., 2020):

$$TPS_{ijl-n} = PCS_{jn} - PCS_{il} \quad (6)$$

[1] The last lean period from the time of the survey was the *Boro* lean, to which the recall questions referred. Only for households that had sent a temporary migrant during the last *Aman* lean and not the *Boro* lean, we collected data on food consumption during the *Aman* lean. We asked households to refer to a typical week in the second half of the lean period, when food stocks from own production are particularly low and when possible migrant remittances are already available.

[2] Another indicator that has become popular in recent research to proxy household food access and dietary quality is the household dietary diversity score (HDDS) (Fongar et al., 2019; Vaitla et al., 2017). HDDS simply counts the number of food groups consumed by the household over a specified recall period, so the data requirements are low. One drawback of the HDDS is that it neither considers the quantity nor the frequency of food group consumption. As we have data on the frequency of food group consumption, we use different indicators that offer more information on dietary quality.

where TPS_{ijl-n} is the temporary protein shortfall of household *i* residing in village *j* during lean period *l* in relation to normal period *n*, PCS_{jn} is the average protein consumption score in village *j* during normal period *n*, and PCS_{ijl} is the protein consumption score of household *i* from village *j* during lean period *l*. Positive values of TPS_{ijl-n} indicate the existence of temporary shortfalls, whereas values at or below zero indicate no shortfall.

4. Results

4.1 Descriptive statistics

In our sample of 832 households, 461 (55%) participated in any form of migration during the 12 months prior to the interview, while 371 (45%) did not. Among the migrant households, 338 participated in temporary migration (41% of the total sample, 73% of the migrants), and 123 in longer-term migration (15% of the total sample, 27% of the migrants).

Most of the temporary migration occurs during the *Boro* lean. Around 81% of the temporary migrant households in our sample sent a migrant during the *Boro* lean, 64% during the *Aman* lean, and 49% during both lean periods. More than two-thirds of the temporary migrants migrated for relatively short periods of less than 30 days per episode.

Summary statistics of key explanatory variables for migration decision-making are shown in Table A5 in the Appendix. A test of mean differences mostly supports our hypothesized associations with indicators of employment seasonality, family demographic and farm labor constraints, and migration networks.

Table A6 in the Appendix shows summary statistics of households' weekly consumption frequency of various food groups, and their FCS and PCS during normal and lean periods. Staples, and oils and fats are consumed daily by almost all sample households throughout the year. However, notable seasonal consumption differences are observed for most nutrient-dense food groups. For the total sample, FCS and PCS are significantly lower during lean than during normal periods. This is also observed for the subsamples of non-migrant and longer-term migration households. However, strikingly for temporary migration households, the opposite is true: FCS and PCS are higher during the lean. Also, compared to the other two groups, temporary migration households have better dietary quality during the lean period (Table A7).

Table A7 in the Appendix also shows mean incomes of the three subsamples during the lean periods (as mentioned above, we calculate combined income during both lean periods of the year prior to the survey). The lean period income of temporary migration households is around BDT 62 thousand (USD$ 563) on average, slightly higher than that of non-migrant households. However, the mean income difference between these two groups is statistically insignificant. This may indicate that temporary migration can alleviate income shortfalls for poor households during lean periods that would otherwise be worse off. In contrast, longer-term migration households have significantly higher mean incomes than both other groups.

4.2 Factors explaining migration

Table 3 presents results from the Heckman model explained in equations (1) and (2). Column (1) of Table 3 shows the first-stage equation explaining any unskilled economic migration (M_i). Columns (2) shows the decision of choosing temporary over longer-term migration (TM_i) for the subsample of migrant households.

As hypothesized, seasonal employment shortfalls at the origin during lean periods increase the likelihood of any migration (column 1 of Table 3) and also the likelihood of choosing temporary over longer-term migration. This makes sense, as the objective of temporary migration is to smooth shortfalls during lean periods, whereas the objective of longer-term migration is more broadly to increase income. Wage differences between normal and lean periods do not seem to influence the general migration decision over and above the effect of seasonal employment shortfalls. However, in the second-stage decisions, wage gaps increase the likelihood of temporary migration, motivating migrants to return home during normal periods, as an increasing gap also implies better wages in the origin villages during normal periods. Vulnerability to floods, which typically prolongs the lean period, increases the likelihood of choosing longer-term migration, as we expected.

Table 3: Factors explaining household migration decisions (two-stage Heckman model)

Variables	**(1)** **Any migration (M_i)**	**(2)** **Temporary migration (TM_i)**
Employment seasonality (ES_i)		
Seasonal employment shortfalls	0.24** [0.11]	0.69*** [0.16]
Wage gap	0.00 [0.00]	0.01** [0.01]
Flood vulnerability	0.04 [0.19]	-0.64*** [0.22]
Family demographic constraints (FDC_i)		
Small household	-0.27** [0.13]	0.42** [0.19]
Elderly member	-0.21 [0.13]	0.30 [0.19]
Children	-0.08 [0.12]	0.40** [0.18]
Adolescent girl	-0.01 [0.11]	0.38** [0.16]
Distrust in neighbors	-1.17*** [0.13]	1.21*** [0.37]
Farm labor constraints (FLC_i)		
Crop farming	-0.36*** [0.13]	0.11 [0.17]
Livestock farming	-0.34*** [0.12]	0.46*** [0.16]
Migration networks (MN_i)		
Migrant networks	0.12*** [0.01]	0.06** [0.02]
Controls (X_i)		
Village size	-0.00 [0.00]	0.00 [0.00]
Household head's age	-0.01 [0.01]	-0.03*** [0.01]
Household head's education	-0.03** [0.02]	0.04 [0.02]
Household head is male	-0.02 [0.36]	0.40 [0.50]
Major occupation: agriculture	0.13 [0.17]	0.77*** [0.23]
Major occupation: selling labor	-0.09 [0.15]	0.72*** [0.20]
Having business	-0.57*** [0.13]	0.05 [0.20]
Membership of microcredit NGOs	0.16 [0.11]	-0.21 [0.16]
Access to social safety nets	-0.14 [0.12]	-0.03 [0.18]
Experience of damage	-0.35*** [0.11]	-0.12 [0.18]
Distance to nearby migration hub	0.00 [0.00]	-0.00 [0.00]
Land ownership	-0.02*** [0.01]	0.01 [0.01]
Wealth index	0.11*** [0.04]	-0.11** [0.05]

Membership in community institutions	-0.41** [0.17]	
Constant	1.10** (0.52)	-0.76 [0.73]
λ_i		-0.57* [0.30]

N=832; robust standard errors in brackets; *p<0.10, **p<0.05, ***p<0.01

In terms of family demographic constraints, small households are less likely to send migrants, and if they do, temporary migration is more likely than longer-term migration. This aligns with our hypotheses. Having elderly household members, children, or adolescent girls does not seem to influence the general migration decision significantly. Nevertheless, if migration is chosen, having children or adolescent girls makes temporary migration more likely. Childcare obligations and personal attachment make it less likely for a parent to migrate for longer periods. For adolescent girls, safety concerns and cultural norms also play roles in the local context. Distrust in neighbors makes migration less likely, and if migration occurs, this is more likely to be temporary migration, as hypothesized.

In terms of farm labor constraints, households engaged in crop and livestock farming are less likely to send migrants, as these activities require family labor. However, crop farming does not influence the second-stage decision, whereas livestock farming does. Being involved in livestock farming makes temporary migration more likely than longer-term migration, which is plausible, as livestock farming requires consistent family labor all year round (Deshingkar & Start, 2003). Around 62% of our sample households have cattle, which is predominantly managed by household members. Hiring labor for household-level livestock activities is uncommon in rural Bangladesh. However, hiring labor for crop farming is widespread, even among smallholder farms. Therefore, crop farming-related family labor constraints may not significantly affect the migration duration decisions.

In terms of migrant networks, we find that the size of the network of family and friends that can help during migration, positively influences the general migration decision. Moreover, the size of the migrant network is positively associated with the likelihood of temporary migration. Longer-term migrants often target specific jobs at the destination, which can be arranged by one person in the migrant network. For temporary migrants, in contrast, a larger migrant network is more important. Temporary migrants often move across different destinations even during the same migration episode. For instance, the time of the paddy harvest varies regionally, meaning that migrant workers move from place to place to find available jobs. In this respect, receiving information and support from network members in different regions can be very useful. It is also common that temporary migration is organized in groups, which can mitigate risks and make migration more pleasurable.

The other control variables in Table 3 also provide a few interesting insights. Ownership of business and larger landholdings, and higher education levels of the household head are negatively associated with the likelihood of unskilled migration. This may be related to lower economic needs for unskilled migration and possibly labor constraints, but also to the social stigma associated with unskilled migration that better-off households would like to avoid. Against this background, the positive and significant coefficient for the wealth index in the

first-stage equation is somewhat surprising. This may be related to capabilities and resources needed for migration (De Haas, 2021), apart from the possibility of reverse causality. However, wealth is negatively associated with temporary migration, meaning that temporary migration is more commonly observed among the poor, as also found in the existing studies (Chen et al., 2019; Keshri & Bhagat, 2013). Finally, agriculture-dependent households, either through own farming or labor sales, are more likely to migrate temporarily during lean periods.

The statistical significance of the inverse Mills ratio (λ) confirms that correcting for selection bias is important. Furthermore, our approach of comparing temporary to longer-term migration yields plausible effects, particularly for family constraining factors. In the first-stage MNLS (Table A3), where temporary migration is contrasted with non-migration, we observe reversed and counterintuitive effects mainly for these constraining factors.

4.3 Migration effects on dietary quality and income

Table 4 summarizes the MESR results in terms of effects of temporary and longer-term migration on household dietary quality and income. Full estimation results are presented in Tables A8-A11 in the Appendix. Table 4 shows the predicted values of the outcome variables with migration (actual) and without migration (counterfactual), as well as the difference between these predicted values, the ATT. As can be seen, households with temporary migration have an average FCS of around 69 during the lean period, but would only have an FCS of around 49 had they not sent temporary migrants. This implies that the ATT for participating in temporary migration is a 20-point increase in FCS during the lean period. This effect is statistically significant at the 1% level. Longer-term migration also increases the average FCS significantly, but the magnitude of the ATT is smaller (around an 8-point increase). Similarly, for the PCS, the ATT of temporary migration is larger than that of longer-term migration. Furthermore, while both types of migration help to offset temporary protein shortfalls (TPS) during lean periods, temporary migration generates a considerably larger effect here as well.

Table 4: Effects of migration on household dietary quality and income

Outcome variable	Type of migration	Predicted outcome with migration	Predicted outcome without migration	ATT
FCS	Temporary	68.76 [0.22]	48.92 [0.53]	19.84*** [0.58]
	Longer-term	61.65 [0.68]	53.21 [1.08]	8.44*** [1.28]
PCS	Temporary	39.61 [0.18]	23.05 [0.43]	16.56*** [0.47]
	Longer-term	34.27 [0.61]	26.75 [0.87]	7.51*** [1.06]
TPS	Temporary	-1.17 [0.18]	15.35 [0.52]	-16.52*** [0.55]
	Longer-term	4.50 [0.59]	11.78 [1.03]	-7.28*** [1.18]
Income	Temporary	62.46 [1.92]	36.40 [2.08]	26.06*** [2.83]
	Longer-term	81.58 [4.02]	40.91 [4.64]	40.66*** [6.14]

N=832; Robust standard errors in brackets. FCS, food consumption score; PCS, protein consumption score; TPS, temporary protein shortfall; ATT, average treatment effect on the treated; income refers to lean period income and is measured in thousand BDT; *p<0.10, **p<0.05, ***p<0.01

These results suggest that temporary migration is more effective than longer-term migration in terms of food consumption smoothing and in improving dietary quality during the lean period. During the survey, we could also sense that households involved in temporary migration come from the poorest sections of society and are vulnerable to risks of insufficient consumption of nutrient-rich foods. Therefore, one can expect that these households devote a large part of their migration-related income to smoothing consumption during lean periods, when they, otherwise, would have faced serious consumption deficits. In contrast, households involved in longer-term migration are inclined to utilize their migration-related income for improving living standards more generally, through savings and wealth-building, rather than for consumption smoothing. These households also may not suffer from consumption shortfalls to the same extent, as indicated by their higher predicted counterfactual outcomes for FCS and PCS without migration (Table 4).

Figure 3 presents a visualization of the effects of migration on dietary quality and income using kernel density distributions of the predicted outcome variables. The FCS and PCS distributions for temporary migrants are located furthest to the right, indicating notable improvements in lean-period dietary quality through temporary migration. Likewise, temporary migration seems more effective than longer-term migration in offsetting TPS.

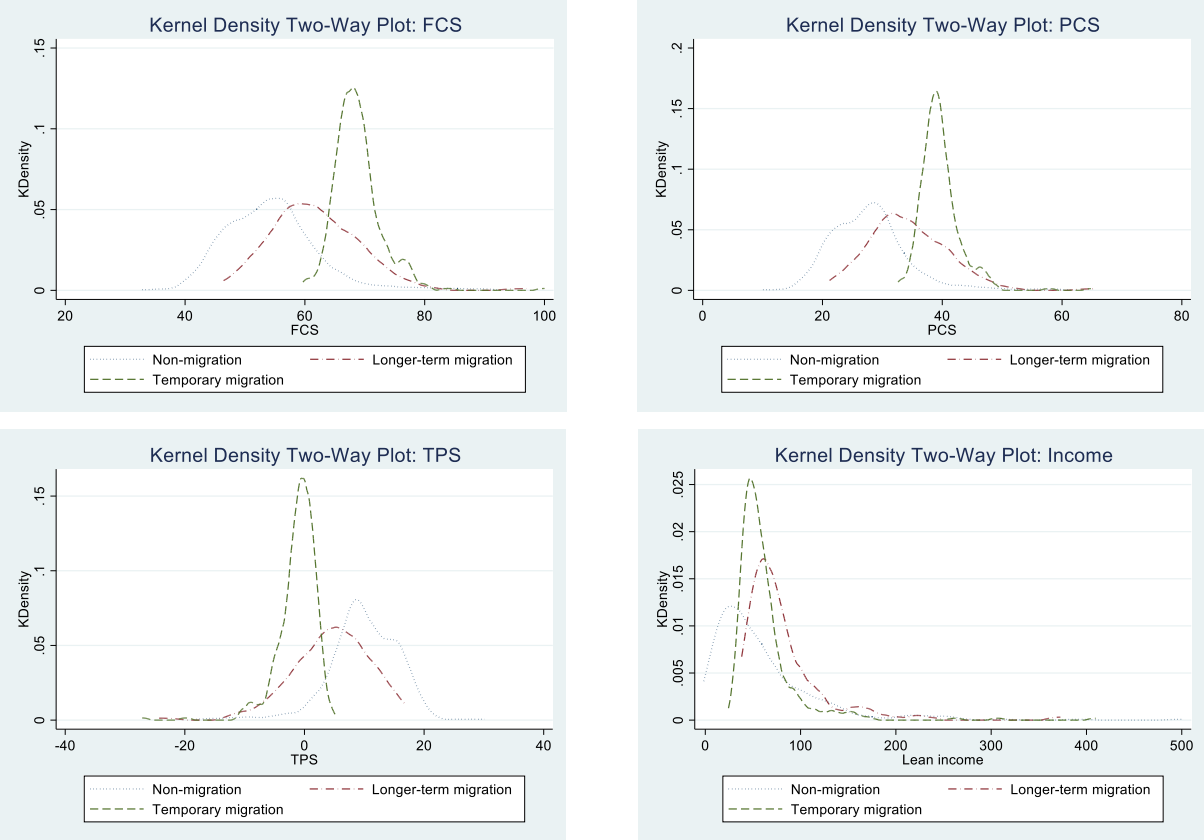

Figure 3: Kernel density distributions of the predicted effects of migration on dietary quality and income by migration status

The effects of the different types of migration on lean-period income are also shown in Table 4 and Figure 3. Table 4 suggests that temporary migration leads to significantly higher lean-

period income, with an ATT of approximately BDT 26 thousand (USD$ 235). This is equivalent to about half of the total mean income of non-migrant households during the lean periods. This large positive income effect of temporary migration is likely the main mechanism underlying the effects in terms of food consumption smoothing. Indeed, our data reveal that about 94% of temporary migrant households utilized their migration remittances to purchase food.

Interestingly, longer-term migration generates positive income effects that are still much larger than those of temporary migration (Table 4 and Figure 3). As discussed earlier, temporary migration often lasts less than 30 days. Longer-term migration is not only longer but often also involving higher-paying jobs; hence the larger income effects are unsurprising. However, longer-term migration is typically also more demanding than temporary migration in terms of financial and emotional costs and requirements (Coffey et al., 2014; Chen et al., 2019; Lagakos et al., 2023). We have shown that poorer households with family constraints are less likely to engage in longer-term migration. For these households in particular, temporary migration can serve as a viable strategy to smooth income and dietary quality.

As mentioned, we also carry out a robustness check using IPWRA as an alternative methodological approach. The results of this robustness check are shown in Table 5. They are very similar to the results in Table 4 and support the same effects.

Table 5: Robustness checks (treatment effects estimated with IPWRA)

	FCS	**PCS**	**TPS**	**Income**
Temporary migration *vs* non-migration	19.97***	17.43***	-17.11***	23.34***
	[1.85]	[1.67]	[1.69]	[1.88]
Longer-term migration *vs* non-migration	9.30***	8.20***	-7.43***	36.23***
	[2.07]	[1.75]	[1.84]	[3.53]

N=832; Robust standard errors in brackets. IPWRA, inverse probability weighting with regression adjustment; FCS, food consumption score; PCS, protein consumption score; TPS, temporary protein shortfall; ATT, average treatment effect on the treated; income refers to lean period income and is measured in thousand BDT; *p<0.10, **p<0.05, ***p<0.01

5. Conclusion and policy implications

Poor rural households often resort to unskilled economic migration as a response to seasonality and incomplete markets in agrarian societies worldwide. Such migration is often temporary in nature, lasting for less than 30 days. However, despite its importance for the rural poor, short-term temporary migration often remains invisible for researchers and policy-makers. Most existing research focuses on longer-term migration. Yet the drivers and effects of short-term temporary and longer-term migration are likely different (Chen et al., 2019; Keshri & Bhagat, 2013; Lucas, 2015).

While several studies analyze determinants of temporary migration (Asefawu & Nedessa, 2022; Dodd et al., 2016; Keshri & Bhagat, 2013; Khandker et al., 2012; Shahriar et al., 2006; Sucharita, 2020), these studies typically consider non-migration as the only alternative. In our study with primary data from rural Bangladesh, we have shown that this standard treatment of temporary migration as a binary choice against non-migration is incomplete in explaining migration decision-making. Consistent with earlier research, we highlight the important roles of employment seasonality and migration networks in shaping migration decisions. However, we also show that some family constraining factors, which reduce the likelihood of migration in general, tend to increase the likelihood of temporary over longer-term migration.

Especially the poorest households have a strong preference for temporary migration, which can be explained by their specific needs and abilities. Poor households often face labor and other socio-demographic constraints that may hinder them from sending migrants for longer durations. The decision to send temporary migrants, even under such constraints, indicates the distress-driven nature of this type of migration, as also highlighted by Keshri & Bhagat (2013) and Khandker & Mahmud (2012). Our data suggest that temporary migration is an effective strategy to smooth income and consumption shortfalls during lean periods. Temporary migration significantly improves dietary quality during lean periods and thus helps to offset temporary nutrient shortfalls. This is a crucial finding in the context of rural Bangladesh, where many poor people still suffer from protein and micronutrient deficiencies (Lomborg, 2016; Raihan, 2022).

Interestingly, longer-term migration has larger positive income effects than temporary migration, whereas temporary migration has larger positive effects on lean-period food consumption and dietary quality. This makes sense given the different objectives of both types of migration. While temporary migration, mostly observed among the poorest households, is a key strategy to smooth consumption and prevent dietary shortfalls, longer-term migration is primarily a strategy to increase income and improve living standards in the longer term through savings and wealth-building, as also observed in the existing research (Keshri & Bhagat, 2013; Mishra 2016).

Agricultural seasonality is a predictable phenomenon that agriculture-dependent households try to cope with. However, the vulnerabilities of poor rural households will likely further increase and become less predictable due to climate change, shrinking farm sizes, and several

other factors. This requires more policy attention to identify risks for poor households and implement effective adaptation strategies. Advancements in agricultural technology to reduce the duration of lean periods and make farming more productive and resilient are one important avenue (Palis et al., 2016). Improvements in rural non-agricultural employment opportunities and social safety-net programs are another important avenue (Khandker & Mahmud, 2012, Shonchoy, 2015). However, we have demonstrated that temporary migration is also an effective strategy for smoothing income and dietary shortfalls during lean periods, particularly for the rural poor. The different avenues are not mutually exclusive. They should be seen as complements, serving the needs of vulnerable households under heterogenous conditions.

Our findings underscore that a blanket negative perception of temporary migration, as often observed among policy-makers in Bangladesh and elsewhere (Shonchoy, 2015), is inappropriate. There is a need for recognizing the important role of temporary migration for rural household livelihoods, for capturing this phenomenon more explicitly in statistical data, and for improving related conditions through supportive policies.

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Appendix

Table A1: Mean of household's membership in local community institutions

Variable	(1) All observations (n=832)	(2) Economic migrant (n=461)	(3) Non-migrant (n=371)	(4) Difference (2-3)	(5) Temporary migrant (n=338)	(6) Longer-term migrant (n=123)	(7) Difference (5-6)
Membership in social institutions (EV_i)	0.12 (0.33)	0.09 (0.29)	0.15 (0.36)	-0.06*** [0.02]	0.09 (0.28)	0.11 (0.32)	-0.03 [0.03]

Standard deviations are shown in parentheses, standard error in square brackets; *p<0.10, **p<0.05, ***p<0.01

Table A2: Collinearity tests for variables in two-stage Heckman model

Variables	Variance Inflation Factor (VIF)	
	First-stage	Second-stage
Employment seasonality (ES_i)		
Seasonal employment shortfalls	1.28	1.26
Wage gap	1.21	1.20
Flood vulnerability	1.13	1.13
Family demographic constraints (FDC_i)		
Small household	1.56	1.52
Elderly member	1.36	1.28
Children	1.32	1.30
Adolescent girl	1.14	1.10
Distrust in neighbors	1.13	1.03
Farm labor constraints (FLC_i)		
Crop farming	1.32	1.31
Livestock farming	1.23	1.19
Migration networks (MN_i)		
Migrant networks	1.18	1.12
Controls (X_i)		
Village size	1.07	1.08
Household head's age	1.58	1.49
Household head's education	1.28	1.29
Household head's gender	1.05	1.07
Major occupation: Agriculture	2.18	2.18
Major occupation: Selling labor	2.23	2.22
Having business	1.24	1.19
Membership of microcredit NGOs	1.08	1.05
Access to safety-nets	1.09	1.12
Experience of damage	1.06	1.08
Distance to nearby migration hub	1.09	1.06
Land ownership	1.72	1.48
Wealth index	2.13	1.89
Membership of social institutions	1.10	
Mean VIF	1.35	1.32
N	832	461

Table A3: First-stage MNLS results (Base category: M_{il}= 1, non-migration)

Variables	M_{il}= 2, Longer-term migration	M_{il}= 3, Temporary migration
IV: Unskilled economic migration proportion of the village	0.05*** [0.01]	0.05*** [0.01]
Employment seasonality (ES_i)		
Seasonal employment shortfalls	-0.47* [0.26]	0.70*** [0.23]
Wage gap	-0.00 [0.00]	0.00 [0.00]
Flood vulnerability	0.34 [0.39]	-0.50 [0.41]
Family demographic constraints (FDC_i)		
Small household	-0.97*** [0.31]	-0.31 [0.25]
Elderly member	-0.67** [0.32]	-0.21 [0.26]
Children	-0.71** [0.31]	-0.08 [0.23]
Adolescent girl	-0.63** [0.29]	0.10 [0.21]
Distrust in neighbors	-2.96*** [0.56]	-1.64*** [0.29]
Farm-labor constraints (FLC_i)		
Crop farming	-0.72** [0.32]	-0.67*** [0.25]
Livestock farming	-1.04*** [0.28]	-0.36 [0.23]
Migration networks (MN_i)		
Migrant networks	0.12*** [0.04]	0.25*** [0.03]
Controls (X_i)		
Village size	-0.00 [0.00]	0.00 [0.00]
Household head's age	0.02 [0.01]	-0.03*** [0.01]
Household head's education	-0.10** [0.04]	-0.05 [0.03]
Household head's gender	-0.49 [0.84]	-0.02 [0.68]
Major occupation: Agriculture	-0.72* [0.40]	0.81** [0.34]
Major occupation: Selling labor	-0.92** [0.37]	0.42 [0.32]
Having business	-0.87*** [0.32]	-0.99*** [0.27]
Membership of microcredit NGOs	0.43 [0.29]	0.21 [0.23]
Access to safety-nets	-0.10 [0.31]	-0.31 [0.24]
Experience of damage	-0.41 [0.28]	-0.67*** [0.21]
Distance to nearby migration hub	0.01 [0.01]	0.00 [0.01]
Land ownership	-0.03** [0.01]	-0.03** [0.01]
Wealth index	0.27*** [0.08]	0.08 [0.08]
Constant	-0.58 [1.38]	-1.99* [1.12]

N=832; Robust standard errors in brackets; * p<0.10, ** p<0.05, *** p<0.01

Table A4: Falsification tests for the IV

Variables	FCS	PCS	TPS	Income
IV: Unskilled economic migration proportion of the village	0.08 [0.06]	0.08 [0.06]	0.06 [0.06]	0.03 [0.06]
Constant	42.50*** [4.11]	17.73*** [3.71]	11.50*** [3.63]	-1.80 [2.00]
Relevant controls (Z_i)	Yes	Yes	Yes	Yes
p-value	0.00	0.00	0.00	0.00

N=371 (non-migrant households); Robust standard errors in brackets; FCS, food consumption score; PCS, protein consumption score; TPS, temporary protein shortfall; * p<0.10, ** p<0.05, *** p<0.01

Table A5: Summary statistics of key explanatory variables for migration decision-making

Variables	(1) All observations (n=832)	(2) Economic migrant (n=461)	(3) Non-migrant (n=371)	(4) Difference (2-3)	(5) Temporary migrant (n=338)	(6) Longer-term migrant (n=123)	(7) Differences (5-6)
Employment seasonality (ES_i)							
Seasonal employment	0.47	0.55	0.37	0.18***	0.64	0.28	0.36***
shortfall	(0.50)	(0.50)	(0.48)	[0.03]	(0.48)	(0.45)	[0.05]
Wage gap	111.17	125.27	93.65	31.62***	144.90	71.34	73.55***
(in BDT)	(128.90)	(133.82)	(120.40)	[8.93]	(134.34)	(116.94)	[13.68]
Flood vulnerability	0.11	0.12	0.10	0.02	0.09	0.20	-0.11***
	(0.31)	(0.32)	(0.30)	[0.02]	(0.28)	(0.40)	[0.03]
Family demographic constraints (FDC_i)							
Small household	0.61	0.57	0.67	-0.09***	0.61	0.46	0.15***
	(0.49)	(0.50)	(0.47)	[0.03]	(0.49)	(0.50)	[0.05]
Elderly member	0.32	0.28	0.36	-0.08**	0.26	0.33	-0.07
	(0.47)	(0.45)	(0.48)	[0.03]	(0.44)	(0.47)	[0.05]
Children	0.58	0.60	0.56	0.05	0.63	0.53	0.10**
	(0.49)	(0.49)	(0.50)	[0.03]	(0.48)	(0.50)	[0.05]
Adolescent girl	0.38	0.38	0.37	0.01	0.41	0.31	0.10**
	(0.49)	(0.49)	(0.48)	[0.03]	(0.49)	(0.46)	[0.05]
Distrust in neighbors	0.22	0.07	0.41	-0.34***	0.08	0.03	0.05*
	(0.41)	(0.25)	(0.49)	[0.03]	(0.28)	(0.18)	[0.03]
Farm labor constraints (FLC_i)							
Crop farming	0.67	0.62	0.74	-0.13***	0.64	0.54	0.11**
	(0.47)	(0.49)	(0.44)	[0.03]	(0.48)	(0.50)	[0.05]
Livestock farming	0.62	0.56	0.70	-0.15***	0.59	0.46	0.14***
	(0.49)	(0.50)	(0.46)	[0.03]	(0.49)	(0.50)	[0.05]
Migration networks (MN_i)							
Migrant networks	5.69	7.54	3.38	4.16***	8.36	5.30	3.06***
	(4.92)	(4.98)	(3.74)	[0.31]	(4.84)	(4.65)	[0.50]

Standard deviations in parentheses, standard errors in square brackets; *p<0.10, **p<0.05, ***p<0.01

Table A6: Mean weekly consumption of various food groups

Food groups	All observations (n=832)			Temporary migrants (n=338)			Longer-term migrants (n=123)			Non-migrants (n=371)		
	Normal period	Lean period	Differences (normal– lean)	Normal period	Lean period	Differences (normal– lean)	Normal period	Lean period	Differences (normal– lean)	Normal period	Lean period	Differences (normal– lean)
Meat, fish	5.48	4.88	0.60***	5.38	5.99	-0.61***	5.56	4.93	0.63***	5.55	3.85	1.69***
	(1.83)	(2.24)	[0.08]	(1.86)	(1.60)	[0.11]	(1.94)	(2.12)	[0.17]	(1.78)	(2.29)	[0.10]
Milk, dairy products	1.79	1.33	0.46***	1.68	1.61	0.07	1.90	1.44	0.46**	1.85	1.04	0.82***
	(2.69)	(2.31)	[0.08]	(2.63)	(2.42)	[0.11]	(2.61)	(2.29)	[0.22]	(2.76)	(2.17)	[0.14]
Legumes, pulses	2.94	2.91	0.03	2.91	3.07	-0.16***	3.02	2.93	0.08	2.95	2.77	0.19***
	(1.80)	(1.69)	[0.04]	(1.87)	(1.75)	[0.06]	(1.84)	(1.68)	[0.10]	(1.71)	(1.64)	[0.06]
Staples	7.00	6.99	0.00	7.00	7.00	0.00	7.00	7.00	0.00	7.000	6.99	0.00
	(0.00)	(0.03)	[0.00]	(0.00)	(0.00)	[0.00]	(0.00)	(0.00)	[0.00]	(0.000)	(0.05)	[0.00]
Vegetables	6.20	6.05	0.15***	6.15	6.34	-0.18**	6.14	6.05	0.09	6.26	5.78	0.47***
	(1.34)	(1.35)	[0.05]	(1.40)	(1.15)	[0.07]	(1.49)	(1.36)	[0.12]	(1.23)	(1.46)	[0.07]
Fruits	3.55	2.44	1.11***	3.21	3.36	-0.14	3.67	2.33	1.34***	3.82	1.64	2.18***
	(2.70)	(2.19)	[0.10]	(2.69)	(2.08)	[0.17]	(2.69)	(2.29)	[0.28]	(2.68)	(1.94)	[0.12]
Oils, fats	6.99	6.99	0.00	6.99	6.99	0.00	7.00	7.00	0.00	7.00	7.00	0.00
	(0.10)	(0.10)	[0.00]	(0.16)	(0.16)	[0.00]	(0.00)	(0.00)	[0.00]	(0.00)	(0.00)	[0.00]
Sugar, sweets	3.76	3.52	0.24***	3.79	3.92	-0.13**	3.32	3.01	0.31***	3.88	3.33	0.54***
	(2.92)	(2.92)	[0.04]	(2.94)	(2.82)	[0.06]	(2.99)	(2.95)	[0.12]	(2.88)	(2.96)	[0.06]
FCS	67.05	61.32	5.73***	65.74	68.76	-3.02***	67.87	61.65	6.22***	67.98	54.44	13.55***
	(17.04)	(17.60)	[0.57]	(17.46)	(14.95)	[0.79]	(17.12)	(17.55)	[1.40]	(16.58)	(17.11)	[0.76]
PCS	37.93	33.58	4.35***	36.98	39.61	-2.63***	38.90	34.27	4.63***	38.47	27.85	10.61***
	(15.54)	(15.55)	[0.51]	(15.74)	(13.39)	[0.69]	(15.56)	(15.48)	[1.25]	(15.35)	(15.31)	[0.73]

Standard deviations in parentheses, standard errors in square brackets; *p<0.10, **p<0.05, ***p<0.01

Table A7: Mean FCS, PCS, TPS, and household income during lean periods

	(1) All observations (n=832)	(2) Temporary migrants (n=338)	(3) Longer-term migrants (n=123)	(4) Non-migrants (n=371)	(5) Differences (2- 4)	(6) Differences (3- 4)	(7) Differences (2- 3)
FCS	61.32	68.76	61.65	54.44	14.32***	7.22***	7.10***
	(17.60)	(14.95)	(17.55)	(17.11)	[1.21]	[1.79]	[1.65]
PCS	33.58	39.61	34.27	27.85	11.76***	6.41***	5.34***
	(15.55)	(13.39)	(15.48)	(15.31)	[1.08]	[1.60]	[1.47]
TPS	4.59	-1.17	4.50	9.87	-11.05***	-5.38***	-5.67***
	(15.41)	(13.61)	(16.41)	(14.75)	[1.07]	[1.58]	[1.52]
Income	63.96	62.46	81.58	59.49	2.97	22.08***	-19.11***
(in thousand BDT)	(53.30)	(42.44)	(57.12)	(59.48)	[3.91]	[6.13]	[4.93]

Standard deviations in parentheses, standard errors in square brackets; *p<0.10, **p<0.05, ***p<0.01

Table A8: Second-stage regression results for FCS

Variables	(1) FCS_1	(2) Ancillary	(3) FCS_2	(4) Ancillary	(5) FCS_3	(6) Ancillary
Household member number	1.54***		1.41**		0.58	
	[0.30]		[0.67]		[0.52]	
Household head's education	0.18		0.04		0.41	
	[0.17]		[0.42]		[0.34]	
Seasonal employment shortfalls	-6.92***		-12.06**		-2.09	
	[2.16]		[5.57]		[1.72]	
Experience of damage	-1.71		7.35**		0.51	
	[1.63]		[3.33]		[2.91]	
Land ownership	0.18***		0.26		0.15**	
	[0.05]		[0.22]		[0.07]	
Income from agriculture during lean	0.01		-0.29		0.05	
	[0.04]		[0.21]		[0.11]	
Income from livestock during lean	0.00		0.01		-0.01	
	[0.01]		[0.05]		[0.01]	
Income from labor during lean	0.02		0.26**		0.04	
	[0.05]		[0.11]		[0.05]	
Income from business during lean	0.10***		-0.05**		-0.00	
	[0.03]		[0.02]		[0.04]	
Other monthly income during lean	0.10***		0.30		0.25**	
	[0.03]		[0.26]		[0.12]	
Other seasonal income during lean	-0.16*		-0.06		-0.06	
	[0.09]		[0.35]		[0.08]	
Income from assets during lean	-0.44***		0.01		0.04	
	[0.07]		[0.26]		[1.78]	
_m2	-0.83				-6.77***	
	[3.96]				[2.44]	
_m3	1.24		-12.40***			
	[3.18]		[3.77]			
Sigma2		230.36***		489.72***		267.41***
		[19.28]		[115.75]		[55.22]
rho2		-0.07				-0.53***
		[0.33]				[0.14]
rho3		0.11		-0.72***		
		[0.26]		[0.16]		
_m1			12.11***		6.91**	
			[3.82]		[3.04]	
rho1				0.70***		0.54***
				[0.14]		[0.19]
Constant	47.12***		52.74***		65.58***	
	[2.69]		[1.75]		[2.53]	

N=832; Robust standard errors in brackets; * p<0.10, ** p<0.05, *** p<0.01

Table A9: Second-stage regression results for PCS

Variables	(1) PCS_1	(2) Ancillary	(3) PCS_2	(4) Ancillary	(5) PCS_3	(6) Ancillary
Household member number	1.33***		1.09		0.24	
	[0.24]		[0.66]		[0.40]	
Household head's education	0.08		-0.02		0.42	
	[0.17]		[0.34]		[0.28]	
Seasonal employment shortfalls	-5.52***		-10.54**		-0.33	
	[2.08]		[4.73]		[1.38]	
Experience of damage	-1.77		7.31**		0.75	
	[1.38]		[3.70]		[2.51]	
Land ownership	0.15***		0.20		0.11	
	[0.06]		[0.15]		[0.07]	
Income from agriculture during lean	0.00		-0.25		0.04	
	[0.04]		[0.16]		[0.11]	
Income from livestock during lean	-0.01		0.02		-0.00	
	[0.01]		[0.04]		[0.01]	
Income from labor during lean	0.02		0.22**		0.04	
	[0.05]		[0.10]		[0.05]	
Income from business during lean	0.07*		-0.04		-0.01	
	[0.04]		[0.03]		[0.03]	
Other monthly income during lean	0.09***		0.27		0.20*	
	[0.02]		[0.24]		[0.12]	
Other seasonal income during lean	-0.14*		-0.01		-0.13	
	[0.08]		[0.32]		[0.09]	
Income from asset during lean	-0.35***		-0.01		0.05	
	[0.09]		[0.03]		[1.53]	
_m2	-0.85				-7.30***	
	[3.82]				[1.65]	
_m3	1.43		-10.97***			
	[3.13]		[3.14]			
Sigma2		191.913***		379.391***		227.57***
		(17.000)		[75.799]		[38.64]
rho2		-0.078				-0.62***
		(0.346)				[0.10]
rho3		0.132		-0.722***		
		(0.283)		[0.161]		
_m1			10.59***		6.36***	
			[3.30]		[2.36]	
rho1				0.697***		0.54***
				[0.161]		[0.16]
Constant	22.30***		26.99***		36.13***	
	[2.79]		[1.94]		[1.95]	

N=832; Robust standard errors in brackets; * p<0.10, ** p<0.05, *** p<0.01

Table A10: Second-stage regression results for TPS

Variables	(1) TPS_1	(2) Ancillary	(3) TPS_2	(4) Ancillary	(5) TPS_3	(6) Ancillary
Household member number	-0.91***		-1.03*		0.00	
	[0.14]		[0.62]		[0.57]	
Household head's education	-0.02		-0.02		-0.40	
	[0.18]		[0.29]		[0.27]	
Seasonal employment shortfalls	4.82**		10.80**		0.75	
	[2.20]		[4.78]		[1.50]	
Experience of damage	1.40		-4.65		0.39	
	[1.12]		[4.14]		[2.56]	
Land ownership	-0.12**		-0.07		-0.00	
	[0.05]		[0.12]		[0.07]	
Income from agriculture during lean	-0.02		0.26		-0.04	
	[0.04]		[0.16]		[0.10]	
Income from livestock during lean	0.01		-0.03		0.01	
	[0.01]		[0.04]		[0.01]	
Income from labor during lean	-0.04		-0.24**		-0.04	
	[0.04]		[0.11]		[0.04]	
Income from business during lean	-0.07*		0.04		0.00	
	[0.04]		[0.04]		[0.03]	
Other monthly income during lean	-0.08***		-0.24		-0.21**	
	[0.02]		[0.34]		[0.10]	
Other seasonal income during lean	0.13**		0.01		0.05	
	[0.06]		[0.34]		[0.10]	
Income from asset during lean	0.45***		-0.01		-0.05	
	[0.16]		[0.60]		[1.44]	
_m2	1.92				7.55***	
	[4.47]				[1.62]	
_m3	-2.76		11.58***			
	[3.97]		[2.11]			
Sigma2		189.15***		432.233***		236.22***
		[26.78]		[45.253]		[36.85]
rho2		0.18				0.63***
		[0.40]				[0.10]
rho3		-0.26		0.714***		
		[0.35]		[0.108]		
_m1			-11.15***		-6.35**	
			[2.20]		[2.47]	
rho1				-0.688***		-0.53***
				[0.117]		[0.17]
Constant	13.61***		10.31***		0.45	
	[2.85]		[2.15]		[2.76]	

N=832; Robust standard errors in brackets; * p<0.10, ** p<0.05, *** p<0.01

Table A11: Second-stage regression results for income (Inc)

Variables	(1) Inc_1	(2) Ancillary	(3) Inc_2	(4) Ancillary	(5) Inc_3	(6) Ancillary
Household member number	1.24*		4.30		2.41**	
	[0.73]		[5.34]		[1.10]	
Household head's education	-0.26*		1.46		0.69**	
	[0.14]		[1.41]		[0.28]	
Seasonal employment shortfalls	0.62		-14.28*		0.15	
	[0.93]		[7.62]		[2.67]	
Experience of damage	-2.25***		6.31		-0.35	
	[0.74]		[10.82]		[3.42]	
Land ownership	-0.01		0.80***		-0.34***	
	[0.02]		[0.27]		[0.09]	
Income from agriculture during lean	1.00***		1.19		0.92***	
	[0.01]		[1.24]		[0.04]	
Income from livestock during lean	1.00***		0.81***		0.99***	
	[0.00]		[0.19]		[0.03]	
Income from labor during lean	0.95***		0.43*		0.56***	
	[0.02]		[0.23]		[0.07]	
Income from business during lean	0.95***		0.58***		0.68***	
	[0.03]		[0.07]		[0.05]	
Other monthly income during lean	0.97***		0.21		0.86***	
	[0.02]		[0.81]		[0.11]	
Other seasonal income during lean	0.84***		0.86		0.43**	
	[0.11]		[1.27]		[0.18]	
Income from asset during lean	1.00***		1.08**		1.05	
	[0.04]		[0.49]		[1.77]	
_m2	-5.38				-8.25	
	[5.43]				[5.97]	
_m3	4.46		-6.79**			
	[4.62]		[2.72]			
Sigma2		182.15		1,351.52***		657.64***
		[115.71]		[232.82]		[187.82]
rho2		-0.51				-0.41*
		[0.42]				[0.23]
rho3		0.42		-0.24**		
		[0.35]		[0.12]		
_m1			7.57**		9.54**	
			[3.41]		[4.36]	
rho1				0.26**		0.48***
				[0.14]		[0.15]
Constant	-0.29		32.50**		30.53***	
	[1.74]		[15.51]		[4.13]	

N=832; Robust standard errors in brackets]; * p<0.10, ** p<0.05, *** p<0.01