

Remittances and Household Dependence: Evidence from Bangladesh

Md Shahadath Hossain¹
Adesola Sunmoni²
Estiaque Bari³

August 03, 2024

Abstract

Remittances, as private transfers to households, can generate two opposing effects: the income effect and the liquidity effect. The income effect may lead to remittance dependence by reducing the recipient households' non-remittance income. Conversely, the liquidity effect may enhance income-generating activities through capital accumulation and improved health productivity. It is theoretically ambiguous to determine which of these effects is relatively stronger. Consequently, this study empirically investigates whether remittances lead to dependence in Bangladesh. To address endogeneity concerns, we employ instrumental variable and imperfect instrumental variable approaches. Our results show that remittances do not lead to dependence at either the extensive or intensive margins. These findings are robust across different model specifications and relaxation of the instrumental variable exogeneity assumption. Exploring the potential channels of the effect, we find that remittances significantly enhance household living standards and facilitate capital accumulation, thereby promoting higher productivity and engagement in income-generating activities.

JEL classification codes: D13, F22, F24, I32, J22, O12, O15.

Keywords: Remittances, Household dependence, Health productivity effect, Capital accumulation, Imperfect instrument, Bangladesh.

¹ Department of Economics, University of Houston, TX, USA Email: mhossai7@Central.UH.EDU

² Department of Economics, University of Reading, UK, Email: a.sunmoni@reading.ac.uk

³ Department of Economics, East West University, Dhaka, Bangladesh. Email: estiaque@ewubd.edu

We would like to thank Prof Simonetta Longhi, Prof Corrado Giuliatti, Dr Stefania Lovo, Dr Samantha Rawlings, Dr Elisa Tavera Pena, Dr Anisa Butt, Meg Sullivan, and Shahidul Islam for their helpful comments and advice as well as the participants at the Annual Southern PhD Economics Conference (ASPEC) 2022.

1. Introduction

The impact of non-labor income on household labor supply has received considerable attention in labor economics. Notably, extensive research has focused on the labor supply response of wives to their husbands' income, a form of non-labor income for wives (Halla et al., 2020; Kohara, 2010). Similarly, studies in migration economics have explored the labor supply response of non-migrant family members to remittances, a source of non-labor income for them. The increase in disposable income through remittances can potentially reduce the incentives to work for non-migrant family members, particularly if such transfers raise their reservation wage and lower the opportunity cost of leisure. As a result, a rise in remittance transfers may decrease the labor force participation of non-migrant family members and foster dependence on remittance income (Démurger, 2015).

Whether remittances lead to dependence (i.e., lower non-remittance income) or higher non-remittance income from increased income-generating activities is theoretically ambiguous, making this an interesting empirical question. In this study, we investigate the effect of remittances on the likelihood and magnitude of households non-remittance income. A negative effect of remittances on non-remittance income would indicate rising remittance dependence.

While previous studies have primarily focused on analyzing the effect of remittances on labor supply (Acosta, 2020; Amuedo-Dorantes & Pozo, 2006; Azizi, 2018; Cox-Edwards & Rodríguez-Oreggia, 2009; Jadotte & Ramos, 2016), they have not explicitly addressed the question we aim to explore in this study. Notably, these studies have revealed that a 10 percent increase in remittances results in a reduction of work hours ranging from 0.33% to 3.4%.⁴ However, our study uniquely seeks to shed light on the relationship between remittances and non-remittance income, which has not been examined in the existing literature.

The analysis of labor supply decisions alone may not provide a comprehensive understanding of the effects of remittances on household non-remittance income for several reasons. First, relying solely on hours worked fails to account for the potential increase in effective work hours resulting from higher productivity in remittance-receiving households. Remittances can enhance sanitary conditions and promote healthier lifestyles, leading to improved labor productivity through better health (Amuedo-Dorantes, 2014). Consequently, household

⁴ These studies find a substantial effect heterogeneity by sector of work (formal and informal) and gender of the workers.

members may reduce their work hours while still earning more overall due to increased productivity.

Second, focusing only on labor supply neglects non-labor income earning activities such as rental income from properties or sharecropping, and capital gains from dividends and interest. Remittances could enhance asset ownership and non-labor income earning opportunities, resulting in lower dependence on remittances. Finally, labor supply fails to account for the upsurge in home production resulting from higher asset ownership facilitated by remittances. Cain (1991) shows that higher asset ownership tends to increase the need for time allocation in home production, thus reducing time for income-earning work in Bangladesh.⁵

For our empirical analysis, we utilize data from the Bangladesh Survey on the Use of Remittances, 2013. This cross-sectional survey is a nationally representative household survey of international migrant households. It provides comprehensive information about migration patterns, remittances received, and remittance uses. Additionally, it provides detailed information on the characteristics of migrants as well as the socio-economic and demographic profiles of the family members left behind. Our final sample consists of 8,995 remittance receiving households with temporary male migrants who migrated at least 18 months before the survey.⁶

Our key explanatory variable is the cash remittances received in the previous 12 months before the survey. Our outcome of interest is household's non-remittance income. We explore non-remittance income at both the extensive and intensive margins. At the extensive margin, we measure non-remittance income using a binary indicator variable that equals one if the household reports income from non-remittance sources in last 12 months, and zero otherwise.⁷

At the intensive margin, non-remittance income is defined as the amount of income from non-

⁵ Cain (1991) shows that Bangladeshi households dedicate substantial labor hours into (1) home production, labor necessary for maintenance and upkeep of the household, which is not directly productive in the sense of generating income; (2) income earning work, labor necessary for generating income and capital. This study further shows that household with higher asset ownership tend to spend less time in income-earning work. This negative association is likely due to higher need for home production time and substituting away to non-labor activities such as renting land and sharecropping. Sharecropping involves a contract where the landowner provides the land and capital, while a landless farmer contributes the labor, with the crop shared according to a predetermined agreement (e.g., 50-50).

⁶ Our sample includes households with temporary economic migrants who will return to their home country after living in the destination country for a period. We keep households with male migrants as migration is predominantly a male phenomenon in Bangladesh. Finally, we keep households with a migration duration of at least 18 months because households' reports of total remittances in the last 12 months will be incomplete if migration happened within the last year. In addition, migrants do not start sending remittances immediately after arriving at their destination.

⁷ To keep the definitions of the extensive and intensive margins consistent, we define remittance dependence in this manner. The way it is defined actually measures remittance independence.

remittance sources in last 12 months. This approach allows us to examine the degree to which households can generate income from non-remittance sources.

A simple regression of remittances on non-remittance income is likely to produce biased estimates due to unobserved confounders such as household wealth prior to migration leading to reverse causality. We therefore employ an instrumental variable (IV) approach using changes in economic fitness in migrants destination countries as an instrument. Economic fitness is a measure of a country's diversification and capability to produce complex goods on a globally competitive basis. We consider the change in economic fitness from 2011 to 2012 as the IV, as it reflects the change in a country's ability to produce a diverse range of goods and upgrade to more complex ones. An increase in economic fitness reduces the demand for low-skilled workers while increasing the demand for high-skilled workers. A fall in the demand for low-skilled workers is likely to reduce both their employment prospects and earnings.

Since the majority of Bangladeshi migrants are low-skilled workers, a positive change in economic fitness is expected to adversely affect their earnings and remittances sent. Furthermore, a change in economic fitness at the destination is not likely to affect households' decisions in the origin country through any other channels except remittances. The plausible exogeneity of destination-level characteristics makes them suitable instruments to study left behind household decisions in the migration literature (Amuedo-Dorantes, 2014; Cuadros-Menaca & Gaduh, 2020; Yang, 2008).

The exogeneity condition is a crucial assumption for instrumental variable estimation. We explore potential violations of this condition, including the impact of international trade and selection biases due to destination preferences. First, in the case of Bangladesh, five destination countries account for over 75% of migrants, but they represent a small (less than 5%) share of the country's imports and exports. Thus, the influence of international trade on remittance dependence is not a major concern.

Second, migration decisions were made prior to 2012, indicating that migrants did not have access to information on changes in economic fitness when choosing their destinations. We also show that it is difficult to predict changes in economic fitness, minimizing concerns about selection bias. Third, we investigate whether high-paying destinations had differential changes in economic fitness and find no discernible correlation between per capita remittances and changes in economic fitness. This result suggests that high-paying destinations do not exhibit a differential change in economic fitness compared to low-paying destinations.

Although our instrument is plausibly exogenous, we test the sensitivity of our results to the relaxation of the exogeneity assumption using Nevo & Rosen (2012)'s Imperfect Instrumental Variables (IIV) approach. Unlike the traditional IV method, which requires zero correlation between the instrument and the error term, the IIV approach allows for some correlation, resulting in bound estimates instead of point estimates.

Our instrumental variable (IV) estimation provides compelling evidence on the impact of remittances on households' non-remittance income. At the extensive margin, we find that remittances significantly increase the likelihood of having non-remittance income. Specifically, a 10 percent increase in remittances corresponds to a 1.5 percentage point rise in the probability of having non-remittance income. Furthermore, at the intensive margin, remittances positively affect households' non-remittance income, with a 10 percent increase in remittances leading to a 2.7 percent increase in non-remittance income. These findings indicate that remittances do not lead to remittance dependence.

We conduct robustness checks using different model specifications and relaxing the exogeneity assumption of the instrumental variables approach, and our conclusion remains unchanged. These findings provide further credibility to our main results.

We also explore specific income sources that contribute to the increase in non-remittance income. Examining various income sources, including salary and wage earnings, agricultural and non-agricultural enterprise earnings, rental income, and financial income, we gain a deeper understanding of how remittances affect non-remittance income. Our results show that remittances reduce the likelihood of receiving salary and wages. However, we find no significant effect on the amount of salary and wage earnings. Similarly, we find no significant effects on either the likelihood or amount of agricultural and non-agricultural enterprise earnings or financial income. Conversely, we find a significant positive effect of remittances on both the likelihood and amount of rental income. These results suggest that while remittances may reduce households' labor supply, they concurrently foster increased engagement in non-labor income-earning activities.

We further explore two potential channels through which remittances affect household non-remittance income: the health productivity effect and the capital accumulation effect. The health productivity effect suggests that remittances enable individuals to improve their health and living conditions, leading to increased productivity and engagement in income-generating activities. Our results show a significant positive effect of remittances on healthy lifestyle

indicators, supporting the notion that remittances contribute to improved health and sanitation. Additionally, we explore the capital accumulation effect, which posits that remittances alleviate household budget constraints and facilitate capital accumulation. Our results show that remittances significantly enhance physical and financial capital accumulation, which can subsequently increase non-remittance income and reduce remittance dependence.

This study makes two notable contributions to the existing literature on the effect of remittances on household economics. First, it extends the analysis beyond labor supply and explores the causal relationship between remittance and non-remittance income, providing a comprehensive understanding of how remittances influence household income. The findings reveal the nuanced effects of remittances on various income sources.

Second, the study investigates the capital accumulation and health productivity effects, shedding light on the mechanisms through which remittances affect household dependence. The positive relationship between remittances and healthy lifestyle indicators supports the notion that remittances contribute to improved human capital. Additionally, the significant enhancement of physical and financial capital accumulation due to remittances increases the potential for non-remittance income and reduced remittance dependence. These contributions enhance our understanding of the relationship between remittances and household economics, providing valuable insights for researchers and policymakers.

The rest of the paper is structured as follows: Section 2 covers the data sources, Section 3 covers the empirical methodology, Sections 4 to 6 covers the main results, robustness checks, and heterogeneity analysis, Section 7 explores the mechanisms, Section 8 provides additional results, and Section 9 concludes the paper.

2. Data Source

This study employs data from the Bangladesh Survey on the Use of Remittance 2013, which is a nationally representative cross-sectional household survey specifically designed to collect information from international remittance receiving households. The survey was conducted by the Bangladesh Bureau of Statistics (BBS) in 2013 (Bangladesh Bureau of Statistics, 2013). It offers a comprehensive range of data, including details on the characteristics of the migrants, the socioeconomic conditions of the remittance receiving households, and detailed information on the use of remittances. Additionally, the survey provides detailed information on migrant characteristics including the destination country of the migrant. Notably, the survey collected

retrospective household income and expenditure data, spanning the 12 months preceding the survey. Furthermore, households reported the amount of remittances received during the same 12-month period.

Our primary explanatory variable in this study is the cash amount of remittances received by households in the previous 12 months before the survey. Our outcome of interest is household's non-remittance income. We explore non-remittance income at both the extensive and intensive margins. At the extensive margin, we measure non-remittance income using a binary indicator variable that equals one if the household reports income from non-remittance sources, and zero otherwise. At the intensive margin, non-remittance income is defined as the amount of income from non-remittance sources in last 12 months.⁸

The rationale behind employing measures at both the extensive and intensive margins is to capture different aspects of remittance dependence within the household. At the extensive margin, we assess whether households have income from non-remittance sources, as this indicates that a household is not completely dependent on remittances. On the other hand, at the intensive margin, we focus on the amount of income derived from non-remittance sources. Higher non-remittance income of a household signifies a lower level of dependency on remittances. By considering both the extensive and intensive margins, we obtain deeper understanding of the relationship between remittance amounts and the level of household dependence on remittances.

Our sample includes households with temporary economic migrants who will return to their home country after living in the destination country for a period.⁹ We keep households with male migrants as migration is predominantly a male phenomenon in Bangladesh. Finally, we keep households with a migration duration of at least 18 months because any reports of total remittances in the last 12 months will be incomplete if migration happened within the last year. In addition, migrants do not start sending remittances immediately after arriving at their

⁸ One limitation of this survey is that it only provides total income from remittance and non-remittance sources. However, it does not provide detailed breakdown of non-remittance income sources. As a result, we cannot identify the exact sources of non-remittance income. To address this data limitation, we use Household Income and Expenditure Survey, 2016 in Section 7.

⁹ Labour migration in Bangladesh is typically of a temporary nature with workers returning in some future period. Every year, thousands of Bangladeshi workers migrate to Gulf countries to work on short-term visas and short-term contracts (Bossavie et al., 2021). Furthermore, permanent migrants are less likely to send remittances as their ties with Bangladesh weakens over time.

destination.¹⁰ Our final sample consists of 8,995 remittance receiving households with temporary male migrants who migrated at least 18 months before the survey.

Table 1 presents the distributional characteristics of the sample. Columns (1) and (2) provide the means and standard deviations for the full sample. Meanwhile, Columns (3) and (4) present the mean and standard deviations for the sample with non-remittance income. Almost half (48%) of the remittance receiving households in Bangladesh are female headed. About a third (32%) of household heads in remittance receiving households have secondary education and a little above a quarter (28%) have primary education. The typical household head in remittance receiving households is 49 years old. On average, 21% of non-migrant family members are adult males and 40% are adult females.

Most migrants from Bangladesh are young men with an average age of 33 years. These migrants have typically low levels of education, only 12% have above-secondary level education. It is therefore not surprising that about 64% of them work as laborers. The Gulf Cooperation Countries (GCC) are the main destination for Bangladeshi migrants as they account for 70% of the migrants in our sample. More than half (53%) of the migrants are sons of the household head and about 34% are the husband of the household head. Bangladeshi migrants sent a total of \$2,850 in remittances over the 12 months preceding the survey which amounts to an average of \$238 per month.¹¹ Finally, about 74% of the sample reports having non-remittance income, which implies that about 26% of the sample are fully remittance dependent, i.e., they have no income sources except remittances.

Table 1: Summary Statistics

| | Full Sample | | Sample with Non-remittance Income | |
|--|-------------|-----------|-----------------------------------|-----------|
| | Mean | Std. Dev. | Mean | Std. Dev. |
| | (1) | (2) | (3) | (4) |
| Household Head's Characteristics | | | | |
| Household head is female (=1 if yes) | 0.479 | 0.500 | 0.385 | 0.487 |
| Head has primary education (=1 if yes) | 0.282 | 0.450 | 0.281 | 0.450 |
| Head has secondary education (=1 if yes) | 0.324 | 0.468 | 0.309 | 0.462 |
| Head's age | 48.68 | 16.48 | 51.07 | 16.02 |
| Household Characteristics | | | | |
| Household size | 4.683 | 2.320 | 4.993 | 2.435 |
| Proportion of male members aged 16-60 years | 0.209 | 0.204 | 0.235 | 0.201 |
| Proportion of female members aged 16-60 years | 0.402 | 0.180 | 0.400 | 0.175 |
| Remittance receipt by migrant's parents (=1 if yes) | 0.399 | 0.490 | 0.450 | 0.498 |
| Remittance receipt by migrant's wife (=1 if yes) | 0.417 | 0.493 | 0.353 | 0.478 |
| Remittance receipt by migrant's brother/sister (=1 if yes) | 0.123 | 0.329 | 0.140 | 0.347 |

¹⁰ Using a migration duration of at least 18 months allows us to receive a complete report of remittances over the last 12 months before the survey, leaving migrants 6 months to settle and start sending remittances.

¹¹ The cash amount of remittances was converted from Bangladesh Taka (BDT) to USD using the average exchange rate in 2013 which was BDT78/\$1.

| | | | | |
|---|----------|----------|----------|----------|
| Frequency of remittance received | 5.234 | 3.145 | 5.044 | 3.069 |
| Migrant's Characteristics | | | | |
| Migrant's age | 33.311 | 9.125 | 32.476 | 9.056 |
| Migrant has above secondary education (=1 if yes) | 0.120 | 0.325 | 0.131 | 0.337 |
| Migrant is a husband (=1 if yes) | 0.340 | 0.474 | 0.251 | 0.434 |
| Migrant is a son (=1 if yes) | 0.526 | 0.499 | 0.596 | 0.491 |
| Migrant is a laborer (=1 if yes) | 0.642 | 0.480 | 0.641 | 0.480 |
| Migrant is in the Gulf countries (=1 if yes) | 0.723 | 0.448 | 0.703 | 0.457 |
| Remittance Information | | | | |
| Total remittances in past 12 months (USD) | 2,849.76 | 2,917.13 | 2,935.79 | 2,961.24 |
| Household income | | | | |
| Have non-remittance income (=1 if yes) | 0.736 | 0.441 | 1.00 | 0.00 |
| Non-remittance income in past 12 months (USD) | - | - | 940.74 | 1,315.53 |
| Change in economic fitness of the destination countries | 0.121 | 0.131 | 0.120 | 0.131 |
| Observations | 8,995 | | 6,518 | |

Notes: (a) This table shows the mean and standard deviation of the key variables. For full sample mean is reported in column 1 and standard deviation is reported in column 2. For sample with non-remittance income mean is reported in column 3 and standard deviation is reported in column 4.

3. Empirical Methodology

This study examines whether remittances lead to dependence – reduce the likelihood and the magnitude of non-remittance income generated by the recipient household. We start our analysis by estimating a linear regression model using the ordinary least squares (OLS) estimator. The baseline model is:

$$Y_i = \beta_0 + \beta_1 R_i + X_i' \Pi + \epsilon_i \quad (1),$$

where Y_i captures household i 's non-remittance income at both the extensive and intensive margins. At the extensive margin Y_i is dummy variable that equals 1 if the household declares to have non-remittance income and zero otherwise. The function $Y_i = 1(Y_i^* > 0)$ is an indicator function that takes the value of 1 if $Y_i^* > 0$ and zero otherwise. Y_i^* is an unobserved or latent variable that captures the probability that household i has non-remittance income (i.e., not remittance dependent). At the intensive margin, Y_i is the natural logarithm of household i 's total non-remittance income in the last 12 months.¹² Our key explanatory variable, R_i , is the natural logarithm of total remittances received by the household in the last 12 months. X_i' is a vector of individual and household level characteristics which include household head, household, and migrant characteristics presented in Table 1. β_1 is the parameter of interest and ϵ_i is the error term, where $\epsilon_i \sim N(0, \sigma^2)$.

An OLS estimation of Eq (1) is likely to produce biased estimates due to the endogeneity of remittances. This endogeneity could arise from household level unobserved characteristics

¹² This includes households' income from all other sources except remittance.

such as household wealth prior to migration, leading to reverse causality. Since migration involves large upfront costs, wealthier households are able to send migrants to high-paying countries and thus receive large remittances. On the contrary, receiving large remittances can facilitate income generation and asset acquisition, thus increasing household wealth.

We address the endogeneity of remittance using an instrumental variable (IV) approach. We use changes in economic fitness at the destination countries to instrument for remittances. According to the World Bank, economic fitness is a measure of a country's level of diversification and capability to produce complex goods on a globally competitive basis (World Bank, 2023b). Countries with higher levels of economic fitness can produce a more diverse set of goods and services, they are able to quickly upgrade into more complex goods, they are likely to have more predictable long-term growth and to attain globally competitive positions, compared to other countries.

In our context, the IV is defined as changes in the economic fitness of the migrants' destination countries from 2011 to 2012. A positive change in economic fitness shows relatively greater capabilities, higher value additions, greater ease in diversifying products, which reduces the demand for low-skilled workers while increasing the demand for high-skilled workers (World Bank, 2023b). Cervantes-Martínez & Villaseñor-Becerra (2023) shows that increase in economic fitness enhances labor productivity in formal sector, without any significant effect on the informal sector. Appendix Figure A1 shows a negative correlation between change in economic fitness and the change in informal sector contribution to GDP.¹³ Therefore, the evidence suggests that an increase in economic fitness is likely to decrease the demand for low-skilled workers relative to skilled workers.

A fall in the demand for low-skilled workers is likely to reduce both their employment prospects and earnings. Since the majority of Bangladeshi migrants are low-skilled workers, a positive change in economic fitness is expected to adversely affect their earnings and remittances sent. Furthermore, a change in economic fitness is not likely to affect households' decisions in the origin country through any other channels except remittances. The exogeneity of destination-level characteristics makes them suitable instruments to study left behind

¹³ The figure shows that an increase in the change in economic fitness is associated with a decrease in the informal sector's contribution to GDP across countries in 2012. This finding implies that an increase in the change in economic fitness is likely to reduce the demand for low-skilled workers, who predominantly work in the informal sector. In the absence of direct data on the demand for low-skilled workers, this figure provides indicative evidence of the negative association between change in economic fitness and the demand for low-skilled workers.

households' decisions in the migration literature (for example, see Amuedo-Dorantes, 2014; Antman, 2014; Cuadros-Menaca & Gaduh, 2020; Yang, 2008).

The key identifying assumption of instrumental variable estimation is the exogeneity condition. This condition requires that the instrument affects the endogenous variable (in this case, remittances), but does not have a direct effect on the dependent variable (in this case, non-remittance income) through other channels. Although we have argued that our instrument is exogenous, we have also conducted an exploration of potential channels through which the exogeneity assumption might be violated.

One potential violation of the exogeneity condition could arise from international trade. If the major migrant destination countries also happen to be significant trading partners of a country, changes in the economic situation in those destination countries can impact economic activities, including non-remittance income, in the origin country through channels other than remittances. In case of Bangladesh, it is worth noting that five major destination countries – Saudi Arabia, United Arab Emirates, Malaysia, Kuwait, and Oman – account for 76% of all Bangladeshi migrants (Bangladesh Bureau of Statistics, 2011). However, as of 2016, these countries represent less than 1% and 5% of Bangladesh's imports and exports, respectively (World Bank, 2023c). Consequently, we conclude that the international trade channel does not raise concerns in our context.

A second potential source of violation of the exogeneity condition relates to selection bias stemming from destination preferences. If migrants are able to observe changes in economic fitness and adjust their migration decisions accordingly, then the exogeneity condition would be violated as the choice of destination becomes endogenous. However, in our case, migration occurred prior to 2012, which means that migrants did not have access to information regarding economic fitness changes between 2011 and 2012 when making their destination choices. We also show in Appendix Figure A2 that it is difficult to predict the change in economic fitness.¹⁴

Finally, the exogeneity condition could also be violated if high-paying destinations have a differential change in economic fitness. In such a scenario, migrants might choose destinations with higher incomes and indirectly select destinations with favorable changes in economic fitness. To address this concern, we examine the correlation between per capita remittances

¹⁴ This figure underscores that using a simple average of change in economic fitness over past 15 years (1997 - 2011) to predict the change in economic fitness in year 2012 will result in large forecast errors. This finding implies that it is difficult for migrants to choose favorable destinations based on their prediction of economic fitness change as their prediction are prone to substantial inaccuracies.

and changes in economic fitness of the destination countries. If high-paying destinations have favorable change in economic fitness, we would expect to observe a positive correlation between per capita remittances and change in economic fitness. However, Appendix Figure A3 shows no discernible correlation between the remittance levels and changes in economic fitness.¹⁵ This result suggests that high-paying destinations do not exhibit differential changes in economic fitness compared to low-paying destinations, and migrants cannot indirectly choose favorable changes in economic fitness by selecting high paying destinations.

So far, we have provided evidence supporting the exogeneity of our instrument. Nevertheless, it is important to acknowledge that exogeneity is a strong condition that is difficult to test empirically. To address this issue, we employ Nevo & Rosen (2012)'s imperfect instrumental variables (IIV) approach, which allows us to relax the exogeneity assumption. Unlike the traditional instrumental variable approach that imposes zero correlation between the regression error term and the instrument i.e., $Corr(Z, \epsilon) = 0$, the IIV approach relaxes this strong assumption by allowing the error term to be correlated with the instrument. By doing so, the exogeneity assumption is replaced with two weaker assumptions that allow for partial identification of the parameter of interest, resulting in a bound estimate instead of a point estimate.

First, the IIV approach assumes that the correlation between the IIV and the error term shares the same direction as the correlation between the endogenous regressor and the error term.¹⁶ This assumption is presented formally in equation 2:

$$\rho_{X\epsilon}\rho_{Z\epsilon} \geq 0 \quad (2).$$

¹⁵ The figure shows the scatter plot of per capita remittance from major migration destinations in 2010 and the change in economic fitness from 2011 to 2012. Remittance data for this exercise was obtained from the Bangladesh Bank database (Bangladesh Bank, 2023) and migrant stock data was obtained from the World Development Report 2023 (World Bank, 2023a). These two datasets combined provided us per capita remittance data in 2010 for only 15 migration destinations. However, these 15 countries account for 91% of all Bangladeshi migrants.

¹⁶ The IIV assumptions are likely be satisfied in our context. First, household level unobserved characteristics such as household wealth prior to migration are expected to be positively correlated with remittances. Second, if the violation of the strong exogeneity condition could arise from international trade, changes in economic fitness in migrants' destination countries could also exhibit a positive correlation with unobserved household characteristics. Therefore, it is highly likely that the first assumption of the IIV framework is satisfied in our context.

By employing a weak inequality this assumption directly relaxes the exogeneity assumption of the standard IV method, which assumes $\rho X_\epsilon = 0$. Here, ρX_ϵ represents the correlation between the endogenous regressor (X) and the error term (ϵ), whereas ρZ_ϵ denotes the correlation between the IIV and the error term. To further refine the bounds on the parameter of interest, they introduce a second assumption:

$$|\rho X_\epsilon| \geq |\rho Z_\epsilon| \quad (3).$$

This assumption posits that the IIV exhibits weaker correlation with the error term compared to the endogenous regressor. This assumption is quite intuitive as we believe that the IIV is not exogenous, but it is less endogenous than the endogenous regressor of interest.¹⁷ This assumption, in addition to the first assumption, helps tighten the bounds on the parameter of interest. By combining these two assumptions, Nevo & Rosen (2012) define an “imperfect instrumental variable” – an IV that shares the same direction of correlation with the error term as the endogenous regressor but has a weaker correlation. These two weaker assumptions, in place of the traditional validity assumption, generate bounds on the parameter of interest.

We present the results of IIV estimation in Section 5 “Robustness Check”. Next, we specify the linear IV model as follows:

$$Y_i = \beta_0 + \beta_1 \hat{R}_i + X_i' \Pi + \epsilon_i \quad (4),$$

$$R_i = \delta_0 + \delta_1 \Delta E_d + X_i' \Pi + \epsilon_i \quad (5),$$

where ΔE_d is the change in economic fitness in the destination country, δ_0 and δ_1 are parameters to be estimated. The other variables and parameters are as before.

Columns (1) and (2) of Table 2 show the first stage results of our instrumental variables estimation. The first stage estimate of remittances (in log scale) is statistically significant and has the expected sign. A positive change in economic fitness reduces the size of remittances received by the household. The F -statistics of 232.70 and 221.23 respectively are greater than the conventionally accepted value of 10, which provides some assurance of the quality of the instrument.

¹⁷ Regarding the second assumption, it is reasonable to expect that the correlation between remittances and unobserved household characteristics is stronger compared to the correlation between changes in economic fitness in migrants’ destination countries and unobserved household characteristics. We argue that the instrumental variable is less endogenous than the endogenous regressor, thus providing support for the satisfaction of the IIV assumptions.

We also check for under-identification and weak identification using the Sanderson-Windmeijer (SW) and Cragg-Donald tests. The null hypotheses are that the endogenous regressor is weakly identified, and the model is under-identified. We reject the null hypotheses as the associated F statistics are greater than the critical values (see Table 2). These results provide further assurance about the credibility of our instrument.

Table 2: First Stage Regression

| | Full Sample | Sample with Non-remittance Income |
|--|----------------------|-----------------------------------|
| | Log (Remittances) | Log (Remittances) |
| | (1) | (2) |
| Change in the economic fitness | -0.732*** (0.048) | -0.828*** (0.056) |
| Household head is female (=1 if yes) | 0.003 (0.016) | -0.018 (0.018) |
| Head has primary education (=1 if yes) | 0.033** (0.013) | 0.029* (0.017) |
| Head has secondary education (=1 if yes) | 0.025* (0.014) | -0.006 (0.016) |
| Head's age | 0.001 (0.001) | -0.001 (0.001) |
| Household size | 0.053*** (0.003) | 0.046*** (0.003) |
| Proportion of male members aged 16-60 years | 0.029 (0.042) | -0.077* (0.063) |
| Proportion of female members aged 16-60 years | 0.273*** (0.053) | 0.260*** (0.051) |
| Remittance receipt by migrant's parents (=1 if yes) | 0.012 (0.013) | 0.032* (0.016) |
| Remittance receipt by migrant's brother/sister (=1 if yes) | -0.041 (0.033) | 0.006 (0.039) |
| Frequency of remittance received | 0.073*** (0.002) | 0.086*** (0.003) |
| Migrant's age | 0.001 (0.001) | 0.001 (0.002) |
| Migrant has above secondary education (=1 if yes) | 0.139*** (0.028) | 0.128*** (0.028) |
| Migrant is a husband (=1 if yes) | -0.083*** (0.030) | 0.016 (0.040) |
| Migrant is a son (=1 if yes) | 0.008 (0.033) | 0.073* (0.041) |
| Migrant is a laborer (=1 if yes) | -0.127*** (0.014) | -0.118*** (0.026) |
| Migrant is in the gulf countries (=1 if yes) | -0.086*** (0.014) | -0.094*** (0.016) |
| District fixed effects | Yes | Yes |
| First-stage F-statistics | 232.70 | 221.23 |
| SW Chi-square statistics (underidentification test) | 235.55 | 224.73 |
| SW F-statistics (weak identification test) | 232.70 | 221.23 |
| Cragg-Donald Wald F statistic (weak identification test) | 135.05 | 116.73 |

Notes: (a) This table presents the first stage regression coefficients of the two stage least squares (2SLS) estimation. (b) Outcome variable in columns 1-2 is log (remittances). Column 1 is the first stage for the extensive margin indicator of remittance dependence (i.e., not remittance dependent (=1 if yes)) and column 2 is the first stage for intensive margin indicator of remittance dependence (i.e., log (non-remittance income)). (c) Standard errors are clustered at the village level

and appear in parentheses. (d) All columns include district fixed effects. (e) The list of controls are household head's characteristics, household characteristics, and migrant's characteristics included in Table 1. (f) The Sanderson-Windmeijer (SW) F -statistics is a test of weak identification with a null hypothesis that the endogenous regressor is weakly identified. (g) ***Significant at the 1 percent level, **Significant at the 5 percent level, and *Significant at the 10 percent level.

4. Results

In this section, we present the effect of remittances on households' non-remittance income. We have two indicators – the existence of non-remittance income and the amount of non-remittance income. We present the results of our ordinary least squares (OLS) and instrumental variable (IV) estimations in Table 3. The outcome variable in columns (1) and (2) of Table 3 is the existence of non-remittance income, whereas the outcome variable in columns (3) and (4) is the natural logarithm of non-remittance income. All estimation includes a set of controls and district fixed effects.¹⁸ Furthermore, we cluster the standard errors at the village level to address within-village correlations and heteroskedasticity between villages.

Column (1) of Table 3 presents the OLS estimate which shows that remittances have no significant effect on the likelihood of having non-remittance income. However, the OLS estimate is likely biased downwards due to reverse causality. The instrumental variable (IV) estimate presented in column (2) shows that remittances increase the likelihood of having non-remittance income. More precisely, a 10 percent increase in remittances increases the probability of having non-remittance income by 1.5 percentage points.¹⁹ The OLS estimate in column (3) of Table 3 shows that remittances increase the magnitude of non-remittance income. The IV estimate in column (4) shows a much bigger effect which further indicates that the OLS estimate is biased downward. We find that a 10 percent increase in remittances increases household non-remittance income by 2.7 percent.

These results suggest that remittances do not crowd out non-remittance income and make households remittance dependent. The findings suggest quite the opposite – remittances increase the likelihood and magnitude of non-remittance income. These results suggest that remittances promote income generating activities by the non-migrant household members. However, data limitations restrict us from further exploring the specific economic activities

¹⁸ The list of controls are household head's characteristics, household characteristics, and migrant's characteristics included in Table 1. District is a second-tier administrative unit in Bangladesh. We check the robustness of our main results of Table 3 using different specifications without controls and without district fixed effects. The result of this exercise is presented in appendix Table A1. We find that our main result is not sensitive to different specifications.

¹⁹ We also estimate Probit and IV-Probit models as a robustness check in Appendix Table A2. We find similar results to our instrumental variable estimate.

that contribute to the increase in non-remittance income. We address this limitation using a secondary dataset in Section 7 “Additional Results”.

Table 3: Effect of Remittances on Non-remittance Income

| | Have Non-remittance Income (=1 if Yes) | | Log (Non-remittance Income) | |
|--------------------------|--|---------------------|-----------------------------|---------------------|
| | (1) | (2) | (3) | (4) |
| Log (Remittances) | 0.007 (0.006) | 0.149*** (0.030) | 0.070*** (0.021) | 0.266*** (0.073) |
| Controls | Yes | Yes | Yes | Yes |
| District fixed effects | Yes | Yes | Yes | Yes |
| First-stage F-statistics | - | 232.70 | - | 221.23 |
| Mean of outcome | 0.736 | | 10.528 | |
| Estimation approach | OLS | IV | OLS | IV |
| Observations | 8,995 | 8,995 | 6,518 | 6,518 |

Notes: (a) This table presents the effect of remittances on household non-remittance income. (b) The treatment variable is remittances in log scale. (c) Outcome variable in columns 1-2 is an extensive margin indicator of remittance dependence that equals one if households have non-remittance income, and zero otherwise. (d) Outcome variable in columns 3-4 is an intensive margin indicator of remittance dependence, which is the amount of non-remittance income (in log scale) households have. (e) Columns 1 and 3 show ordinary least square (OLS) estimates and columns 2 and 4 show two-stage instrumental variable estimates. (f) Standard errors are clustered at the village level and appear in parentheses. (g) All columns include district fixed effects. (i) The list of controls are household head’s characteristics, household characteristics, and migrant’s characteristics included in Table 1. (j) ***Significant at the 1 percent level, **Significant at the 5 percent level, and *Significant at the 10 percent level.

5. Robustness Check

In this section, we present the findings on the impact of remittances on households’ non-remittance income using changes in economic fitness as an imperfect instrumental variable (IIV). As discussed in the methodology section, we acknowledged that the exogeneity condition of our instrument could potentially be violated through international trade and endogenous selection of destinations. However, we argued that these channels do not raise concerns within our specific context. Nonetheless, given the inability to empirically test the exogeneity condition, we employed the IIV estimation approach proposed by Nevo & Rosen (2012). The IIV approach relaxes the exogeneity assumption and provides a bound estimate instead of point estimate. The results of this analysis are presented in Table 4.

The estimates in column (1) of Table 4 consistently demonstrate a significant, positive effect of remittances on the likelihood of having non-remittance income. We still find a significant positive effect, that is remittances increase the likelihood of having non-remittance income. The coefficient of remittances is bounded between 0.023 and 0.152, with a 95 percent confidence interval of 0.012 and 0.209. These coefficients are statistically significant, as the 95 percent confidence interval does not contain zero. Similarly, in line with our main findings from IV estimation, column (2) of Table 4 shows a significant positive effect of remittances on

household income from non-remittance sources. The coefficient of remittances is bounded between 0.089 and 0.231, with a 95 percent confidence interval of 0.049 and 0.368.

In this robustness section, we checked the sensitivity of our main results to the relaxation of the exogeneity condition of the traditional instrumental variables approach. We find that our main results are robust to relaxing the exogeneity condition. This exercise lends further credence to our main results.

Table 4: Imperfect IV Estimation of Remittances on Non-remittance Income

| | Have Non-remittance Income (=1 if Yes) | Log (Non-remittance Income) |
|------------------------|---|----------------------------------|
| | (1) | (2) |
| Log (Remittances) | [0.023, 0.152] (0.012, 0.209) | [0.089, 0.231] (0.049, 0.368) |
| Controls | Yes | Yes |
| District fixed effects | Yes | Yes |
| Observations | 8,995 | 6,518 |

Notes: (a) This table presents the effect of remittances on household non-remittance income (b) The treatment variable is log(remittances). (c) Outcome variable in columns 1-2 is an extensive margin indicator of remittance dependence that equals one if households have non-remittance income, and zero otherwise. (d) Outcome variable in columns 3-4 is an intensive margin indicator of remittance dependence, which is the amount of non-remittance income (in log scale) households have. (e) Columns 1 and 2 show imperfect instrumental variable (IIV) estimates. (f) Standard errors are clustered at the village level and appear in parentheses. (g) IIV estimation bounds are reported in square brackets and corresponding confidence intervals are reported in parentheses in columns 1 and 2. (h) All columns include district fixed effects. (i) The list of controls are household head's characteristics, household characteristics, and migrant's characteristics included in Table 1. (j) ***Significant at the 1 percent level, **Significant at the 5 percent level, and *Significant at the 10 percent level.

6. Heterogeneity

In our main estimation, the key explanatory variable is a continuous one, i.e., the natural logarithm of the cash amount of remittance received. Here, we test whether the size of remittances have any differential effect on non-remittance income. We explore whether a high level of remittances affect households' remittance dependence differently compared to a relatively lower level of remittances. To begin, we define our treatment as an indicator variable that equals one if the amount of remittance received is in the top quartile of the remittance distribution and equals zero if in the bottom three. The result of this exercise is presented in Panel A of Table 5.

In a subsequent analysis, we define our treatment as a binary indicator variable that equals one if remittance received is in the top tercile of the remittance distribution and zero if it is in the bottom two terciles. The result of this analysis is presented in Panel B of Table 5. Furthermore,

in another analysis, we define our treatment as an indicator variable that equals 1 if the household received remittances above the median of the remittance distribution and zero otherwise. The result of this analysis is presented in Panel C of Table 5.

The instrumental variable (IV) estimates in Panel A (column 2) show that households in the top quartile are on average 36 percent more likely to have non-remittance income compared to households in the bottom three quartiles. Similarly, at the intensive margin, top quartile remittances receiving households earn 63 percent higher non-remittance income, compared to their counterparts. These differences are statistically significant at the 1% level.

Similarly, the IV estimates in columns (2) and (4) of Panel B show that top tercile remittances receiving households are on average 32 percent more likely to have a non-remittance income and earn about 57.5 percent higher non-remittance income, compared to their counterparts. Following the similar pattern, the estimates in columns (2) and (4) of Panel C shows that households receiving above-median remittances are on average 28 percent more likely to have non-remittance income and earn about 49 percent higher non-remittance income compared to households below median.

Table 5: Effect of Remittances on Non-remittance Income with Alternative Definitions

| | Have Non-remittance Income (=1 if Yes) | | Log (Non-remittance Income) | |
|--------------------------------------|---|---------------------|--------------------------------|---------------------|
| | (1) | (2) | (3) | (4) |
| Panel A | | | | |
| Top quartile remittances (=1 if yes) | 0.034*** (0.008) | 0.355*** (0.074) | 0.194*** (0.042) | 0.633*** (0.179) |
| Controls | Yes | Yes | Yes | Yes |
| District fixed effects | Yes | Yes | Yes | Yes |
| Estimation approach | OLS | IV | OLS | IV |
| First-stage F-statistics | - | 98.05 | - | 87.50 |
| Observations | 8,995 | 8,995 | 6,015 | 6,015 |
| Panel B | | | | |
| Top tercile remittances (=1 if yes) | 0.025*** (0.006) | 0.316*** (0.064) | 0.158*** (0.031) | 0.575*** (0.161) |
| Controls | Yes | Yes | Yes | Yes |
| District fixed effects | Yes | Yes | Yes | Yes |
| Estimation approach | OLS | IV | OLS | IV |
| First-stage F-statistics | - | 159.42 | - | 144.44 |
| Observations | 8,995 | 8,995 | 6,015 | 6,015 |
| Panel C | | | | |
| Above median remittances (=1 if yes) | 0.030*** (0.007) | 0.282*** (0.057) | 0.107*** (0.021) | 0.492*** (0.138) |
| Controls | Yes | Yes | Yes | Yes |
| District fixed effects | Yes | Yes | Yes | Yes |
| Estimation approach | OLS | IV | OLS | IV |
| First-stage F-statistics | - | 161.77 | - | 178.16 |
| Observations | 8,995 | 8,995 | 6,015 | 6,015 |

Notes: (a) This table presents the effect of high level of remittances on household dependence on remittance income. (b) The treatment variable in Panel A is an indicator of high level of remittances equals 1 if received remittances is in the top quartile of remittance distribution, and zero if received remittances is in the bottom three quartile of remittance distribution. The treatment variable in Panel B is an indicator of high level of remittances equals 1 if received remittances is in the top tercile of remittance distribution, and zero if received remittances is in the bottom two tercile of remittance distribution. The treatment variable in Panel C is an indicator of high level of remittances equals 1 if received remittances is above the median of remittance distribution, and zero if received remittances is below the median of remittance distribution. (c) Outcome variable in columns 1-2 is an extensive margin indicator of remittance dependence that equals one if households have non-remittance income, and zero otherwise. (d) Outcome variable in columns 3-4 is an intensive margin indicator of remittance dependence, which is the amount of non-remittance income (in log scale) households have. (e) Columns 1 and 3 show ordinary least square (OLS) estimates and columns 2 and 4 show two-stage instrumental variable estimates. (f) Standard errors are clustered at the village level and appear in parentheses. (g) All columns include district fixed effects. (i) The list of controls are household head's characteristics, household characteristics, and migrant's characteristics included in Table 1. (j) ***Significant at the 1 percent level, **Significant at the 5 percent level, and *Significant at the 10 percent level.

The heterogeneity analysis provides further evidence supporting a negative relationship between remittances and remittance dependence. Specifically, the results indicate that as the level of remittances increases, both the probability and magnitude of non-remittance income also increase.

7. Additional Results

In our main result section, we have demonstrated the positive effect of remittances on the likelihood and magnitude of households non-remittance income. However, due to data limitations, we could not identify the exact sources contributing to the increase in non-remittance income.²⁰ To address this issue, we employ a secondary data source – Bangladesh Household Income and Expenditure Survey (HIES) 2016-2017 (BBS, 2017).²¹ HIES provides detailed information on various income generating activities in which households engage including salary and wage earnings from employment, self-employment earnings from agricultural and non-agricultural enterprises, rental income from property and sharecropping, and financial income from profit, dividends, and interest. By utilizing the HIES data, we delve deeper into the effect of remittances on households' choices of economic activities.

We re-estimate our main estimation equations using households' income generating activities as outcome variables. Specifically, we explore both the likelihood (extensive margin) and the amount of income earned (intensive margin) from five distinct economic activities: salary and wage earnings, earnings from agricultural enterprises, earnings from non-agricultural enterprises, rental income, and financial income. By examining these different income sources, we gain a deeper understanding of how remittances influence the non-remittance income generated by households. We present the result of this exercise in Table 6.

Panel A of Table 6 shows a negative and significant effect of remittances on the likelihood of receiving salary and wages. Although remittances have a positive effect on the likelihood of receiving agricultural enterprise earnings, non-agricultural enterprise earnings, and financial income, the effects are not statistically significant. Conversely, remittances have a positive and significant effect on the likelihood of receiving rental income.

Panel B of Table 6 shows that remittances negatively affect earnings from salary and wages and agricultural enterprises. However, the effects are not statistically significant. On the contrary, remittances increase earnings from non-agricultural enterprises, rental, and financial sources. However, the effect on rental income is the only statistically significant one. A 10 percent increase in remittances increases rental income by 2.14 percent. This finding suggests

²⁰ One of the limitations of the Remittance use survey is that it doesn't provide the type of economic activities household engaged in.

²¹ HIES 2016-17 is a nationally representative survey conducted by Bangladesh Bureau of Statistics (BBS). It offers a comprehensive dataset that provides insights into the income and expenditure patterns of households in Bangladesh.

that increase in rental income explains about 80 percent of the effect of remittances on households' non-remittance income.²² Therefore, rest of the 20 percent of income increase is likely coming from sources like non-agricultural enterprise earnings and financial income.

The existing literature suggests that remittances reduce labor supply due to increased reservation wage (Amuedo-Dorantes & Pozo, 2006; Démurger, 2015; Vadean et al., 2017). However, these studies focus on labor income and overlook income from non-labor sources. Our result shows that while remittances may reduce households labor supply, it increases their participation in non-labor economic activities. In the context of Bangladesh, where the majority of non-migrant household members are parents, wives, and children, it is likely that remittances will lead to higher participation in non-labor activities. This finding suggests that remittances help households to substitute away from labor activities to non-labor activities but does not create dependence.

Table 6: Effect of Remittances on Household Income Generating Activities

| | (1) | (2) | (3) | (4) | (5) |
|------------------------------|------------------------------|--|--|---------------------------|------------------------------|
| Panel A: Dummy Outcomes | | | | | |
| | Salary and Wages (=1 if Yes) | Agricultural Enterprise Earnings (=1 if Yes) | Non-Agricultural Enterprise Earnings (=1 if Yes) | Rental Income (=1 if Yes) | Financial Income (=1 if Yes) |
| Log (Remittances) | -0.197* (0.118) | -0.033 (0.152) | 0.123 (0.087) | 0.335** (0.138) | 0.063 (0.046) |
| Mean of Outcome | 0.200 | 0.380 | 0.078 | 0.289 | 0.022 |
| Panel B: Continuous Outcomes | | | | | |
| | Log (Salary and Wages) | Log (Agricultural Enterprise Earnings) | Log (Non-Agricultural Enterprise Earnings) | Log (Rental Income) | Log (Financial Income) |
| Log (Remittances) | -1.475 (0.962) | -0.894 (0.663) | 1.155 (0.728) | 2.138*** (0.807) | 0.418 (0.265) |
| Mean of Outcome | 1.621 | 2.027 | 0.591 | 1.585 | 0.104 |
| Controls | Yes | Yes | Yes | Yes | Yes |
| District Fixed Effects | Yes | Yes | Yes | Yes | Yes |
| Method | IV | IV | IV | IV | IV |
| First-stage F-statistics | 11.58 | 11.58 | 11.58 | 11.58 | 11.58 |
| Data Source | HIES | HIES | HIES | HIES | HIES |
| Observations | 2,150 | 2,150 | 2,150 | 2,150 | 2,150 |

Notes: (a) This table presents the effect of remittances on household income generating activities. (b) The treatment variable is remittances in log scale. (c) Outcome variables in Panel A and B are dummy and continuous variables, respectively. (d) Outcome variables are household income sources: salary and wages, agricultural enterprise, non-agricultural enterprise, rental income, and financial income. Agricultural enterprise earnings include earnings from crops, livestock, fishery, and forestry. Rental income includes income from land rent and sharecropping. Financial income includes profit, dividends, and interest. (e) Standard errors are clustered at the village level and appear in parentheses. (f) All columns include district fixed effects. (g) The list of controls are household head's characteristics, household characteristics, and migrant's

²² Our main estimation result in Table 3 shows that a 10 percent increase in remittances lead to a 2.7 percent increase in non-remittances income. This result shows that about 80 percent of the effect (2.138) is coming from the increase in rental income.

characteristics. (h) Data used in this table comes from Bangladesh Household Income and Expenditure Survey (HIES) 2016. (i) ***Significant at the 1 percent level, **Significant at the 5 percent level, and *Significant at the 10 percent level.

8. Mechanisms

Remittances being a private transfer can lead to substantial increase in the liquidity of the recipient households. The liquidity effect may enhance income-generating activities through capital accumulation and improved health productivity. This section explores the channels through which remittances affect households' non-remittance income. We explore both the capital accumulation and health productivity effects as potential channels.

8.1. Capital Accumulation Effect

The first channel we explore is the “capital accumulation effect” mechanism. Extensive literature suggests that remittances relax households' budget constraints, leading to higher consumption expenditure and facilitating capital accumulation (Adams & Cuecuecha, 2010; Adams, 2011; Adams & Cuecuecha, 2013; Hossain & Sunmoni, 2022; Jena, 2018). Hence, we examine whether remittances, through relaxing household budget constraints, facilitate capital accumulation. The result of this analysis is presented in Table 7.

The outcome variables in Table 7 are: an indicator for above-district average consumption, an indicator for physical capital accumulation, amount of physical capital accumulation (in log scale), an indicator for financial capital accumulation, and amount of financial capital accumulation (in log scale). Our findings provide strong evidence in support of the capital accumulation mechanism. Column 1 of Table 7 shows that remittances alleviate household budget constraints— one percent increase in remittances increases the likelihood of above-district average consumption expenditure by 0.31 percentage points. Columns (2)-(5) demonstrate that remittances significantly augment capital accumulation. A higher physical and financial capital is likely to boost household non-remittance income and reduce remittance dependence.

Table 7: Liquidity Effect Mechanism

| | Above Average Consumption (=1 if yes) | Physical Capital Accumulation (=1 if yes) | Log (Physical Capital Expenditure) | Financial Capital Accumulation (=1 if yes) | Log (Financial Capital Expenditure) |
|--------------------------|--|--|---|---|--|
| | (1) | (2) | (3) | (4) | (5) |
| Log (Remittances) | 0.312*** (0.036) | 0.135*** (0.029) | 0.647*** (0.191) | 0.187*** (0.034) | 0.711*** (0.170) |
| Mean outcome | 0.510 | 0.263 | 7.015 | 0.481 | 5.728 |
| Controls | Yes | Yes | Yes | Yes | Yes |
| District Fixed Effects | Yes | Yes | Yes | Yes | Yes |
| Estimation approach | IV | IV | IV | IV | IV |
| First-stage F-statistics | 161.69 | 165.03 | 62.54 | 165.03 | 55.02 |
| Observations | 8,984 | 8,985 | 2,304 | 8,985 | 4,644 |

Notes: (a) This table presents the effect of remittances on household investment in high consumption, physical, and financial investment. (b) The treatment variable is log(remittances). (c) All columns show two-stage instrumental variable estimates. (d) Standard errors are clustered at the household level and appear in parentheses. (e) All columns include district fixed effects. (f) The list of controls are household head's characteristics, household characteristics, and migrant's characteristics included in Table 1. (g) ***Significant at the 1 percent level, **Significant at the 5 percent level, and *Significant at the 10 percent level.

8.2. Health and Productivity

The second mechanism we study is the “health productivity effect.” Previous research suggests that unhealthy individuals tend to exhibit lower productivity (Baird et al., 2018; Dasgupta & Ray, 1986). For example, poor health can directly reduce hours worked due to morbidity. It can also indirectly affect income earning activities through caring for sick household members and loss of assets to cover medical expenses (Kwadwo et al., 2011).

Remittances can enable individuals to consume nutritious food, improve living conditions, and invest in their health. These factors contribute to improve overall health of non-migrant household members, thereby resulting in increased productivity and greater involvement in income-generating activities (Amuedo-Dorantes, 2014).

We use six different measures to capture the health productivity effect. These measures include health care expenditure, healthy sanitation facility, healthy cooking facility, healthy lighting facility, healthy water facility, and healthy lifestyle index. The healthy sanitation facility is represented by a binary indicator variable that equals one if the household uses sanitary toilet facilities and zero otherwise. Similarly, the healthy cooking facility is a binary indicator variable that equals one if the household uses clean cooking options such as natural gas or liquefied petroleum gas and zero if the household uses kerosene or wood.

The healthy lighting facility is another binary indicator variable, which equals one if the household uses clean lighting options such as electricity or solar and zero if the household uses

kerosene. Furthermore, the healthy water facility is also represented by a binary indicator variable that equals one if the household uses healthy water sources such as piped water or deep well and zero if the household uses pond or river water. Lastly, the healthy lifestyle index is the first principal component of the four variables (i.e., healthy sanitation facility, healthy cooking facility, healthy lighting facility, and healthy water facility) and is normalized to have zero mean and a standard deviation of one.²³

We re-estimate our main estimation equations using the healthy lifestyle indicators as outcome variables. The result of this exercise is presented in Table 8. We find strong evidence of the health productivity effect. Specifically, we observe a statistically significant positive effect of remittances on a healthy lifestyle. These results are consistent with previous studies that suggest remittances contribute to improving households' health and sanitation facilities (Adams, 2011; Amuedo-Dorantes & Pozo, 2011).

Table 8: Health Productivity Effect Mechanism

| | Log (Health Care Expenditure) | Healthy Sanitation Facility (=1 if yes) | Healthy Cooking Facility (=1 if yes) | Healthy Lighting Facility (=1 if yes) | Healthy Water Facility (=1 if yes) | Healthy Lifestyle Index |
|--------------------------|-------------------------------------|--|---|--|---|-------------------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Log (Remittances) | 0.651*** (0.084) | 0.330*** (0.038) | 0.075** (0.035) | 0.147*** (0.026) | 0.021 (0.030) | 0.749*** (0.104) |
| Mean outcome | 4.266 | 0.485 | 0.051 | 0.857 | 0.987 | -0.002 |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| District fixed effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Estimation approach | IV | IV | IV | IV | IV | IV |
| First-stage F-statistics | 139.20 | 165.03 | 165.03 | 165.03 | 165.03 | 165.03 |
| Observations | 8,646 | 8,985 | 8,985 | 8,985 | 8,985 | 8,985 |

Notes: (a) This table presents the effect of remittances on household investment in healthy lifestyle. (b) The treatment variable is log(remittances). (c) Healthy lifestyle index is the first principal component of four variables (i.e., healthy sanitation facility, healthy cooking facility, healthy lighting facility, and healthy water facility) and normalized it to have zero mean and 1 standard deviation. (d) All columns show two-stage instrumental variable estimates. (e) Standard errors are clustered at the household level and appear in parentheses. (f) All columns include district fixed effects. (g) The list of controls are household head's characteristics, household characteristics, and migrant's characteristics included in Table 1. (h) ***Significant at the 1 percent level, **Significant at the 5 percent level, and *Significant at the 10 percent level.

9. Conclusion

This study has provided valuable insights into the relationship between remittances and household remittance dependence, extending beyond the traditional focus on labor supply. By examining the effect of remittances on non-remittance income, this research has contributed to a comprehensive understanding of how remittances influence household income in

²³ The principal components are shown in Appendix Table A3.

Bangladesh. The findings reveal nuanced effects on various income sources, such as salary and wages, agricultural and non-agricultural enterprise earnings, rental income, and financial income. Notably, the study shows that while remittances reduce the likelihood of labor income, they concurrently foster increased engagement in non-labor economic activities, particularly through the positive effect on rental income.

Furthermore, the study explores two important channels through which remittances impact households' non-remittance income: the capital accumulation effect and the health productivity effect. The results demonstrate a significant positive relationship between remittances and healthy lifestyle indicators, suggesting that remittances contribute to improved health and sanitation, thereby increasing productivity and participation in income-generating activities. Additionally, the study highlights the remittances increase physical and financial capital accumulation, indicating the potential for increased non-remittance income and reduced remittance dependence.

These findings have important implications for policymakers. By understanding the complex relationship between remittances and household economics, policymakers can design targeted interventions and strategies that promote economic well-being, reduce remittance dependence, and enhance the overall welfare of households in Bangladesh. The insights from this study can inform the development of policies and programs aimed at supporting health improvements, facilitating capital accumulation, and fostering income diversification among remittance-receiving households.

References

- Acosta, P. (2020). Intra-Household Labour Allocation, Migration, and Remittances in Rural El Salvador. *The Journal of Development Studies*, 56(5), 1030–1047. <https://doi.org/10.1080/00220388.2019.1626832>
- Adams, R., & Cuecuecha, A. (2010). The Economic Impact of International Remittances on Household Consumption and Investment in Indonesia. In *World Bank Policy Research Working Paper 5433* (Vol. 49, Issue 6). <https://doi.org/10.1353/jda.2015.0101>
- Adams, R. H. (2011). Evaluating the economic impact of international remittances on developing countries using household surveys: A literature review. *Journal of Development Studies*, 47(6), 809–828. <https://doi.org/10.1080/00220388.2011.563299>
- Adams, R. H., & Cuecuecha, A. (2013). The Impact of Remittances on Investment and Poverty in Ghana. *World Development*, 50, 24–40. <https://doi.org/10.1016/j.worlddev.2013.04.009>
- Amuedo-Dorantes, C. (2014). The good and the bad in remittance flows. *IZA World of Labor*, 97, 15185. <https://doi.org/10.15185/izawol.97>
- Amuedo-Dorantes, C., & Pozo, S. (2006). Migration, Remittances and Male and Female Employment Patterns. *American Economic Review*, 96(2), 222–226.
- Amuedo-Dorantes, C., & Pozo, S. (2011). New evidence on the role of remittances on healthcare expenditures by Mexican households. *Review of Economics of the Household*, 69–98. <https://doi.org/10.1007/s11150-009-9080-7>
- Antman, F. M. (2014). The impact of migration on family left behind. In *International Handbook on the Economics of Migration* (Issue 6374, pp. 293–308). <https://doi.org/10.4337/9781782546078.00025>
- Azizi, S. (2018). The impacts of workers' remittances on human capital and labor supply in developing countries. *Economic Modelling*, 75, 377–396. <https://doi.org/10.1016/j.econmod.2018.07.011>
- Baird, S., McKenzie, D., & Özler, B. (2018). The effects of cash transfers on adult labor market outcomes. *IZA Journal of Development and Migration*, 8(1), 1–20. <https://doi.org/10.1186/S40176-018-0131-9/TABLES/2>
- Bangladesh Bank. (2023). *Monthly data on wage earner's remittance*. Bangladesh Bank.
- Bangladesh Bureau of Statistics. (2011). *Bangladesh Population and Housing Census 2011*.
- Bangladesh Bureau of Statistics. (2013). *Survey on the use of Remittances 2013*.
- BBS. (2017). *Household Income and Expenditure Survey 2016-2017*.
- Bossavie, L., Gorchach, J.-S., Ozden, C., & Wang, H. (2021). *Temporary Migration for Long-term Investment* (Policy Research Working Papers). World Bank, Washington, DC. <https://doi.org/10.1596/1813-9450-9740>

- Bredtmann, J., Otten, S., & Rulff, C. (2017). Husband's Unemployment and Wife's Labor Supply: The Added Worker Effect across Europe: *ILR Review*, 71(5), 1201–1231. <https://doi.org/10.1177/0019793917739617>
- Cain, M. T. (1991). The Activities of the Elderly in Rural Bangladesh. *Population Studies*, 45(2), 189–202. <https://doi.org/10.1080/0032472031000145386>
- Cervantes-Martínez, R., & Villaseñor-Becerra, J. (2023). The economic fitness of nations in value added. 2000–2014. *Journal of Economic Structures*, 12(1), 23.
- Cox-Edwards, A., & Rodríguez-Oreggia, E. (2009). Remittances and Labor Force Participation in Mexico: An Analysis Using Propensity Score Matching. *World Development*, 37(5), 1004–1014. <https://doi.org/10.1016/j.worlddev.2008.09.010>
- Cuadros-Menaca, A., & Gaduh, A. (2020). Remittances, child labor, and schooling: Evidence from Colombia. *Economic Development and Cultural Change*, 68(4), 1258–1293. <https://doi.org/10.1086/702790>
- Dasgupta, P., & Ray, D. (1986). Inequality as a Determinant of Malnutrition and Unemployment: Theory. *The Economic Journal*, 96(384), 1011. <https://doi.org/10.2307/2233171>
- Démurger, S. (2015). Migration and families left behind. *IZA World of Labor*, 144. <https://doi.org/10.15185/izawol.144>
- Halla, M., Schmieder, J., & Weber, A. (2020). Job Displacement, Family Dynamics, and Spousal Labor Supply. *American Economic Journal: Applied Economics*, 12(4), 253–287. <https://doi.org/10.1257/APP.20180671>
- Hossain, M. S., & Sunmoni, A. (2022). Remittances and Household Investment Decisions: Evidence from sub-Saharan Africa. *IZA Journal of Development and Migration*, 13(1). <https://doi.org/10.2478/IZAJODM-2022-0004>
- Jadotte, E., & Ramos, X. (2016). The Effect of Remittances on Labour Supply in the Republic of Haiti. *Journal of Development Studies*, 52(12), 1810–1825. <https://doi.org/10.1080/00220388.2016.1156089>
- Jena, F. (2018). Migrant Remittances and Physical Investment Purchases: Evidence from Kenyan Households. *Journal of Development Studies*, 54(2), 312–326. <https://doi.org/10.1080/00220388.2017.1288219>
- Kohara, M. (2010). The response of Japanese wives' labor supply to husbands' job loss. *Journal of Population Economics*, 23(4), 1133–1149. <https://doi.org/10.1007/S00148-009-0247-6/TABLES/5>
- Kwadwo, A.-O., Chiang, C., & Andam, K. S. (2011). *Interactions Between Health and Farm-Labor Productivity - , Catherine Chiang, Kwaw S. Andam - Google Books*. https://books.google.co.uk/books?hl=en&lr=&id=XU0WaGvvX8cC&oi=fnd&pg=PR6&dq=health+and+labor+productivity&ots=8Y_WzrBdr8&sig=ZKRp3zrJj3_fbDtU1Y5NK81uuN0&redir_esc=y#v=onepage&q=health%20and%20labor%20productivity&f=false

- Nevo, A., & Rosen, A. (2012). Identification with imperfect instruments. *Review of Economics and Statistics*, 94(3), 659–671.
- Vadean, F., Randazzo, T., & Piracha, M. (2017). Remittances, Labour Supply and Activity of Household Members Left-Behind. *Journal of Development Studies*, 55(2), 278–293.
<https://doi.org/10.1080/00220388.2017.1404031>
- World Bank. (2023a). *World Development Report 2023 - Migrants, Refugees and Societies*.
- World Bank. (2023b). *Economic Fitness | Data Catalog*.
<https://datacatalog.worldbank.org/search/dataset/0041694>
- World Bank. (2023c). *World Development Indicators | DataBank*.
<https://databank.worldbank.org/source/world-development-indicators>
- Yang, D. (2008). International migration, remittances and household investment: Evidence from Philippine migrants' exchange rate shocks. *Economic Journal*, 118(528), 591–630.
<https://doi.org/10.1111/j.1468-0297.2008.02134.x>

Appendix A: Figures and Tables

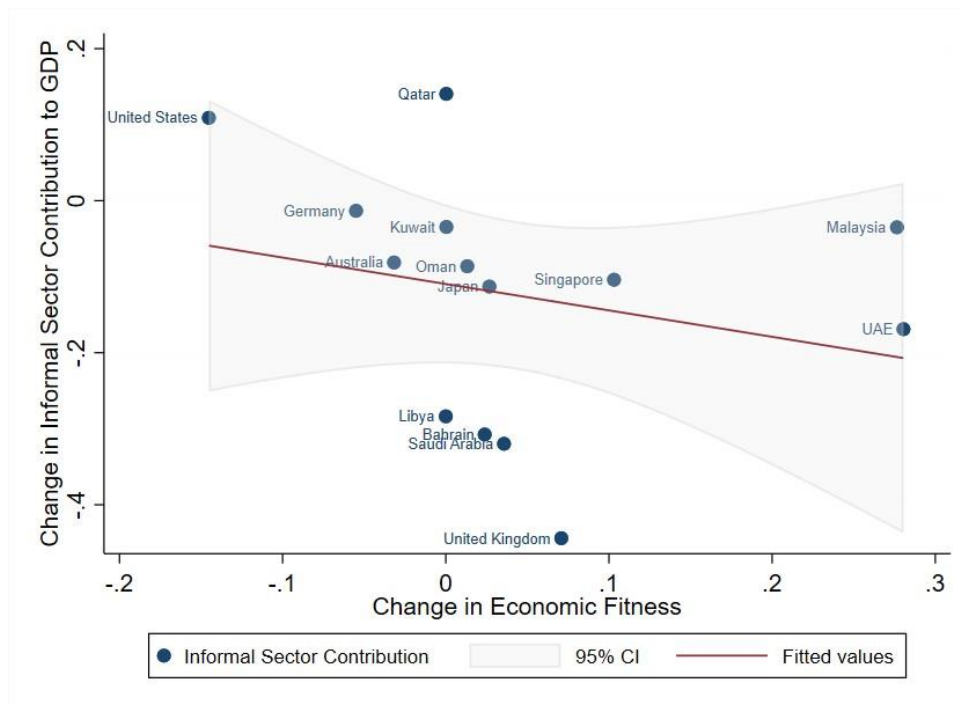


Figure A1: Plot of Change in Economic Fitness and Change in Informal Sector Contribution.

Notes: This figure shows the scatter plot of change in informal sector contribution to GDP and the change in economic fitness from 2011 to 2012. It shows a negative correlation between change in economic fitness and the change in informal sector contribution to GDP across countries in 2012. It provides indicative evidence of decreasing demand for low skilled workers (who predominantly work in informal sector) with positive change in economic fitness.

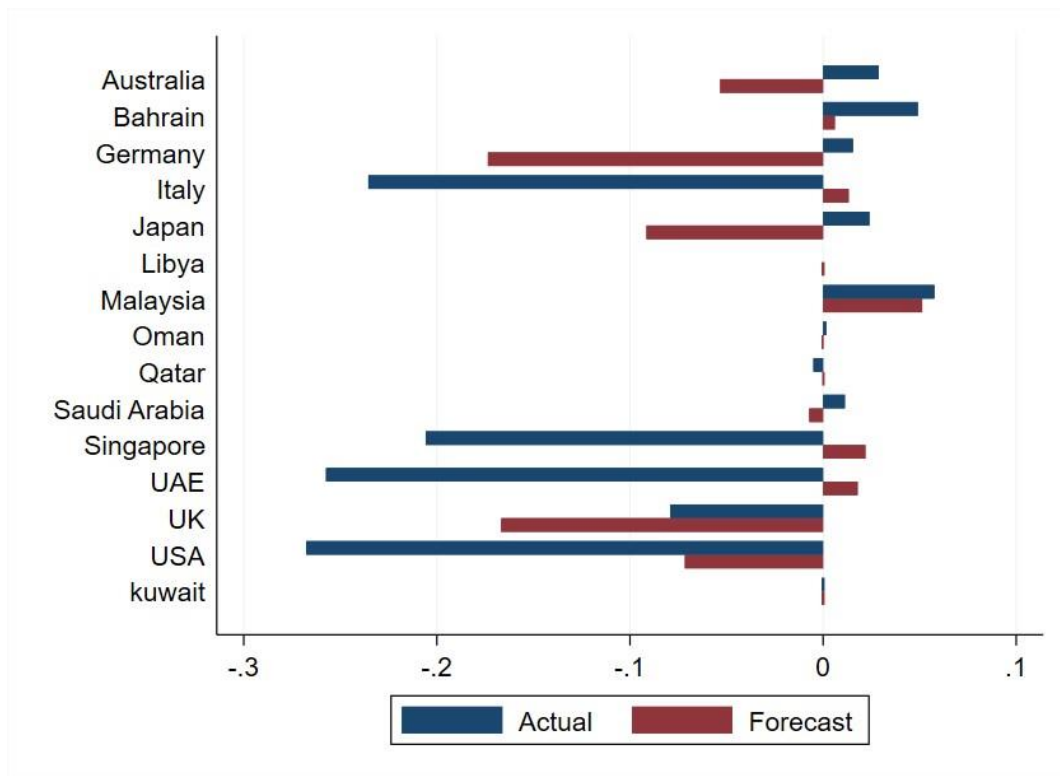
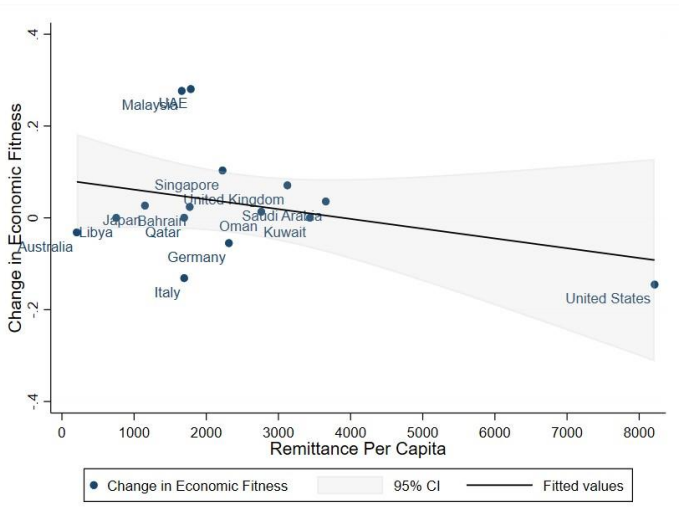


Figure A2: Actual and Forecasted Change in Economic Fitness.

Notes: This figure shows the bar chart of actual and forecasted change in economic fitness from 2011 to 2012. This figure underscores that using a simple average of past 15 years of change in economic fitness to predict the change in year 2012 will result in large forecast errors. This finding implies that it is difficult for migrants to choose favorable destinations based on their prediction of economic fitness change as their prediction are prone to significant inaccuracies.

Panel A. Scatter Plot, Fitted Line, and Confidence Interval



Panel B. Scatter Plot, Fitted Line, and Confidence Interval (Excluding United States)

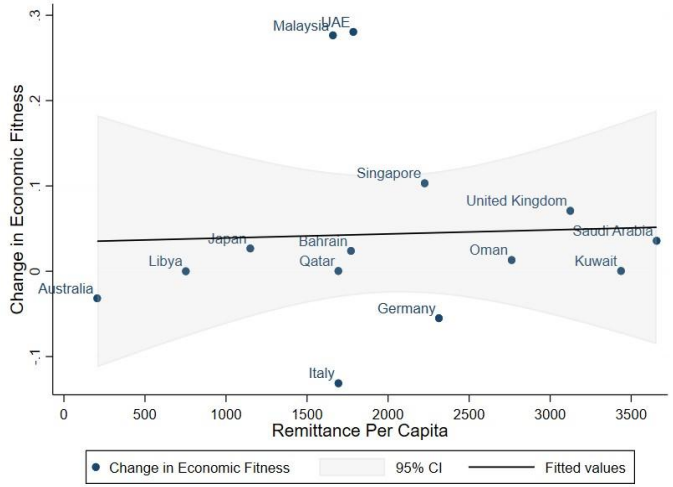


Figure A3: Plot of Destination Level Per Capita Remittance and Change in Economic Fitness.

Notes: This figure shows the scatter plot of per capita remittance from major migration destinations in 2010 and the change in economic fitness from 2011 to 2012. Panel A shows the scatter plot, fitted line, and confidence interval. The confidence interval includes zero, which indicates that there is no significant relationship between the two variables. This result suggests that high-paying destinations do not have a differential change in economic fitness than low-paying destinations. Panel A show that The United States of America is an outlier. A large number of migrants in the United States are undocumented migrants which has likely lowered the official count of migrants and substantially overstates per capita remittances. In Panels B, we present the same correlation as in Panel A but excluding the United States of America. The fitted line here shows almost zero correlation between remittance per capita and change in economic fitness.

Table A1: Effect of Remittances on Household Dependence

| | Have Non-remittance Income (=1 if Yes) | | | | Log (Non-remittance Income) | | | |
|----------------------------|--|---------------------|--------------------|--------------------|-----------------------------|---------------------|---------------------|--------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Log(remittances) | 0.025*** (0.004) | 0.118*** (0.033) | 0.013** (0.006) | 0.103** (0.041) | 0.097*** (0.016) | 0.184*** (0.085) | 0.098*** (0.015) | 0.180** (0.083) |
| Controls | No | No | Yes | Yes | No | No | Yes | Yes |
| District fixed effects | Yes | Yes | No | No | Yes | Yes | No | No |
| Estimation approach | OLS | IV | OLS | IV | OLS | IV | OLS | IV |
| First-stage <i>F</i> -stat | - | 157.22 | - | 234.53 | - | 156.54 | - | 231.44 |
| Estimation approach | OLS | IV | OLS | IV | OLS | IV | OLS | IV |
| Observations | 8,995 | 8,995 | 8,995 | 8,995 | 6,518 | 6,518 | 6,518 | 6,518 |

Notes: (a) This table presents the effect of remittances on household non-remittance income. (b) The treatment variable is log(remittances). (c) Outcome variable in columns 1-4 is an extensive margin indicator of remittance dependence that equals one if households have non-remittance income, and zero otherwise. (d) Outcome variable in columns 5-8 is an intensive margin indicator of remittance dependence, which is the amount of non-remittance income (in log scale) households have. (e) Odd number columns show ordinary least square (OLS) estimates and even number columns show two-stage instrumental variable estimates. (f) Standard errors are clustered at the village level and appear in parentheses. (g) The list of controls are household head's characteristics, household characteristics, and migrant's characteristics included in Table 1. (h) ***Significant at the 1 percent level, **Significant at the 5 percent level, and *Significant at the 10 percent level.

Table A2: Effect of Remittances on Household Dependence

| | Have Non-remittance Income (=1 if Yes) | |
|--------------------------|--|---------------------|
| | (1) | (2) |
| Log (remittances) | 0.016 (0.022) | 0.548*** (0.087) |
| Marginal effect | [0.004] | [0.548] |
| Controls | Yes | Yes |
| District fixed effects | Yes | Yes |
| Estimation approach | Probit | IV-Probit |
| First-stage F-statistics | - | 105.00 |
| Observations | 8,979 | 8,979 |

Notes: (a) This table presents the effect of remittances on household dependence on remittance income. (b) The treatment variable is log(remittances). (c) Outcome variable in columns 1-2 is an extensive margin indicator of remittance dependence that equals one if households have non-remittance income, and zero otherwise. (d) Columns 1 and 2 show probit and IV-probit estimates, respectively. (e) Standard errors are clustered at the village level and appear in parentheses. (f) All columns include district fixed effects. (g) The list of controls are household head's characteristics, household characteristics, and migrant's characteristics. (h) ***Significant at the 1 percent level, **Significant at the 5 percent level, and *Significant at the 10 percent level.

Table A3: Principal Components

| Factors | Component | Unexplained |
|---|-----------|-------------|
| Healthy sanitation facility (=1 if yes) | 0.617 | 0.532 |
| Healthy cooking facility (=1 if yes) | 0.532 | 0.653 |
| Healthy lighting facility (=1 if yes) | 0.580 | 0.587 |
| Healthy water facility (=1 if yes) | -0.015 | 1.000 |

Notes: (a) This table shows the components of the principal component analysis for healthy lifestyle index.

Table A4: Summary Statistics for HIES Sample

| | Mean | Std. Dev. |
|---|----------|-----------|
| | (1) | (2) |
| Household Head's Characteristics | | |
| Household head is female (=1 if yes) | 0.576 | 0.494 |
| Head has primary education (=1 if yes) | 0.442 | 0.497 |
| Head has secondary education (=1 if yes) | 0.112 | 0.315 |
| Head's age | 44.15 | 15.86 |
| Household Characteristics | | |
| Household size | 3.88 | 1.79 |
| Proportion of male members aged 16-60 years | 0.154 | 0.193 |
| Proportion of female members aged 16-60 years | 0.384 | 0.178 |
| Frequency of remittance received | 3.23 | 2.60 |
| Migrant's Characteristics | | |
| Migrant's age | 35.36 | 9.52 |
| Migrant has above secondary education (=1 if yes) | 0.290 | 0.454 |
| Migrant is a husband (=1 if yes) | 0.471 | 0.499 |
| Migrant is a son (=1 if yes) | 0.378 | 0.485 |
| Migrant is in the Gulf countries (=1 if yes) | 0.696 | 0.460 |
| Remittance Information | | |
| Total remittances in past 12 months (USD) | 1,468.05 | 3,005.15 |
| Household income | | |
| Salary and wages (=1 if yes) | 0.200 | 0.400 |
| Agricultural enterprise earnings (=1 if yes) | 0.380 | 0.485 |
| Non-agricultural enterprise earnings (=1 if yes) | 0.078 | 0.268 |
| Rental income (=1 if yes) | 0.289 | 0.454 |
| Financial income (=1 if yes) | 0.022 | 0.146 |
| Ln (Salary and wages) | 1.621 | 3.278 |
| Ln (Agricultural enterprise earnings) | 2.027 | 2.852 |
| Ln (Non-agricultural enterprise earnings) | 0.591 | 2.050 |
| Ln (Rental income) | 1.585 | 2.568 |
| Ln (Financial income) | 0.104 | 0.774 |
| Change in economic fitness of the destination countries | -0.001 | 0.047 |
| Observations | 2,150 | |

Notes: (a) This table shows the mean and standard deviation of the key variables. For full sample mean is reported in column 1 and standard deviation is reported in column 2. Change in economic fitness of the destination countries from 2013 to 2014.