Essays Analyzing the Impact of External Migration & Intra-Household Decisions on Investment in Physical and Human Capital

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SUBMITTIED TO THE DEPARTMENT OF ECONOMICS
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OF LAHORE SCHOOL OF ECONOMICS
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

Rabia Arif
February 2023

I certify that I have read this dissertation and that, in my opinion, it is fully adequate in scope and quality to be considered for the degree of Doctor of Philosophy.

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I certify that I have read this dissertation and that, in my opinion, it is fully adequate in scope and quality to be considered for the degree of Doctor of Philosophy.

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Essays Analyzing the Impact of External Migration & Intra-Household Decisions on Investment in Physical and Human Capital

by

Rabia Arif

Submitted to the Department of Economics
on February, 2023 in Partial Fulfillment of the
Requirements for the Degree of Doctor of Philosophy
in Economics

Abstract

The aim of this thesis is twofold. First, to understand the impact of external migration on labor market outcomes and physical investments (for adults) and human capital investments in children (nutritional health of children under 5 years and educational outcomes of the age group 5-17 years) in Pakistan and second, to show how empowered mothers and coresident grandmothers each benefit children's nutritional health of children under age 5. In the first chapter, we investigate the remittance-controlled impact of emigration on the labor market decisions of migrant-sending households in Pakistan by constructing a large individual-level dataset using several rounds of the Multiple Indicator Cluster Survey conducted between 2003 and 2014. We add to the literature by using a new time-varying instrumental variable to control for endogenous migration decisions, constructed as a composite of three variables that capture opportunities to work abroad: (i) the household's number of adult males, (ii) historic diaspora rates, and (iii) deviations of nighttime light intensity from its trend in migrant-receiving countries. We find a significant shift in domestic labor market activity from lower-status employment categories (not working at all, unpaid family work and manual labor) toward higher-status activities and entrepreneurship such as self-employment and becoming an employer within migrant-sending households. We also find higher investment in property, bank deposits, agricultural land, livestock, poultry and fisheries by individuals in migrant-sending households. The results are stronger for vulnerable groups, implying that migration can be a force for good for rural development, the empowerment of women, and less-educated individuals.

In the second chapter, we investigate the impact of the migration of a household member who is potentially a caregiver on child health and schooling outcomes in Pakistan. We use micro-level cross-sectional data on more than 600,000 children from multiple rounds of the UN's Multiple Indicator Cluster Survey (MICS) dataset from 2008-2018 for Punjab province. We implement a new instrumental variable to address the endogeneity of the migration decision, comprising a triple interaction of nighttime light intensity of the major destination countries, historic migration rates at the district level, and the number of adult males in a household. The absence of the migrating member of the household negatively (positively) affects younger (older) children: the short-term nutritional status of children under age five is harmed, while children aged 5-17 are more likely to be enrolled in school. These results are robust to the inclusion of controls for mother, child, and household characteristics, in addition to location and survey year fixed effects. The negative impact on nutritional status for children under five years is smaller for boys in urban areas, in wealthier households, and in households with more educated mothers. However, the positive impact of migration on schooling outcomes is driven by girls, families in rural areas, and wealthier households.

In the third chapter, we show that i) empowered mothers and ii) coresident grandmothers each benefit children's nutritional health measured by height-for-age z scores (HAZ) and weight-for-age z scores (WAZ) of the age group 5 years and less. First, using a cross-sectional Pakistan Demographic and Health Survey (PDHS) for the survey year 2018, we estimate the impact of empowered mothers on child health outcomes using an instrumental variable approach to correct for endogeneity. Empowerment is measured by two indices constructed separately: as a sum, and alternately using principal component analysis (PCA), using the questions that gauge both intrinsic and extrinsic dimensions of female agency. Second, we use a fuzzy regression discontinuity design (FRDD) to measure the causal impact of coresident grandmothers on the health outcomes of the children using multiple rounds of the Multiple Indicator Cluster Survey (MICS, survey years 2008, 2011, 2014 and 2018). The difference between the actual age of the grandparent and the Potential Retirement Eligibility Criteria (PREC) has been used to exogenously gauge the availability of the grandparent's presence to the household. Finally, we explore heterogeneity in the average effect stated above based upon the gender, wealth and geographic location of the household. The benefits of mothers' empowerment are largely driven by improvements in girls' nutrition, while the presence of grandmothers primarily improves the nutrition of boys in rural areas and belonging to poor families. |

Thesis supervisor: Theresa Chaudhry
Supervisor's Title: Professor, Economics

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Also, I would like to take this opportunity to thank Professor Hillel Rapoport, whose lectures and discussion sessions at the Paris School of Economics inspired me to look at migration-related issues from a different perspective.

Most importantly, I would like to thank my parents, Mr. Arif Qasim and Mrs. Shehla Arif, for their sympathetic advice and wise counsel and for being role models who taught me that only consistent efforts bring results. Time spent with my siblings and nephews throughout the process provided me with necessary and joyful distractions outside of research.

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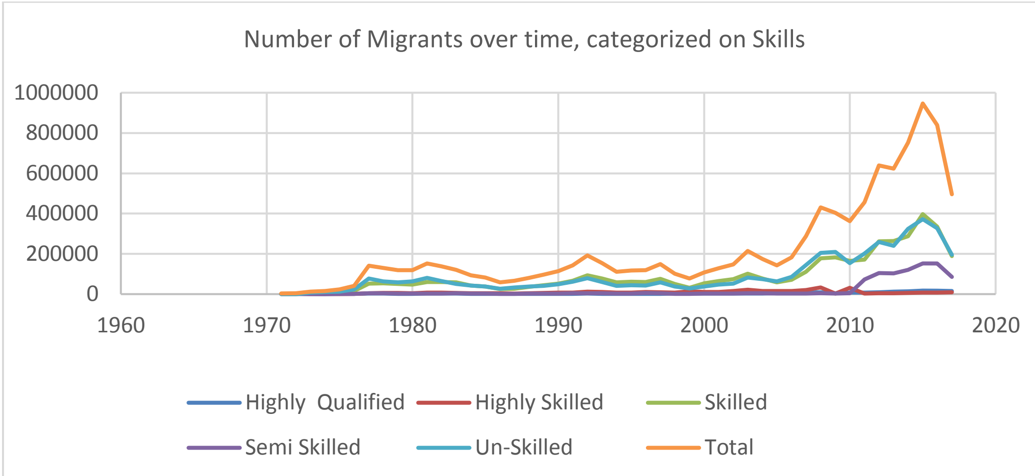
1. Introduction

Pakistan has seen a significant increase in the number of people emigrating abroad over the last few decades, which has led workers' remittances to increase from US $14.96 billion in 2014 to US $26.08 billion in 2021, an increase of almost 75%. According to the World Bank, 2015 and UNDESA, 2017, Pakistan is not only among the top ten migrant-sending countries but also among the top 10 remittance-receiving countries. Even this number may be an understatement since it is estimated that 20 to 40 percent of remittances are unrecorded and made by migrants through informal *hundi* and *hawala* systems (Amjad, Irfan & Arif, 2015). According to the official estimates calculated by the Bureau of Emigration and Overseas Employment, the number of Pakistanis abroad was approximately 9.5 million in early 2018[2]. Of these, approximately 0.19 million workers who migrated out of Pakistan were highly qualified, 0.41 million were highly skilled, 4.3 million were skilled, 0.91 million were semiskilled and 4.34 million were unskilled workers. Figure 1 shows the increase in the number of people migrating from Pakistan over time; the number has increased significantly, especially when one looks at skilled, semiskilled and unskilled labor.

[2] Official estimates collected by the Bureau of Emigration and Overseas Employment (gathered data from the Pakistani Missions Abroad) are underestimates of the actual size of the migrants, since it only records the migrants that have migrated formally. As long as the underreporting across districts is random (not-systematic), the under reported estimates will not bias the results drawn in study using this data.

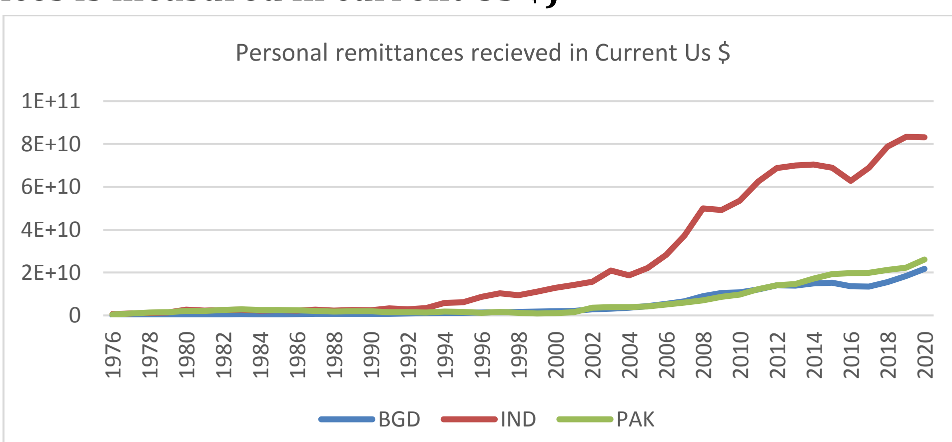
Figure 1: The number of External Migrants over time (1971-2017)



Source: Beaureau of Emigration and Overseas Employment, 2017

Figure 2 shows the amount of personal remittances (in US$) received by Pakistan over time compared to India and Bangladesh (countries with similar geographic and historical experiences). These numbers strongly imply that the Pakistani diaspora has maintained strong links with their family members at home, especially in terms of sending money to their family or extended family.

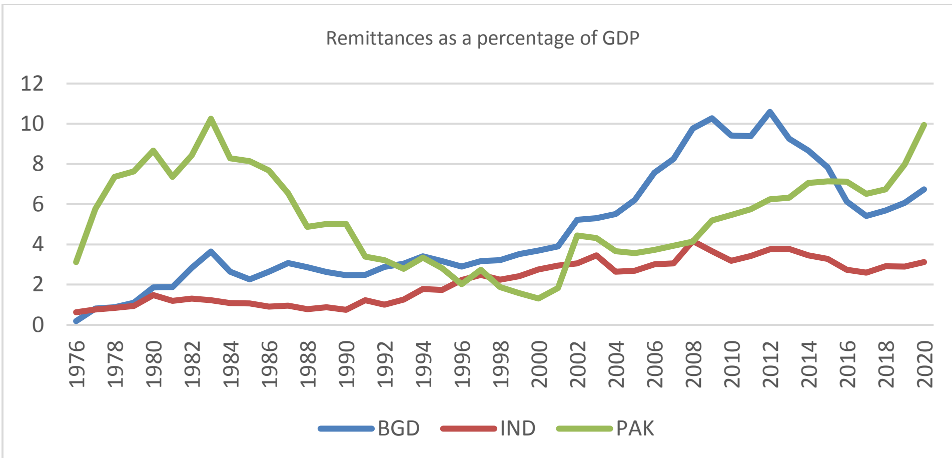
Figure 2: Remittance inflows over time (1976-2020) (the amount of remittances is measured in current US $)



Source: The World Bank Database, 2021

Figure 2 shows that over time, the inflow of remittances to India has increased significantly over time, while remittances to Bangladesh and Pakistan have also grown over time. To adjust for the different sizes of the three countries, we compare the amount of remittances as a percentage of GDP in Figure 3.

Figure 3: Remittance inflows as a percentage of GDP for the years 1975-2015



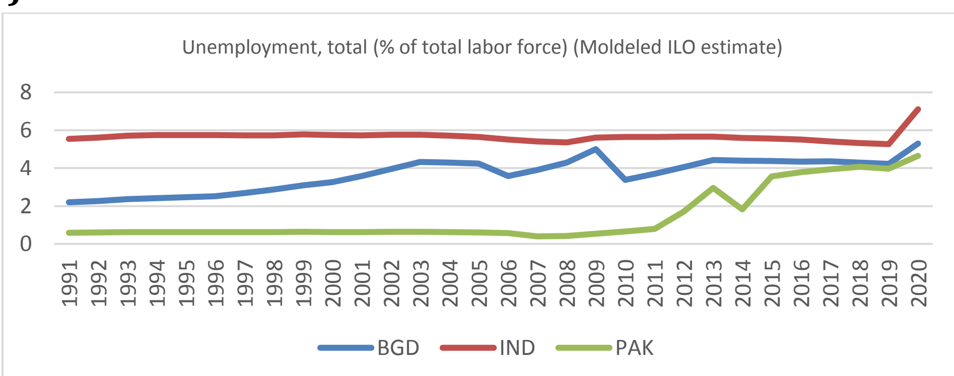
Source: IMF, BOP; World Bank Database (2016)

The share of remittances as a proportion of GDP in Figure 3 has been fluctuating over the course of time for all three countries, but over the last few years, we see that their share in GDP for Pakistan has exceeded that of Bangladesh and India. Clearly, remittances are one of the largest sources of external finance for Pakistan. However, there is a need to better understand the microeconomic impacts of these migrations and remittances on households in Pakistan.

Another important economic aspect of migration and remittances is the impact on employment in sending countries. Remittances may lead to changes in the employment behavior of households with an external migrant. Additionally, having a member of the family abroad may lead to knowledge transfers about running businesses or investing, which can also have an impact on unemployment in the home countries. Other impacts include moral hazard in household expenditure decisions and psychic costs of the migrant's physical absence.

Figure 4 shows unemployment rates over time for Pakistan, India and Bangladesh. In the case of Pakistan, the unemployment rate has remained persistently lower than those of India and Bangladesh. While there can be multiple reasons for the decrease in the unemployment rate over time for Pakistan, we intend to measure whether migration is one of the reasons behind it and, if so, what type of specific labor market activities (self-employment, employer, laborer, unpaid family work) and investments (property, bank deposits and agricultural land) do these migrant-sending households engage in.

Figure 4: Unemployment, total (% of total labor force) (modeled ILO estimate)



Source: The World Bank Database for the years 1991-2020

While the early literature focused on the decision to migrate by individuals[3], recent literature has focused specifically on the impact of migration and remittances on development in labor-exporting countries. The recent literature on migration and remittances not only sheds light on the positive development-related impacts but also examines the negative impacts of migration and remittances on home countries. Some of the positive aspects discussed in the literature include financial flows, knowledge spillovers, technology adoption, and investment in physical and human capital; migration pessimists have argued that it contributes to brain drain, dependency on the part of those household members left behind, and wasteful consumption-oriented expenditures. Moreover, remittances may increase inequality if they are mostly spent on luxury goods and on "consumptive" investment rather than on productive use, leading to the growth of nonproductive communities. Adams Jr (1998) studies the relationship between remittances and rural asset accumulation in Pakistan and concludes that households are disinclined to sacrifice present consumption.

In this thesis, the first two chapters specifically analyze the impact of migration and remittances on intrahousehold microlevel decisions, with a focus on investments in physical investment and human capital in Pakistan.

The first chapter is an empirical analysis using a large, individual-level dataset constructed from several rounds of the UN-funded MICS survey conducted in Pakistan between 2003 and 2014 to

[3] The early literature in this field focused on reasons individuals migrate, for example, how characteristics like skills and earnings distributions differed between migrants and nonmigrants (Borjas, G. J. (1999). The economic analysis of immigration. In *Handbook of labor economics* (Vol. 3, pp. 1697-1760). Elsevier. Similarly, with a help of a theoretical model, Borjas, G. J. (1987). *Self-selection and the earnings of immigrants* (0898-2937). Argued that individuals migrate if the difference between the earnings and the cost of migration is higher than the earnings in their home country. In this way, individuals migrate to areas where the returns to education are relatively high. Chiquiar, D., & Hanson, G. H. (2005). International migration, self-selection, and the distribution of wages: Evidence from Mexico and the United States. *Journal of Political Economy, 113*(2), 239-281. Builds on Borjas (1987) and show that migration distorts the distribution of skills and therefore, productivity and development in the migrant-sending countries gets altered.

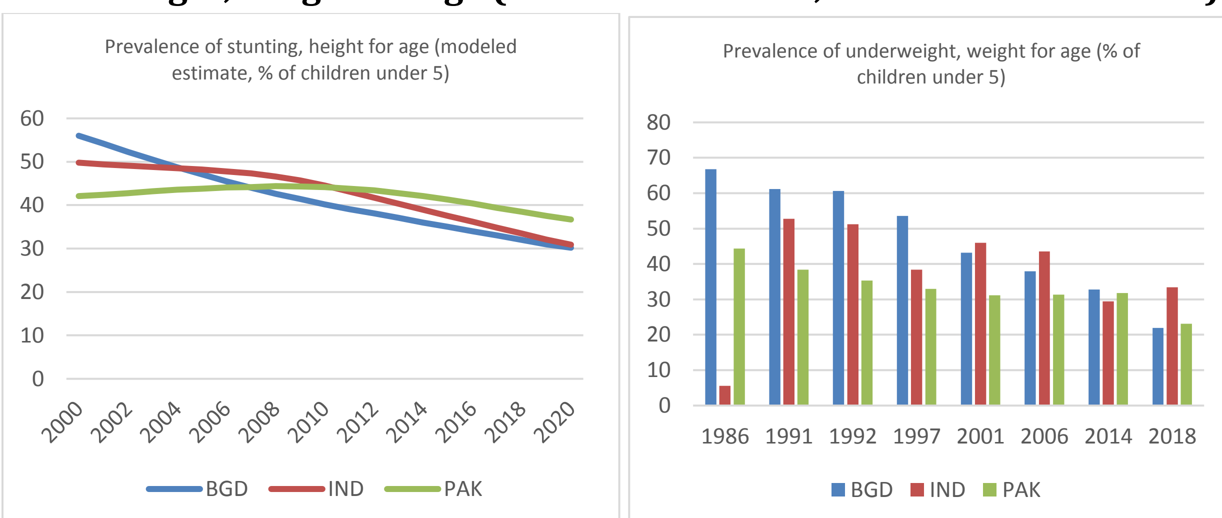
test the impact of external migration on households. This rich dataset has extensive information on household characteristics, geographical characteristics, and individual characteristics as well as information on whether the household receives remittances and has a migrant. We argue that while the impact of migration on households in the home country has been investigated in the literature, there has been less emphasis on analyzing the additional impacts of migration on households *controlling for remittances*. In particular, we find a significant effect of emigration (measured at the household level) beyond its financial impact (i.e., remittances) on labor market activities and investment decisions of those household members who have remained in their home country.

We also add to the literature by using a new time-varying instrumental variable to control for endogenous migration decisions, constructed as a composite of three variables that capture opportunities to work abroad: the household's number of adult males, historic diaspora rates, and deviations of nighttime light intensity from its trend in migrant-receiving countries. As we control separately for the amount remitted, the instrumented migrant indicator captures the impact of migration on the individuals left behind, which may include knowledge spillovers, moral hazard in household expenditure decisions, and psychic costs of the migrant's physical absence. Finally, we explore the heterogeneity in the results by conducting a subsample analysis to see if the results differ in rural versus urban areas, differ between genders, and differ by wealth and education.

The second chapter investigates the impact of the migration of a person who was a potential caregiver on two measures of child wellbeing, health and schooling outcomes, using microlevel longitudinal representative data of more than 600,000 children from multiple rounds of the Multiple Indicator Cluster Survey (MICS) dataset from 2008-2018 for Punjab, Pakistan.

We focus on the height and weight of children for the health outcomes. Figure 5 gives an overall picture of these two anthropometric measures largely used in the literature to evaluate the health outcomes of children in Pakistan, Bangladesh, and India over time: first height-for-age z scores[4] and second weight-for-age z scores[5].

Figure 5: Prevalence of stunting, height for age and prevalence of underweight, weight for age (modeled estimate, % of children under 5).



Source: The World Bank Database for the years 1991-2020

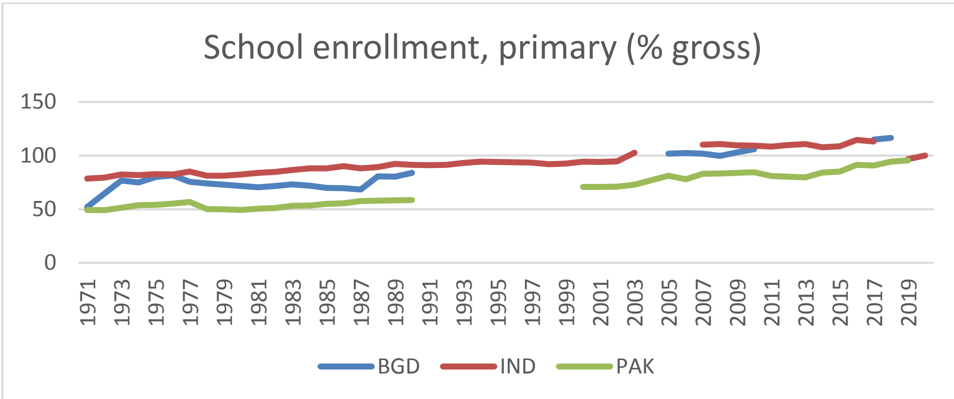
The numbers show that although we see a decline in the prevalence of children being underweight for Pakistan, child stunting in Pakistan is worse than in India and Bangladesh.

[4] Prevalence of stunting is the percentage of children under age 5 whose height for age is more than two standard deviations below the median for the international reference population ages 0-59 months. The data are based on the WHO's new child growth standards released in 2006.

[5] Prevalence of underweight children is the percentage of children under age 5 whose weight for age is more than two standard deviations below the median for the international reference population ages 0-59 months. The data are based on the WHO's new child growth standards released in 2006.

Similarly, when looking at trends in gross primary enrollments[6] in Figure 6, we see that Pakistan also underperforms in the education sector when compared to India and Bangladesh.

Figure 6: School enrollment, primary (% gross)



Source: The World Bank Database for the years 1991-2017

We argue that in many developing countries, such as Pakistan, there is a significant probability that the migration of household members may affect the wellbeing of children because of the role these members play in the household. Recent literature argues that the child's wellbeing, defined as a multidimensional state (both psychological and physical aspects), can be influenced by the dynamic processes altered due to changes in tangible as well as intangible resources around the child's immediate as well as distant development environment (Gassmann et al., 2013). Migration can be considered one such channel, especially for the case of developing countries, which might not only improve the financial condition of the households via the inflow of remittances that could improve the child's welfare but also have much more complex effects, such as emotional distress faced by children, that may negatively affect the child's overall wellbeing.

[6] Gross enrollment ratio is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education shown. Primary education provides children with basic reading, writing, and mathematics skills along with an elementary understanding of such subjects as history, geography, natural science, social science, art, and music.

We add to the literature by using our new instrumental variable to solve the problem of endogenous migration decisions, and (as already mentioned) this instrument comprises an interaction of night-time light intensity of the destination countries, historic migration rates at the district level, and the number of adult males in a household; this instrument is correlated with the decision to migrate and is orthogonal to the wellbeing of children.

Finally, in the third chapter, we propose two solutions integrated with the family unit to one of the major problems faced by the children in Pakistan, i.e., malnutrition. In a microlevel study, we show that the accrued benefits associated with an empowered mother and coresident grandmother have a positive impact on child health outcomes measured by two key anthropometric indicators, height-for-age z scores (HAZ) and weight-for-age z scores (WAZ), for children 5 years and less.

To measure each of the respective causal impacts, we employ two approaches using two separate datasets due to the different nature of the information required for the estimation of each respective research question. First, using a cross-sectional Pakistan Demographic and Health Survey (PDHS) for the survey year 2018, we estimate the impact of empowered mothers (measured by an additive index and an index constructed using principal component analysis) on child health outcomes using an instrumental variable approach to correct for the endogeneity problem in the OLS specification. Second, we use a fuzzy regression discontinuity design (FRDD) to measure the causal impact of coresident grandmothers on the health outcomes of the children using multiple rounds of the Multiple Indicator Cluster Survey (MICS) for the years 2008, 2011, 2014 and 2018. The difference between the actual ages of the grandparents and the potential retirement eligibility criteria (PREC) has been used to measure the exogenous availability of grandparents in a household. Finally, we explore heterogeneity in the results based upon the gender of the child, the wealth of the household, and the location of the household.

The findings of the first chapter show a significant shift in domestic labor market activity from lower-status employment categories (not working at all, unpaid family work and manual labor) toward higher-status activities and entrepreneurship (such as self-employment and becoming an employer) within migrant-sending households. We also find higher investments in property, bank deposits, agricultural land, livestock, poultry and fisheries by individuals in migrant-sending households. The results are stronger for vulnerable groups, implying that migration has a significant impact on rural development and the empowerment of women and less-educated individuals.

The results from the second chapter show that the absence of the migrating member of the household negatively (positively) affects younger (older) children: the nutritional status of children under age five is harmed, while children aged 5-17 are more likely to be enrolled in school. These results are robust to the inclusion of controls such as mother and child characteristics, household characteristics, and location, time and year fixed effects. The negative impact on nutritional status for children under five years is smaller for boys in urban areas, in richer households, and in households with more educated mothers. The positive impact of migration on schooling outcomes is driven by girls, families in rural areas, and wealthier households.

Finally, the results from the third chapter show that on average, the health outcomes for children in households significantly improve as the mother's empowerment index increases. Similarly, there is a significant increase in the height-for-age z scores and weight-for-age z scores in the households where grandparents are present. However, the results for mothers' empowerment are largely driven by the positive impact on girls. Additionally, we see that the significant benefits on health outcomes due to the presence of grandmothers primarily impact boys and children in rural areas.

Research Question(s)

Research Questions for Chapter 1

Research Question 1: Does External Migration have an insignificant effect on labor market activity after controlling for remittances?

Hypothesis 1a: External migration has a significant impact on an individual's decision to be self-employed after controlling for remittances.

Hypothesis 1b: External migration has a significant impact on an individual's decision to be an employer after controlling for remittances.

Hypothesis 1c: External migration has a significant impact on an individual's decision to be a Laborer after controlling for remittances.

Hypothesis 1d: External migration had a significant impact on an individual's decision to indulge in unpaid family work after controlling for remittances.

Hypothesis 1e: External migration has a significant impact on an individual's decision to be unemployed after controlling for remittances.

Research Question 2: Does External Migration have an insignificant effect on the decision to invest, after controlling for remittances?

Hypothesis 2a: External migration has a significant impact on an individual's decision to invest in property after controlling for remittances.

Hypothesis 2b: External migration has a significant impact on an individual's decision to invest in bank deposits after controlling for remittances.

Hypothesis 2c: External migration has a significant impact on an individual's decision to invest in agricultural land after controlling for remittances.

Hypothesis 2d: External migration had a significant impact on an individual's decision to invest in livestock, poultry and fisheries after controlling for remittances.

Research Question 3: Does External Migration affect the Labor Market Activity of the Vulnerable Group Differently, after controlling for remittances?

Hypothesis 3a: External migration has a significant impact on labor market activities based on the rural urban divide after controlling for remittances.

Hypothesis 3b: External Migration had a significant impact on Labor Market Activities based upon gender after controlling for remittances.

Hypothesis 3c: External migration had a significant impact on labor market activities based upon education after controlling for remittances.

Hypothesis 3d: External migration had a significant impact on labor market activities based upon the gender of the household head after controlling for remittances.

Research Question 4: Does External Migration Affect the Decision to Invest of the Vulnerable Group Differently after Controlling for remittances?

Hypothesis 4a: External migration has a significant impact on the decision to invest based upon the rural urban divide after controlling for remittances.

Hypothesis 4b: External migration has a significant impact on the decision to invest based upon gender after controlling for remittances.

Hypothesis 4c: External migration has a significant impact on the decision to invest based upon education after controlling for remittances.

Hypothesis 4d: External migration had a significant impact on the decision to invest based upon the gender of the household head, after controlling for remittances.

Research Questions for Chapter 2

Research Question 1: Does the External Migration of Potential Caregivers significantly affect children's health outcomes?

Hypothesis 1a: External migration had a significant impact on the child's height for age z scores (age group 5 years and less)

Hypothesis 1b: External migration had a significant impact on the child's weight for age z scores (age group 5 years and less)

Hypothesis 1c: External migration had a significant impact on the probability of a child being stunted (age group 5 years and less)

Hypothesis 1d: External migration had a significant impact on the probability of a child being severely stunted (age group 5 years and less)

Hypothesis 1e: External migration had a significant impact on the probability of a child being underweight (age group 5 years and less)

Hypothesis 1f: External migration had a significant impact on the probability of a child being severely underweight (age group 5 years and less)

Research Question 2: Does the External Migration of Potential Caregivers significantly affect children's schooling outcomes?

Hypothesis 2a: External migration has a significant impact on the enrollment of children (age 5-17 years)

Hypothesis 2b: External migration had a significant impact on the dropout of children from school (age 5-17 years)

Hypothesis 2a: External migration had a significant impact on the current years of schooling (age 5-17 years)

Research Question 3: Are the effects of the external migration of potential caregivers on the child's health outcomes significantly heterogenous?

Hypothesis 3a: External migration had a significant impact on the child's (age group 5 years and less) health outcomes based upon the rural urban divide.

Hypothesis 3b: External migration had a significant impact on the child's (age group 5 years and less) health outcomes based upon gender.

Hypothesis 3c: External migration had a significant impact on the child's (age group 5 years and less) health outcomes based upon wealth.

Hypothesis 3d: External migration had a significant impact on the child's (age group 5 years and less) health outcomes based upon mother's education.

Research Question 4: Are the effects of the external migration of potential caregivers on the child's schooling outcomes significantly heterogenous?

Hypothesis 4a: External migration had a significant impact on the child's (age group 5 years and less) schooling outcomes based upon the rural urban divide.

Hypothesis 4b: External migration had a significant impact on the child's (age group 5 years and less) schooling outcomes based upon gender.

Hypothesis 4c: External migration had a significant impact on the child's (age group 5 years and less) schooling outcomes based upon wealth.

Research Questions for Chapter 3

Research Question 1: Does the presence of Empowered Mothers in a household improve the child's health outcomes?

Hypothesis 1a: Empowered Mothers had a significant impact on the child's height for age z scores (age group 5 years and less)

Hypothesis 1b: Empowered Mothers had a significant impact on the child's weight for age z scores (age group 5 years and less)

Research Question 2: Does the presence of grandmothers in a household improve the child's health outcomes?

Hypothesis 1a: The presence of grandmothers had a significant impact on the child's height for age z scores (age group 5 years and less)

Hypothesis 1b: The presence of grandmothers had a significant impact on the child's weight for age z scores (age group 5 years and less)

Research Question 3: Are the effects of the presence of Empowered Mothers in a household on the child's health outcomes heterogeneous?

Hypothesis 3a: Empowered mothers had a significant impact on the child's (age group 5 years and less) health outcomes based upon the rural urban divide.

Hypothesis 3b: Empowered mothers had a significant impact on the child's (age group 5 years and less) health outcomes based upon gender.

Hypothesis 3c: Empowered mothers had a significant impact on the child's (age group 5 years and less) health outcomes based upon wealth.

Research Question 4: Are the effects of the presence of grandmothers in a household on the child's health outcomes heterogeneous?

Hypothesis 4a: The presence of grandmothers had a significant impact on the child's (age group 5 years and less) health outcomes based upon the rural urban divide.

Hypothesis 4b: The presence of grandmothers had a significant impact on the child's (age group 5 years and less) health outcomes based upon gender.

Hypothesis 4c: The presence of grandmothers had a significant impact on the child's (age group 5 years and less) health outcomes based upon wealth.

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Paper I: Beyond Remittances: Heterogeneous Effects of Emigration on Labor Market Activity and Investment Decisions in Punjab, Pakistan

1. Introduction

Numerous studies have explored either the effect of remittances alone (Edwards & Ureta, 2003; López-Córdova, 2004) or the discrete effect on the household of having an external migrant (usually combining both the financial and nonfinancial aspects of the migration experience) on a variety of development outcomes, including education, health, assets, and entrepreneurship (Yang, 2008; Hanson & Woodruff, 2003; McKenzie & Rapoport, 2007). In this study, first, we introduce a new instrumental variable (IV) that estimates more precisely the impact of migration beyond its role as a pure cash transfer on the labor market activity and investment decisions of those household members left behind in the home country, as compared to previously used instruments in the literature. Second, we argue that the impact of migration is highly heterogeneous amongst the subgroups and that the more vulnerable groups in society benefit most from migration.

Since our main specifications control for the amount remitted as a proxy for the migrant's unobserved characteristics, the effects on labor market and investment decisions reflect migration's impact beyond, i.e. on top of remittances. Controlling for remittance amounts separately from migration does not necessarily mean that they play no further role in migrant-sending household decisions; beyond the direct loosening of financial constraints, remittances may have spillover effects on the migrant-sending households that we will discuss shortly. Econometrically, there are several reasons for controlling for remittance amounts in assessing the impact of migration. First, there are households without a migrant that receive remittances. Second, by controlling for remittances, we purge the estimated coefficient on the migrant indicator of the *marginal increase* in financial contributions made by the migrant and vary dramatically from one migrant-sending household to another. Third, the amount remitted serves as a proxy for the migrant's unobserved characteristics, and excluding it may introduce omitted variable bias.

Existing research suggests that, apart from remittances, emigration facilitates knowledge transfers across borders, including knowledge about new techniques of production, technology adoption, and capital investment (Andersson et al., 2022; Docquier & Veljanoska, 2020; Hübler, 2016; Mendola, 2008; Tian et al., 2022; Tshikala et al., 2019; Woodruff & Zenteno, 2007). Migration may have other long term impacts on development through investments in education and health (Berloffa & Giunti, 2019; Hanson & Woodruff, 2003; Hildebrandt & McKenzie, 2005; Kapri & Jha, 2020). Migrants' own absences may push up marginal rural labor productivity (Drapier et al., 2006; Akram et al., 2017), thus helping poor countries to take off economically. As a result of higher local labor costs induced by the loss of local labor, emigration can promote innovative activity, adoption of technology, and labor-saving capital investments in migrant-sending areas (Andersson et al., 2022). The physical absence of the migrant may enfranchise other members of the household in making financial decisions, to start a small enterprise, or choose to work outside the home. Mobarak et al. (2020) finds that migration empowers women to make important household decisions, including the buying and selling of assets.

Similarly, other "spillover"-type effects associated with the promise of remittances from a household migrant may positively affect migrant-sending households in several ways. First, they may provide implicit insurance to the households left behind due to which they may become more risk-taking, promoting investment. Migration has been shown to influence technology adoption apart from remittances by attenuating risk and liquidity concerns (Quinn, 2009; Tshikala et al., 2019). Second, having a household migrant supplying a steady stream of remittances may improve the creditworthiness of the household. The gains associated with emigration and remittances are therefore larger than the financial gains alone, and facilitate households to invest, diversify, and move up the employment ladder.

On the other hand, there are reasons to suggest that emigration can also have adverse effects on migrant-sending households. The physical absence of the migrant from the household may have negative psychosocial effects on their spouse and children left behind (Meng & Yamauchi, 2017). However, if only one parent is absent, the harm is usually less (Zhang et al., 2014). It may also open up opportunities for moral hazard due to the migrant's inability to effectively monitor household production activities (like smallholder farming and animal husbandry), as well as reduce the motivation of remaining household members to generate income if they withdraw from the labor market (Chami et al., 2005; Amuedo-Dorantes & Pozo, 2012). Many studies have found that migration depresses labor market activities at home by distorting the labor market and leaving the less skilled behind, while others show that the number of working hours in the labor market falls significantly among migrant-sending households (Acosta, 2007; Funkhouser, 2006; Justino & Shemyakina, 2012; Kim, 2007). More importantly, there is a gender-specific impact of remittances on labor activity such that women leave paid jobs in larger numbers and experience increases in hours of unpaid work and household chores (Mendola & Carletto, 2012). In addition, while migration may buffer shocks it contributes to dependency on the part of those household members left behind, the loss of human resources from poor countries, and wasteful consumption-oriented expenditures (Adams, 1998; Ratha, 2005). Indeed, migrant households were especially vulnerable to the economic shock of the COVID-19 pandemic (Barker et al., 2020).

Hence, to investigate whether the negative or positive aspects dominate the impact of migration on income generating activities of individuals left behind in migrant-sending households, we measure to what extent has their work status as well as their investment in assets have changed in the case of Pakistan. The literature suggests that migration tends to reduce incentives for paid work and increase the burden of unpaid work for those who remain in the home country but also may simultaneously encourage investment in assets, agriculture, and business activities, and we hypothesize that we will find similar effects in our study. As paid work and income-generating assets together constitute the household's financial position, it makes sense to consider both together. We start by assembling a large individual- and household-level dataset based on information collected from several rounds of the United Nations-funded Multiple Indicator Cluster Survey (MICS) conducted between 2003 and 2014 with more than half a million observations containing detailed information on individual household members' economic activity.

Next, we construct a novel time-varying instrumental variable based on a triple interaction of nighttime light intensity in migrant-receiving countries, historic migration, and the number of potential migrants in a household, to address the problem of the migrant's endogenous decision to migrate. We compare the performance of this new instrument with that of a simpler, double-interaction instrument already established in the literature, that is, the interaction of historic migration rates with the number of adult males in the household (Arif & Chaudhry, 2015). We use variation in economic activity in host countries to create variation in the IV over time and demonstrate empirically that causality runs from experiencing positive economic shocks in the destination countries to the decision to migrate. Later it is argued that our new instrument fulfills the exclusion restriction.

We assess the impact of migration, on a wide variety of labor market activities and investment decisions. Together, our results provide a detailed portrait of the effect of having an external migrant on the income-generating activities of those household members who remain behind. Putting these together, we estimate if the positive intangible elements of migration (for example, knowledge flows) on investment decisions outweigh its disruptive effects (such as moral hazard, psychological impacts of separation) on the labor market activities of nonmigrant members of migrant-sending households.

Our results show positive net effects on the labor market activities and investments of nonmigrating members of migrant-sending households. On average, they shift away from lower-status employment categories, including not working at all, unpaid family work, and manual labor, toward higher-status activities and entrepreneurship, ranging from self-employment to becoming an employer. Likewise, investments made by migrant-sending households are significantly larger than those made by households without migrants. Finally, we find that the impact of emigration on labor market activity and investment is heterogeneous. In particular, we find on average economically vulnerable groups (the less educated, women, and rural populations) to have experienced greater gains in employment status and investment such that migration in Pakistan can be argued to be a potential force for positive social change with regard to women's financial wellbeing, rural development and upward mobility for less-educated individuals. The probability of being a (higher status) employer increases by 8.0 percentage points for women, by 7.3 percentage points in rural areas and by 6.9 percentage points for less-educated individuals. Women also drive the reduction in low-status unpaid family work. We also see that the reduction in individuals not working at all can be mainly attributed to individuals in rural areas and less-educated individuals. The increase in receipt of property rents is primarily enjoyed by women.

This paper is divided into five sections. The first section comprises of the introduction, which is followed by literature review in section 2. In section 3 we discuss the dataset, a detailed empirical strategy and descriptive statistics. Our results are discussed in Section 4. The study's results and mechanisms are discussed in Section 5. We conclude in Section 6.

2. Literature review

The early literature in this field focused on reasons individuals migrate, for example, how characteristics like skills and earning distributions differed between migrants and non-migrants (Borjas (1987, 1999), Harris and Todaro (1970)). With a help of a theoretical model, Borjas (1987) argued that individuals migrate if the difference between the earnings and the cost of migration is higher than the earnings in their home country, and that migrants from developing to developed countries will tend to be less educated. Chiquiar and Hanson (2005) emphasize the relevance of migration costs in deterring the migration of low-skilled workers and smaller skill premia in host countries discouraging high skilled individuals, so that individuals with intermediate levels of education and skill are the most likely to migrate. However, high net returns to migration for some individuals can be obscured in average figures when there is heterogeneity (Lagakos et al., 2020). Other types of costs have been emphasized in more recent literature trying to explain the lack of rural-to-urban migration within developing countries; these included opportunity costs of migration such as the loss of access to informal insurance in the home village (Munshi & Rosenzweig, 2016), the financial risk involved in migrating for the first time especially for very poor households (Bryan et al., 2014); and the disutility of migration itself including poor living conditions in host locations (Lagakos et al., 2022). Recent literature has continued to explore the drivers of migration, both international and national with new data and methodologies. Several of these works consider the role of migrant networks in promoting emigration, including the role of push and pull factors. Theoharides (2018) uses historic migration to predict demand from abroad for migrants from different areas of the Philippines. Blumenstock et al. (2019) use rich cell phone data to conclude that it is the social support aspect of migration networks occurring through embedded and interconnected networks, rather than information flows through diffuse and expansive networks, that drives migration within Rwanda. Mahajan and Yang (2020) consider the interaction of migrant networks with the push-factor of a negative home-country shock in the form of hurricanes that propel migrants to the United States from around the developing world. McKenzie et al. (2014) demonstrate that international migration of workers from the Philippines is highly sensitive to host-country GDP shocks.

Another recent strand of literature has focused more on the impacts of migration and remittances on the development of labor-exporting countries. Since income constraints are tighter in developing countries, remittances and savings are two of the main factors financing development (Dustmann & Kirchkamp, 2002; Ilahi, 1999; Mesnard, 2004). Remittances of course directly augment the income of households and could be spent in a variety of ways, ranging from building small businesses and accumulating assets to investing in children's education and taking steps to improve household health through better nutrition and preventive medical services. Investments in education as a result of migration have been widely documented (Acosta, 2007; Arif & Chaudhry, 2015; Hanson & Woodruff, 2003; Khanna et al, 2022; Theoharides, 2018). Even when, or possibly because remittances are considered an uncertain stream of income, migrant households use it consciously in productive investments. Examining the issue from the counterfactual side, migration restrictions have been found to reduce self-employment and incomes while increasing salaried work and child labor in affected migrant-sending regions (Conover et al., 2021; Theoharides, 2020).

Most of the studies have found that through strong migration networks and appropriate usage of remittances, home countries can create a significant push in investments and boost entrepreneurial activities (Woodruff & Zenteno (2007) and Kilic et al. (2007)). The New Economics of Labor Migration (NELM) was the first strand of the economic literature to address the relationship between migration and investment (Taylor, 1999). Kilic, Carletto, Davis, and Zezza (2007) show that there is a positive association between international migration and owning a non-farming related business. Yang (2008) explores the impact of migrant earnings on a migrant's household, particularly on human capital and enterprise investments. The results showed that the exogenous increase in remittances was primarily used for investment rather than consumption with households making more investment related decisions particularly in human capital accumulation and entrepreneurship. Households back home who were receiving remittances reported an increase in the number of hours worked in self-employment, starting capital-intensive household enterprises.

The “migration optimists” treat remittances as a part of broader mechanisms associated with external migration and believe that migration leads to a transfer of not just capital and labor but of ideas, awareness, learning and modern knowledge, helping poor countries economically take off. Therefore, those studies link positive effects of migration to skill and knowledge spillovers and argue that in addition to the relaxed budget constraint, the skills acquired by migrants in their host countries may further help individuals left behind in setting up businesses and even improving the existing businesses by exerting positive knowledge spillover effects. Migration has been associated with long-run improvements in income and human capital in migrant-sending areas (Khanna et al., 2022; Dinkelman & Mariotti, 2016). Le (2008) concludes that international labor movements may help transfer technology across borders in both directions: from donor countries to host countries and vice versa. Hence, migration might actually lead to ‘brain circulation’ or rather a ‘brain gain’ as opposed to the common ‘brain drain’ phenomena. More educated migrants remit larger amounts (Bollard et al., 2011). Foreign R&D has a greater impact on productivity when a country is more open to both trade and migration. Real estate is another top investment choice for international migrants. This is because of the fact that housing proves to be a generally safe investment through which households can hold wealth and make extra money through rental agreements. Home ownership can be a very successful investment strategy, with the potential to help migrant households secure and grow their income (Dhonte , Bhattacharya, & Yousef, 2000). There have been numerous empirical studies that show how remittances from abroad have been crucial in promoting agricultural investments. Through the acquisition of land and livestock, the introduction of new crops and methods, application of agricultural inputs like herbicides, and the use of modern agricultural machinery like tractors and water pumps, migrants play a significant role in the development of subsistence and commercial agriculture (de Haas, 2009; Abebaw et al., 2021; Mendola, 2008; Tshikala et al., 2019). Taylor & Lopez-Feldman (2010) show that Mexico's agricultural land productivity increased in households that sent migrants to the United States. Similarly, (Taylor, Rozelle, & De Brauw, 2003) shows that migrants' remittances boost income levels both directly and indirectly by encouraging agricultural output. Remittances may even reduce the pressure on households to rely on natural resource extraction in their home countries (Lopez-Feldman & Chavez, 2017). On the other hand, migration reduces labor supply in agricultural activities (Taylor et al., 2003; Lopez-Feldman & Escalona, 2017)

Migration pessimists, on the other hand, argue that remittances increase inequality since the remittances are mostly spent on luxury goods and on “consumptive” investment rather than on productive use, leading to a growth of non-productive communities. Adams (1998) studies the relationship between remittances and rural asset accumulation in Pakistan, and concludes that these households are less inclined to sacrifice present consumption. Similarly, Ratha (2003) argues that remittances from abroad in many cases might buffer economic shocks in the migrant’s home countries and hence might be used to smooth income rather than being spent on productive investments. Hence, they argue that remittances dampen the effects of various sources of consumption instability in developing countries, stabilizing household consumption but is not used to for investment purposes (Jean-Louis Combes, 2007). Clement (2011) examines the impact of both internal and external migration on household expenditure patterns in Tajikistan. Using propensity score matching, the study shows that neither internal nor external remittances lead to productive investment, and moreover the external remittances contribute more significantly towards an increase in the households’ consumption levels, increasing the consumption expenditure by 1.7 percentage points. Finally, the remittances did not significantly affect the household educational investments.

Moreover, as far as the labor market activity is concerned, we find rather depressing effects of migration. Many studies show that migration leads to talent distortion, leaving the less skilled individuals behind, especially in developing countries. For Africa alone, nearly one-third of its highly qualified professionals are living abroad. For Africa, the effect is severe because of the politically and economically unfavorable environment. Croix & Docquier (2011) shows that the link between high skilled migration with poverty can result in multiple equilibria. Countries sharing the same situation can be either in the "high poverty-high brain drain" equilibrium or in "low poverty-low brain drain" equilibrium. Using data, they show that it is usually the small countries that fall into a bad equilibrium resulting in high poverty and high brain drain, mainly due to coordination problems and poor development policies.

Others have shown that the number of working hours individuals allocate to the labor market falls significantly if they belong to a migrant-sending household (Acosta, 2007; Funkhouser, 2006; Justino & Shemyakina, 2012; Kim, 2007) resulting in reduced labor supply. More importantly, there is a gender-specific impact of remittances on labor activity discussed by large body of literature that argues that the women are the most affected in migrant-sending households; they leave their paid jobs and increase the number of hours for unpaid work i.e., taking care of household chores (Mendola & Carletto, 2012).

Most of the studies mentioned above have either used short term or long-term exogenous shocks as an instrument to correct for the problem of endogeneity in the specifications measuring the impact of migration in the home country. In some cases, host-country conditions have been a source for exogenous variation in migration: Mesnard (2004) used exogenous policy changes in destination countries to assess their impact on Tunisian migration while McKenzie et al. (2014) considered economic conditions in host countries as a pull factor for migration. Similarly, economic shocks at home can spur emigration, such as: rainfall shocks (Munshi, 2003); the Asian currency crisis (Yang, 2005); hurricanes spurring emigration from a number of countries to the United States (Mahajan & Yang, 2020). On the other hand, Woodruff and Zenteno (2007) used distance from railway lines, the major form of transport for US-bound Mexican migrants, as an instrument for migration. Similarly, historic migration rates have been used by themselves (Acosta, 2007; Hanson & Woodruff, 2003) or interacted with other variables (Mansuri, 2006; Arif & Chaudhry, 2015) as an instrument for the current decision of migration. Historic migration has been adapted in other ways to estimate demand for migrant workers (Theoharides, 2018).

We build on these insights to, first, generate a new instrumental variable varying at household level that interacts short-run economic shocks with long-term exogenous variation in the form of established migration networks. Similarly, most of the work done so far has not looked at the full financial picture of work and investments affecting the stream of income generated by the individuals left behind. Last, we show that the impact of migration is largely heterogeneous amongst subgroups of the population; migration differentially affects segments of society traditionally more vulnerable due to cultural or economic barriers.

3. Empirical Strategy

3.1 Data

We create a large dataset of pooled cross-sections for Pakistan by appending the MICS for 2003, 2008, 2011 and 2014.[7] While primarily an instrument for tracking progress in achieving health and education goals, the MICS includes a comprehensive household roster including primary occupation/source of income and maintains a separate section on migration and remittances at the household level, with the amount of remittances asked of all households regardless of whether the household itself has sent a migrant overseas.

To construct the IV, we use two additional data sources. The first is information from the Bureau of Emigration and Overseas Employment on the aggregate numbers of the Pakistani diaspora who have migrated prior to each year of the MICS since 1980, to calculate historic migration rates at the district level for each respective survey year.[8] The second, the nighttime light intensity data to identify economic activity in the destination country in each respective year, has been obtained from the National Center for Environmental Information.[9]

[7] To measure the wellbeing of children in response to the World Summit for Children, the MICS was developed to meet an internationally agreed set of mid-decade goals. The first round was conducted in 1995 in more than 60 countries. We use the MICS dataset that was used to collect information in Punjab, Pakistan. In Pakistan, the MICS has been conducted in multiple waves over a longer period only for Punjab; there are one or two waves of data for the remaining three provinces—Sindh, Khyber Pakhtunkhwa and Balochistan—but for the most part, the data is either not available for public use (Khyber Pakhtunkhwa) or the quality is suspect (Balochistan).

[8] The Bureau of Emigration and Overseas Employment, a centralized institution under the federal government, keeps formal records of the diaspora working abroad. It is responsible for processing recruitment demands through licensed overseas employment promoters operational in numerous countries to bring in Pakistani human resources.

[9] Henderson et al. (2003) and Chen and Nordhaus (2011) introduced nighttime light data to economic empirical research. They showed that, especially in countries where national statistics are poor, nighttime light data can be used as an effective substitute to measure economic activity. Other applications of nighttime light data in economics include Michalopoulos and Papaioannou (2013, 2018) and Pinkovskiy and Sala-i-Martin (2016).

3.2 Inferential and Descriptive Statistics

Table 1 reports the mean values of the MICS subsample for those households that reported their migration status and/or the amount of remittance inflows. The mean differences between individuals from migrant-sending households and those without a migrant reveal statistically significant differences along several dimensions (Table 1). The working-age population in migrant-sending households tended to be older, better educated and unmarried; they are also more likely to be living in female-headed households; to have a larger number of dependent children; to own more household durables, to live in larger homes and more likely to own their home; and to have more deposits in the bank and greater investments in both agricultural land and property more generally, but fewer in livestock, poultry and the like. On the other hand, working-age individuals in migrant-sending households were less likely to be self-employed and more likely to not be working in any capacity.

Table 1: Inferential and descriptive statistics of labor market activity indicators, investment indicators, individual characteristics, household characteristics and assets

	Migrant		Nonmigrant		
	Observations	**Mean**	**Observations**	**Mean**	**Mean Difference (Migrant – Nonmigrant)**
Dependent Variables					
Self-Employed	45745	0.1008	311021	0.1302	-0.0294***
Employer	45745	0.0056	311021	0.0055	0.000
Laborer	45745	0.0855	311021	0.2228	-0.1374***
Rents	45745	0.005	311021	0.0029	0.0021***
Interest and Profits from Deposits	45745	0.0033	311021	0.0018	0.0015***
Livestock/Fishery/Poultry and Forestry	45745	0.0182	311021	0.0321	-0.0139***
Unpaid Family Work	53226	0.0566	332041	0.0636	-0.0070***
Own Agricultural Land = 1	60412	0.4283	478202	0.328	0.1003***
Total Agricultural Land Owned (in Acres)	60450	2.4652	478599	2.0242	0.4410***
Own Animals = 1	60309	0.4307	478051	0.4725	-0.0418***
Not Working (Unemployed Seeking Job + Unemployed Not Seeking Job)	60450	0.0481	478599	0.0316	0.0164***
Individual Characteristics					
Male	60450	0.4656	478599	0.5098	-0.0441***
Age	60449	39.8687	478599	37.9604	1.9082***
Highest Class Attended	60420	4.7128	478393	3.7199	0.9929***
Married	60410	0.645	478515	0.664	-0.0190***

	Migrant		Nonmigrant		
	Observations	**Mean**	**Observations**	**Mean**	**Mean Difference (Migrant – Nonmigrant)**
Household Characteristics					
Amount of Remittance Received	60450	1.80E+05	478599	806.532	1.8e+05***
Total Number of Males	60450	3.9442	478599	4.0882	-0.1440***
Male Household Head	60450	0.7849	478599	0.9449	-0.1599***
Household Head's Education	57793	4.5485	474408	4.4591	0.0894***
Total Household Members	60450	7.8559	478599	7.397	0.4589***
Number of Eligible Women	60450	1.8968	478599	1.8663	0.0305***
Total Number of Children Under 5	60450	1.0263	478599	0.8562	0.1701***
Rooms	60300	3.0025	477431	2.2067	0.7958***
Dummy = 1 if Own House	60450	0.9443	478599	0.8851	0.0592***
Urban	60450	0.3947	478599	0.3931	0.0016
Assets					
Electricity	60444	0.9883	478492	0.9568	0.0315***
Gas	60354	0.4134	478196	0.3376	0.0758***
Telephone	60450	0.2957	478599	0.0584	0.2373***
Air Conditioner	60367	0.2864	478092	0.0843	0.2021***
Cooking Range	60334	0.1706	477731	0.0688	0.1018***
Refrigerator	60439	0.8075	478260	0.5059	0.3016***
Machine	60363	0.8203	477952	0.5463	0.2740***
Sewing	60425	0.8716	478050	0.707	0.1646***
Radio	60359	0.27	477830	0.0813	0.1887***
Television	60428	0.8512	478313	0.6744	0.1768***
Bicycle	60369	0.4018	477767	0.3986	0.0032
Motorcycle	60406	0.5044	478047	0.4026	0.1018***
Car	60398	0.15	478007	0.0926	0.0574***
Computer	60403	0.2618	478278	0.1278	0.1341***
Water Pump	60450	0.5726	478599	0.606	-0.0333***

***p < 0.01, ** p < 0.05, * p < 0.1.

3.1 Specification

We estimate the following equation for the impact of migration on an individual *I* residing in the home country living in household h in district g in the year of survey *t*:

$$Y_{ight} = \propto_o + \alpha_1 \widehat{M}_{ht} + +\alpha_s remittance\ ctrls_{ht} + \alpha_w HH\ ctrls_h + \alpha_v individual\ ctrls_i + \alpha_g district\ dummies_g + \alpha_t time\ dummies_t + u_{ight} \quad (1)$$

where Y_i represents the outcome(s) of the labor supply decision (self-employment, wage/salaried job, employer, unpaid family work, or not working at all[10]) or investment decision (rents from property, interest and profits from bank deposits, agricultural land

[10] Not working = unemployed, looking for a job + unemployed, not looking for a job.

ownership, or livestock, poultry and fishery). The migrant dummy M_{ht}, which takes a value of 1 when household h has a member who has emigrated, is our variable of interest and captures the effects, net of the cash transfer, of external migration on the dependent variables, such as knowledge spillovers and changes in the dynamics of household decision-making. This is because we control explicitly for the remittance amount and squared remittances in $remittance\ ctrls_{ht}$[11] so that the migrant dummy principally captures the effects of migration beyond the remittance amount, in other words, the effect of migration that cannot be explained by the loosening of the household budget that remittances permit. α is the vector of coefficients associated with each respective control variable.[12]

We also control for observable characteristics at the individual level (age, education, marital status and gender) and household level (assets, number of household members, gender and age of household head). Year dummies and geographical controls (district and urban dummies) are included as well. We control for the three interacted terms of the instrument (deviation of nighttime light intensity in destination countries from its mean, historic migration rates and number of adult males—explained in the following sections) separately in the second stage to predict the probability of emigration in the first stage only out of the interaction terms alone, similar to Karadja and Prawitz (2019).

[11] To identify the correct form of higher-order polynomials for the remittance amount in the specification, we report the results (Appendix F) for the outcome variable 'self-employed' alone, which remains consistent throughout other specifications for the fractional polynomial test conducted for the remittance variable. After fitting 44 different models, the best model is based on the minimum deviation criteria and the results show that the remittance variable should be incorporated with the highest order of –2. The coefficient of the migrant dummy does not change significantly if the order of polynomial for the variable remittance is –2 instead of power 2 (which has been incorporated into our standard regression). The comparison results are available on request.

[12] Where *S* is the number of remittance controls, *w* is the number of household controls, *V* is the number of individual controls, *G* is the number of districts, and *T* is the number of periods.

3.2 Endogenous Decision to Migrate

Measuring impacts on the decision to supply labor and invest in response to migration may suffer from endogeneity bias due to simultaneity, reverse causality, and self-selection. First, it is possible that unobserved local market conditions could simultaneously affect the decision to emigrate as well as change how households earn a living and save. Second, there is potential for reverse causality; that is, the decision of an individual to migrate can influence investment and labor supply decisions, but at the same time, investment and labor supply decisions at home may influence the migrant's decision to either return or remain abroad. Third, there is the possibility of migrants' self-selection based on their nature and characteristics (such as preference for risk, education and age). The migrant's unobserved characteristics can affect the motivation of the individual to migrate and simultaneously affect the decisions of the individuals left behind to supply labor and invest. For instance, if a risk-taking individual, who is also an integral part of their family, decides to take on the risk of migrating and exploring new opportunities abroad, they could potentially also influence the family members left behind to opt for investment decisions that they believe would benefit them the most.

A similar argument could be made with regard to the migrant's level of education. To partly attenuate this problem, we control for the remittance amount to proxy for the migrant's own (unobserved) characteristics that can simultaneously influence the decision to migrate and the labor supply or investment decisions of the family members who remain behind. Even though the amount remitted itself is arguably endogenous, this is of less concern to us, as our intent is not to measure the impact of remittances per se but rather the impact of migration itself, that is, being a migrant-sending household, for which we will use an IV to measure the impact.

3.3 Instrumental Variable

Given the issues caused by the migrant's endogenous migration decision discussed above, we build on an older, simpler instrument[13] used in the literature to propose a novel IV that interacts three exogenous variables[14]. Specifically, the IV that we generate is a composite of three variables that comprise short- as well as long-term exogenous shocks and have strong effects on the decision to migrate: (i) historic diaspora rates, (ii) the number of adult males in the household, and (iii) the weighted average deviation of nighttime light intensity from its trend in migrant-receiving countries.

The first element of our IV is historical migration rates, which is already established in the literature as an instrument for migration. Studies argue that robust migration networks have a significant and positive effect on migration by reducing the cost of current migration but, as they are predetermined, are exogenous to other contemporaneous factors (Hildebrandt & McKenzie, 2005; McKenzie & Rapoport, 2010; Woodruff & Zenteno, 2007). In our case, we exploit those networks formed since the 1980s resulting from Pakistan's migration-promoting policies toward the Gulf region, so that we construct an aggregate of the Pakistani diaspora for each district.

The second element of our IV is the number of adult males[15] in a household. Not only does this increase the number of potential migrants, but the literature also argues that a larger number of adult males in a household facilitates migration by ensuring the security of the

[13] The historic migration rates (varying across districts and over time) interacted with the number of adult males in a household alone (Arif & Chaudhry, 2015).

[14] The correlation matrix for the three variables interacted to create the new IV can be found in Appendix B. Nighttime lights and historic migration are uncorrelated, but there is a slightly negative relationship between the number of adult males and the other two instruments (-0.19 and -0.28).

[15] To create variation in the instrument at the household level, we interact the new instrument with the number of adult males in a household. One potential problem with this is that, since it is the smallest unit of variation, it is plausible to expect that the results of the first stage are driven solely by this term. To address this concern, we have controlled for the number of adult males as a separate variable in each regression with a new instrument. The results in Table 2 shows that the IV remains significant throughout.

household even if some individuals have left the home to migrate (Mansuri, 2006). This variable serves to create important household-level variation in the instrument. The older instrument against which we compare our new instrument was a composite of historic migration and adult males in the household (Arif & Chaudhry, 2015).

The last component of our instrument—and our major contribution—is the incorporation of an important time-varying pull factor for migration, that is, the prospect of better employment opportunities in the destination countries as proxied by deviations in the annual nighttime light intensity data of the three[16] major destination countries—an indicator of their economic activity. Since the district-level impact of variation in the destination country's economic activity will depend on the strength of the migration network in each destination, we use a weighted average of the nighttime light intensity data to measure changes in the economic activity of the three countries to which Pakistanis have principally migrated, with weights based on each district's specific migration destinations. Nighttime light intensity is not only indicative of economic growth (Henderson et al., 2012), but it is high frequency and does not suffer from data collection lags of official statistics. One of the greatest benefits of using nighttime light data as opposed to official GDP figures is that luminosity data is immune to the manipulation of official statistics undertaken by undemocratic governments (Martinez, 2022). The three main destination countries for diasporas from Pakistan, Saudi Arabia, Oman and the UAE, are among the least free nations in the world. In future work, nighttime light data may be useful in understanding how economic conditions at the sub-national level provide emigration incentives.

[16] Although there are multiple countries to which the Pakistani diaspora have emigrated, based on statistics provided by the Bureau of Emigration and Overseas Employment, we confine our analysis to these three countries because the data suggests that there has been a drastic fall in the formal number of individuals emigrating to other countries at the district level, converging at 0 (a single-digit number as opposed to the three countries considered for analysis, where the number of emigrants abroad is at least in the hundreds or more) and thus not providing sufficient variation across districts to carry out the analysis.

The use of nighttime lights as an IV could threaten identification if positive deviations in luminosity are caused by the influx of migrants, especially if those migrants drive urbanization. We do not feel that this is a likely problem because the outflow of migrants from Pakistan to each respective host country as a proportion of total influx of migrants from all over the world in each respective host country over different years is very small, again making it difficult for migrants from Pakistan alone to drive the changes in economic activity in the host countries. Relatedly, urbanization in the three host countries considered has been high and stable throughout the period studied. We believe therefore that the causality runs from experiencing shocks in the nighttime light intensity in the host countries towards the decision of the individuals to migrate from the home country in this case, Pakistan and not vice versa.

Given the strong links between each of the composite variables used to construct the new instrument with the decision to migrate from the home country, we therefore interact historic migration rates at the district level and detrended nighttime intensity of district-specific destination countries in each year with the number of adult males in the household. The instrument we propose can be expressed as follows:

$$Z_{ght} = \sum_{h=1}^{n} M_{gy-5} * A_h * S_{gt} \quad (2)$$

$$S_{gt} = \prod_{g=1}^{36} w_g * N_t \quad (3)$$

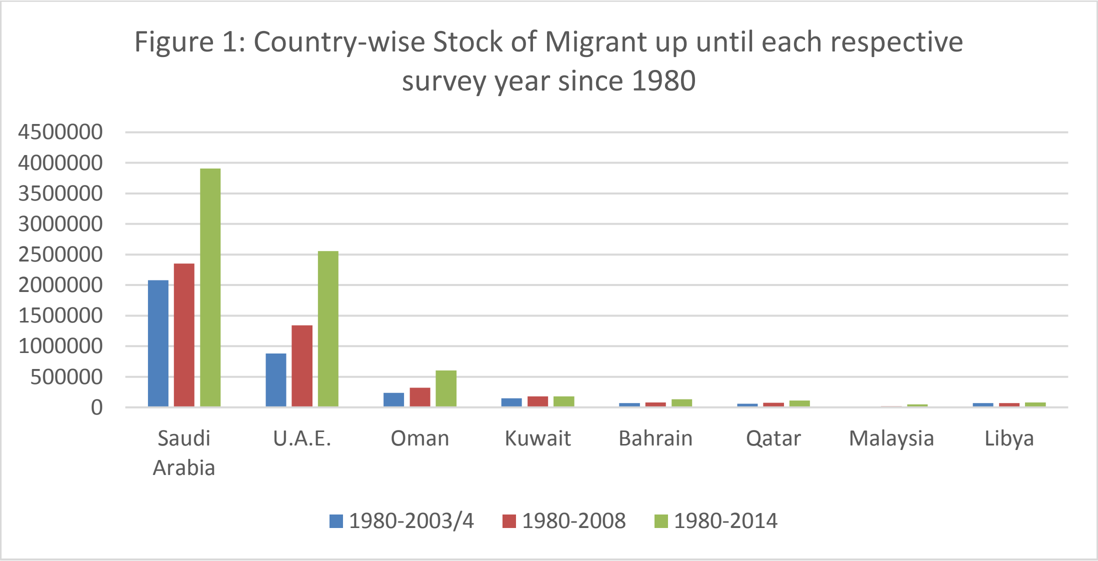
where *A* is the number of adult males in a household *h*; *M* represents the historic migration rates that comprise the proportion of aggregate diaspora migrating from 1980 until at least five years prior to the year of the survey out of the total population in district g; and *S* is the weighted average[17] of shocks to economic activity, measured as the deviation of the

[17] W_g = (number of individuals who migrated to a given country from a district / total number of emigrants in that district).

nighttime light intensity data from its detrended mean, based on the district-specific '*g*' location of networks formed with the three[18] main destination countries for the Pakistani diaspora (Figure 1) —Saudi Arabia, Oman and the UAE—in each respective survey year *t* as calculated in equation 3.

Specifically, we use the data on emigrants over a period of 23 years to calculate district-level weights by dividing the number of individuals who migrated to Oman, the UAE and Saudi Arabia, respectively, by the total number of migrants in each respective district, and interact it with the nighttime light intensity data N_t for each respective survey year to calculate the weighted average of the nighttime light intensity "pull" at the district level.

Figure 1: Number of individuals migrating over time, by destination country



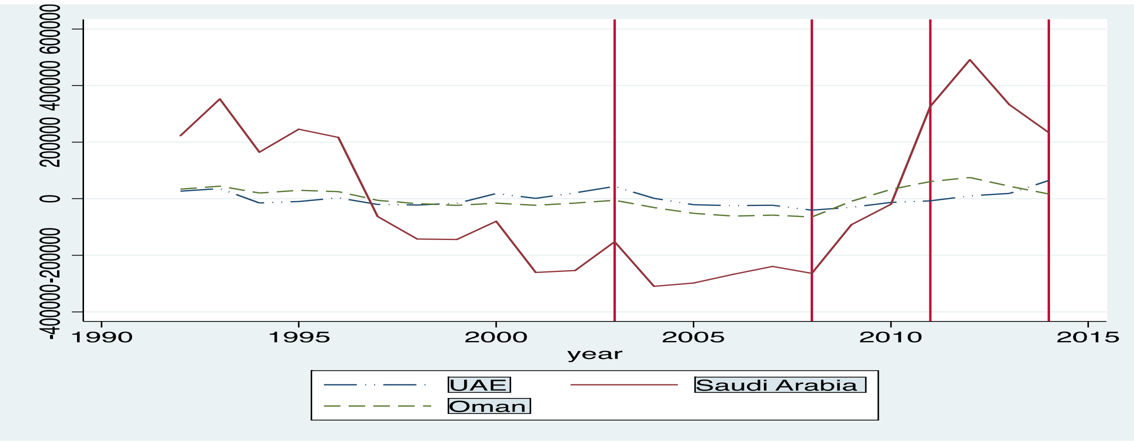
Source: Bureau of Emigration and Overseas Employment.

After identifying the three countries to which the majority of (registered) Pakistani migrants proceed for employment, we identify how the economic activity in these countries has varied over time from 1992 to 2014 (Appendix A), using the nighttime light intensity data. Next, we

[18] We use data from the Bureau of Emigration and Overseas Employment to construct the weights by calculating the number of emigrants to Saudi Arabia, the UAE and Oman from each district and divide this by the total number of migrants in each district.

apply a Hodric-Prescott filter to detrend the economic activity data over time. Figure 2 illustrates the business cycles—short-term fluctuations in economic activity—for each country.

Figure 2: Aggregate of light intensity data for Oman, Saudi Arabia and the UAE over time (1992–2014) after removing the time trend using the HP filter



Source: Author's calculations.

The vertical red lines indicate the MICS years. The business cycles shown in Figure 2 for the three main destination countries show that, for all three countries, survey year 2008 was at the nadir of economic activity (compared to survey years 2003, 2011 and 2014).

Docquier and Rapoport (2009) anticipate the supply-side changes in the labor market across borders, following the global recession that started after the second quarter of 2008, and led by the financial crisis that hit most industrialized countries that resulted in 'job loss carnages'. They identify two potential opposing effects of the world recession on the decision of individuals in developing countries to migrate. The first is the negative effect, where emigration decreases due to job losses and expected lower returns associated with jobs abroad, resulting in return migration (substituting away from jobs abroad toward domestic jobs). However, they also identify an opposing effect on the decision to migrate due to future pressure on the workforce because the world recession transmitted from the developed world may slow down economic activity in developing countries as well (leading to additional pressure to migrate nevertheless due to the income effect). Even if there is a desire to migrate despite the recession, it may be more difficult to finance migration costs when the home country has been affected (Mahajan & Yang, 2020). To argue for the validity of the exclusion restriction, we exploit this variation in economic activity and its correlation with the decision to migrate. In any event, the interaction we use to construct the instrument should have an opposite effect or no effect at all (insignificant effect) on the probability of individuals migrating abroad in 2008 compared to the other survey years (2003, 2011 and 2014).

We modify the standard specification from Karadja and Prawitz (2019) to estimate the first-stage specification as follows:

$$M_{ht} = \beta_0 + \beta_1 A_h * M_{gt-5} * S_{gt} + \beta_2 M_{gt-5} + \beta_3 S_{gt} + \beta_4 A_h + +\beta_8 other\ controls_{ght} + v_{ght} \quad (4)$$

The dependent variable *M* takes a value of 1 if there is an external migrant present at the household level. *Z* is the instrument used to attenuate the problem of endogenous migration decisions after controlling for the interacted variables (the number of adult males A_h, historic migration rates M_{gt-5} and the weighted average of the nighttime light intensity of the destination countries S_{gt}) separately. Other controls comprise household characteristics *h*, geographical characteristics *g*, and individual characteristics *i* as explained in the second-stage specification. Finally, to capture local variation in economic activity that may affect the individual's decision to migrate, we also control for year dummies in the regression.

The second-stage specification is estimated as follows:

$$Y_{ight} = \emptyset_o + \emptyset_1 \widetilde{M_{ht}} + \emptyset_2 M_{gt-5} + \emptyset_3 S_{gt} + \emptyset_4 A_h + +\emptyset_8 other\ controls_{ight} + \epsilon_{ight} \quad (5)$$

We estimate the second-stage regression by incorporating the fitted probabilities of having an external migrant in a household from the first-stage specification regressed on the outcome variable at individual level *i* after controlling for the interacted terms separately as well. Table 2 reports the first-stage results and shows that the new instrument is highly relevant to the decision to migrate, given the highly significant t-statistic on the instrument and the large F-statistic of the regression.

Table 2: First-stage results: Relevance and significance of IV

Dependent Variable: Dummy = 1 if the Household Has an External Migrant

	(1)	(2)	(3)	(4)
	Aggregate	**Year 2003**	**Year 2008**	**Year 2011 and 2014**
New Instrument: Historic Migration Rates * Weighted Average of Deviation of Night Light Intensity from Mean * Number of Adult Males	0.0158***	0.391***	-0.0216	0.0484**
	(0.00273)	(0.144)	(-0.0673)	(0.00284)
Weighted Average of Deviation of Night Light Intensity from Mean (1st Interacted Term)	0.306***	0.217**	0.342	0.00909***
	(0.00362)	(0.109)	(0.210)	(0.00140)
Historic Migration Rates (2nd Interacted Term)	0.509***	0.101***	0.134***	0.0310***
	(0.00250)	(0.0235)	(0.0116)	(0.00240)
Number of Adult Males (3rd Interacted Term)	0.00731***	0.0526***	-0.0214**	0.00519***
	(0.00182)	(0.0131)	(-0.00909)	(0.00175)
Observations	539,049	91,976	58,184	388,889
R-squared	0.417	0.302	0.268	0.410
1st F test	768.157	47.888	220.014	417.921
1st P value	0.000	0.000	0.000	0.000
Hansen J P Value	0.00	0.000	0.000	0.000
District FE	X	X	X	X
Year FE	X			

Note: The dependent variable is a binary variable = 1 if an overseas migrant is present in the household. This information is provided in all rounds of the MICS (2003, 2008, 2011 and 2014). Each specification is different in terms of the two different instruments used. The standard independent variables controlled in the specification for aggregate estimations comprise the following: dummy = 1 if the household is in an urban area; district controls (comprising all districts (n – 1) in Punjab: Bahawalpur, Rahimyar Khan, Dera Ghazi Khan, Layyah, Muzaffargarh, Rajanpur, Faisalabad, Jhang, Toba Tek Singh, Gujranwala, Gujrat, Hafizabad, Mandi Bahauddin, Narowal, Sialkot, Kasur, Sheikhupura, Multan, Khanewal, Lodhran, Vehari, Sahiwal, Pakpattan, Okara, Rawalpindi, Attock, Chakwal, Jhelum, Sargodha, Bhakkar, Khushab, Mianwali, Lahore and Chiniot); and year controls (comprising dummy = 1 for each respective year: 2003, 2008, 2011 and 2014).

Standard errors are clustered at the household level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Column 1 reports the first-stage results of the aggregate data for 2003, 2008 and 2011/14. Columns 2 and 3 report the first-stage results of the subsample regressions for 2003 and 2008, respectively. We pool 2011 and 2014 due to smaller samples and report the results in column 4.

The aggregate results in Table 2 (column 1) first show that the relevance condition is met using the new instrument.[19] The coefficient is highly significant and positive for the new instrument proposed, implying that the probability of individuals migrating abroad increases significantly if the new instrument increases by one standard deviation. This indicates that individuals are more likely to migrate if they belong to districts with stronger migration networks and families with a greater number of adult males when the district's main destination countries experience a positive economic shock.

In this setting, we argue that the interaction of the three variables creates a unique level of variation that predicts the probability of emigration, and any effect it may have on labor market activities or investment decisions is solely via the decision to migrate. The interacted terms—historic migration rates, the number of adult males and economic shocks in the destination countries—are controlled for separately in the first stage to predict the decision to migrate and then again in the second stage, as this may affect the decision to migrate and local market activities simultaneously, thereby biasing the coefficient if each of the three terms is not controlled for individually.

Next, to lend support to our argument that the exclusion restriction is upheld, we use the estimates for each survey year, illustrating how the impact of the instrument on the decision to migrate varies according to the economic circumstances.[20] We use the estimates from the subsample regressions, which imply that, during periods of recovery in the destination

[19] Applying a similar test to the older instrument used in the literature—that is, historic migration rates (varying across districts and over time) interacted with the number of adult males in a household alone (Arif & Chaudhry, 2015)—our results (Appendix B) show that the relevance condition is fulfilled only in this case since the coefficient remains significant and positive for the aggregate data. It does not, however, fulfill the exclusion restriction. The subsample regression results show that the direction of the relationship between the instrument and the decision to migrate remains positive and significant over different years, with no variation in the effect of the IV on the predicted probabilities of emigration.

[20] A similar concept of the exclusion restriction is discussed in Karadja and Prawitz (2019) and Barsbai and Rapoport (2017).

countries (year 2003 reported in column 2 and years 2011/14 reported in column 4), a one-standard deviation increase in the IV significantly increases the individual's probability of migrating abroad. On the other hand, during the destination countries' trough in 2008 due to the world recession, we can see that the results in column 3 show that an increase in the triple-interaction IV of one standard deviation had an insignificant effect on the probability of individuals migrating abroad.[21] This implies that in the times of world recession, the pull-factor of economic activity abroad is missing, because potential migrants anticipate poor economic opportunities abroad or vice versa. The instrument fulfills the exclusion restriction because it affects the probability of individuals migrating in different years, differently. Intuitively, this entire exercise emphasizes on the importance of predicting the probability of migration based upon multiple aspects of the decision-making process; first, there are the household dynamics, potential migrants and an established network, embodied in the double interaction instrument, that are necessary but not sufficient criteria for an individual to migrate. However, the second aspect i.e., the variation in economic activity of the destination countries (in the triple interaction IV) is an important pull factor is crucial to determine the probability of an individual to migrate and hence strengthens the predictive power of the predicted probability in the first-stage.

The assumption we make is that emigration is affected by the interaction between the number of adult males A_h, historic migration rates M_{gt-5}, and the weighted average of the nighttime light intensity of the destination countries S_{gt} conditional on our set of controls so that the following condition is met:

$$E(\epsilon_{ight}| M_{gy-5} * A_h * S_{gt}, M_{gy-5}, A_h, S_{gt})=0$$

[21] Historic migration networks still positively impact migration and there is also a full set of controls in the first stage specification, which is why the first-stage F-stat is large in spite of the triple-interaction's lack of statistical significance.

The individual terms that comprise the triple interaction IV—historic migration rates, the number of adult males and economic shocks in the destination countries—are also controlled for separately in the first stage to predict the decision to migrate and then again in the second stage. We control for each term in both the first and second stages (following Karadja and Prawitz, 2019) because those variables may affect the decision to migrate and local market outcomes simultaneously.

On the other hand, the double interactions may separately have an impact on an individual's decision to migrate but might not pass the exclusion restriction criteria since they can also affect the local labor market activities, simultaneously (results later shown in robustness checks section). According to the exclusion restriction, the IV should only impact the dependent variable through the decision to migrate.

Given that we have three terms which we include individually and as a triple interaction in the first-stage, there may be questions about why double interaction are not included in addition to the triple interaction in the specification. The double interactions and limitations associated with each of them are as follows:

1. Historic migration rates* mean deviation of the nighttime light intensity ($M_{gy-5} * S_{gt}$) suffers from low variation in the data as it only varies at the district level, leading to imprecise estimates.
2. Number of adult males* nighttime light intensity ($A_h * S_{gt}$) varies at the household level, but it unfortunately does not incorporate the cost of migration, which is an essential component of individual's decision to migrate, and therefore would have a weak (if any) relationship to the decision to migrate.
3. Number of adult males*historic migration rates (A_h*M_{y-5}) has been used in the literature for cross-sectional studies and meets the relevance condition but is arguably unlikely to

pass the exclusion restriction in the context of our longitudinal data set covering more than a decade, a time period that also includes a world-wide recession. Because this double-interaction variable would not vary over time, it would not only be related with pull-induced migration from host countries but also with push-induced migration due to poor economic conditions at home, the latter being endogenous to the dependent variables (labor and investment decisions), thus violating the exclusion restriction. The appropriate variation over time can only be provided by the triple interaction that includes variation in nighttime light intensity abroad, and helps to ensure that the predicted migration has been induced by conditions in the host (rather than home) country.

4. Results

4.1 Estimating the Effect of Emigration on Domestic Labor Market Activity

We start by looking at how having a migrant in the household affects various measures of labor market activity on average (Table 3). Given the results of previous research, we expect that migration will depress labor market participation for members of migrant-sending households. Columns (1) and (2) report the ordinary least squares (OLS) results for the regression, initially without controls and then with them, respectively. Column (3) and (4) report the second-stage results of the new triple interaction instrument (weighted average deviation of nighttime light intensity in migrant-receiving countries, historic migration, and number of male household members), first without controlling for the remittance amount and then with the remittances controlled.

Table 3: Second-stage IV and OLS results of emigration and labor market activity, average effects

	(1) OLS	(2) OLS	(3) IV_{triple}	(4) IV_{triple}
Dependent Variable: Subsistence Small Business (Self-Employed)				
Dummy = 1 if HH has Overseas Migrant	-0.008*** [0.002]	-0.014*** [0.002]	0.529*** (0.138)	0.648*** (0.173)

Observations	539,049	525,768	525,768	525,768
1st F-test			23.514	23.234
Hansen J p-value			0.000	0.000
Dependent Variable: Employer				
Dummy = 1 if HH has Overseas Migrant	0.001	-0.001*	0.045**	0.054**
	[0.001]	[0.001]	(0.021)	(0.025)
Observations	539,049	525,768	525,768	525,768
1st F-test			23.514	23.234
Hansen J p-value			0.000	0.000
Dependent Variable: Wage and Salary Earners (Laborer)				
Dummy = 1 if HH has Overseas Migrant	-0.080***	-0.004*	-0.266**	-0.324**
	[0.002]	[0.002]	(0.108)	(0.132)
Observations	539,049	525,768	525,768	525,768
1st F-test			23.514	23.234
1st P-value			0.000	0.000
Individuals and Household Controls		X	X	X
District FE and Time FE		X	X	X
Remittance Amount and Remittance Sq.		X		X
Dependent Variable: Unpaid Family Work				
Dummy = 1 if HH has Overseas Migrant	0.006***	0.006***	-0.098*	-0.122*
	[0.001]	[0.002]	(0.058)	(0.068)
Observations	539,049	525,768	525,768	525,768
1st F-test			23.514	23.234
Hansen J p value			0.000	0.000
Dependent Variable: Not Working At All				
Dummy = 1 if HH has Overseas Migrant	0.016***	0.013***	-0.271***	-0.332***
	[0.001]	[0.001]	(0.074)	(0.093)
Observations	539,049	525,768	525,768	525,768
1st F-test			23.514	23.234
Hansen J p-value			0.000	0.000
Individuals and Household Controls		X	X	X
District and Time FE		X	X	X
Remittance Amount and Remittance Sq.		X		X

Source: Authors' calculations.

Notes: The main independent variable is a dummy variable = 1 if an overseas migrant is present in the household.

IV_{triple} = weighted average mean deviation of nighttime data in the destination countries * historic migration rates * number of adult males. We control for the interacted terms: historic migration rates at district level, number of adult males and the weighted average of the deviation of nighttime light intensity data for the destination countries in the second stage as well.

Individual controls include gender, age, age-squared, highest class attended, and marital status.

Household characteristics include gender of the household head, years of education of the household head, total number of household members, total number of household members squared, number of eligible women, number of children, number of rooms, a dummy = 1 if the household owns its own home, and a dummy = 1 if the household resides in an urban area.

District controls comprise dummies for n-1 districts in Punjab.

Asset controls comprise a dummy = 1 if the following assets are present at the household level: electricity, gas, telephone, air conditioner, cooking range, refrigerator, sewing machine, radio, television, bicycle, motorcycle, car, computer, water pump.

Year controls comprise a dummy = 1 for each year: 2003, 2008, 2011 and 2014.

Remittance controls include the amount of remittance received from abroad and remittances squared.

Standard errors are clustered at the household level. *** p < 0.01, ** p < 0.05, * p < 0.1

Surprisingly, and in contrast with previous studies, we find that migration enhances the labor market participation of members of migrant-sending households. The results show that the probability of an individual being self-employed in a migrant-sending household increases by 64.8 percentage points compared to an individual in a non-migrant-sending household. The probability of an individual employing others (for example, in a cottage industry) increases by 5.4 percentage points if an overseas migrant is present in the household. In addition, the probability of an individual being a laborer (an unstable, low-status job) in a migrant-sending household falls significantly by 32.4 percentage points. Next we report unpaid family work as well as the number of individuals not working at all, indicators of low or no status in the labor market, and we also find that they decrease significantly for individuals in migrant-sending households by 12.2 and 33.2 percentage points, respectively (Table 3). The OLS results in columns (1) and (2) suggest consistent bias in the estimates in comparison to the IV results in columns (3) and (4).We report the second-stage results with specifications using the older double-interaction instrument (historic migration interacted with male household members) in Appendix B Table B.3-B.4. On comparison with the results estimated from using the double interaction instrument, not only is the first stage F-statistic are much higher when the IV includes nighttime light data, giving us a more powerful first stage, the second stage coefficient on the migrant dummy is much more precisely estimated. Adding economic pull factors to the triple interaction IV induces additional (exogenous) variation in the migration variable, changing the subset of households off which the impacts of migration are estimated, leading to both more statistically significant yet quantitatively different impacts. Therefore, we see a clear difference between the estimated second stage coefficients measured using the double interaction IV versus the IV with the triple interaction.

One potential problem with these estimates are linked to the timing of the decision to migrate relative to the labor market decision of the household members who remain. Since the data does not provide any information about the year the individual migrated, it becomes difficult to conclude whether the decision to migrate precedes decisions the migrant-sending household may have made in the estimations shown above. We therefore check the robustness of our results by running regressions in which we restrict the sample to a subsample of individuals aged 17–30 years. The results linked to relatively younger individuals help resolve our problem in two ways: first, any decisions they may have made concerning the labor market and investments would be relatively recent; second, and more importantly, their likelihood of influencing a family member to migrate is significantly lower than that of being influenced by the presence of the migrant themselves.

The results (Appendix D)[22] remain robust to this test, ensuring that, even if we restrict our sample to younger individuals whose investment and labor market decisions are more recent, we can more convincingly argue that the migrant left prior to these decisions. We see that the impact of emigration remains similar: the probability of being self-employed increases by 52 percentage points while that of becoming an employer increase by 6.3 percentage points and the reduction on having a low-status position as a laborer in the market is 31.1 percentage points for individuals from migrant-sending households. These impacts are very similar to the estimated average affects for individuals of all age groups.

4.2 Estimating the Effects of Emigration on Domestic Investment Decisions

Table 4 shows whether having an overseas migrant in the household motivates individuals in migrant-sending households to make investments in tangible assets including property (rental income), bank deposits (interest and profit income), agricultural land, and livestock. The

[22] We include the results only for an individual’s decision to be self-employed, an employer or a laborer, as we believe these decisions are long-term ones and the timing of emigration could be of concern to these estimations. The results for other labor market activities and investment decisions can be provided on request.

results imply that individuals choose to invest more if they belong to migrant-sending households. Specifically, we find that, on average, the probability of receiving rents from property investments increases by 4.8 percentage points and that of saving in banks and holding deposits increases by 0.7 percentage points compared to nonmigrant-sending households, although the latter result was not statistically significant. The OLS estimates are given in columns (1) and (2).

Table 4: Second-stage IV and OLS results for emigration and decision to invest, average effects

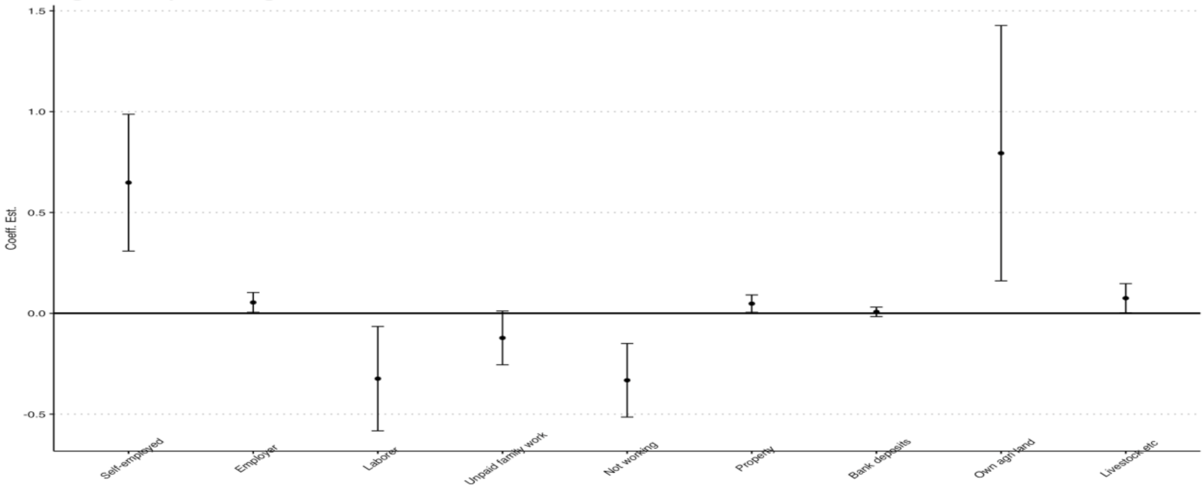
	(1) OLS	(2) OLS	(3) IV_{triple}	(4) IV_{triple}
Dependent Variable: Property				
Dummy = 1 if HH has Overseas Migrant	0.002***	0.001*	0.040**	0.048**
	[0.001]	[0.001]	(0.018)	(0.022)
Observations	539,049	525,768	525,768	525,768
1st F-test			23.514	23.234
Dependent Variable: Bank Deposits				
Dummy = 1 if HH has Overseas Migrant	0.001***	0.001*	0.006	0.007
	[0.000]	[0.000]	(0.010)	(0.012)
Observations	539,049	525,768	525,768	525,768
1st F-test			23.514	23.234
Dependent Variable: Own Agricultural Land				
Dummy = 1 if HH has Overseas Migrant	0.106***	0.056***	0.559***	0.794***
	[0.005]	[0.005]	(0.192)	(0.297)
Observations	145,879	143,947	143,947	143,947
1st F-test			39.845	28.416
Dependent Variable: Total Agricultural Land Owned (in Acres)				
Dummy = 1 if HH has Overseas Migrant	0.629***	-0.031	22.221***	32.979***
	[0.071]	[0.146]	(7.144)	(11.037)
Observations	145,879	143,947	143,947	143,947
1st F-test			39.845	28.416
Dependent Variable: Livestock, Poultry and Fishery				
Dummy=1 if HH has Overseas Migrant	-0.007***	0.004***	0.062**	0.075**
	[0.001]	[0.001]	(0.030)	(0.037)
Observations	539,049	525,768	525,768	525,768
1st F-test			23.514	23.234
Individuals and Household Controls		X	X	X
District and Time FE		X	X	X
Remittance Amount and Remittance Sq.		X		X

Source: Authors' calculations.
Notes: The main independent variable is a dummy variable = 1 if an overseas migrant is present in the household. IV_{triple} = weighted average mean deviation of nighttime data in the destination countries * historic migration rates * number of adult males. We control for the interacted terms: historic migration rates at district level, number of adult males and the weighted average of the deviation of nighttime light intensity data for the destination countries in the second stage as well.

Please see the notes under Table 3 for details of the included control variables.
Standard errors are clustered at the household level. *** p < 0.01, ** p < 0.05, * p < 0.1

The results show that ownership of agricultural land at the household level increases by 79.4 percentage points, acreage owned increases by 32.98 acres, and investment in livestock, poultry, fisheries and forestry rises significantly by 7.5 percentage points for members of migrant-sending households compared to households without a migrant. The results—applying our new triple interaction instrument—in column 4 show that the average impact of migration on the investment decisions of individuals left behind remain positive and strong. The coefficient estimates for Table 3 and 4 are summarized graphically in Figure 3.

Figure 3: Impact of Migration on Labor and Investment Outcomes



5. Heterogeneity

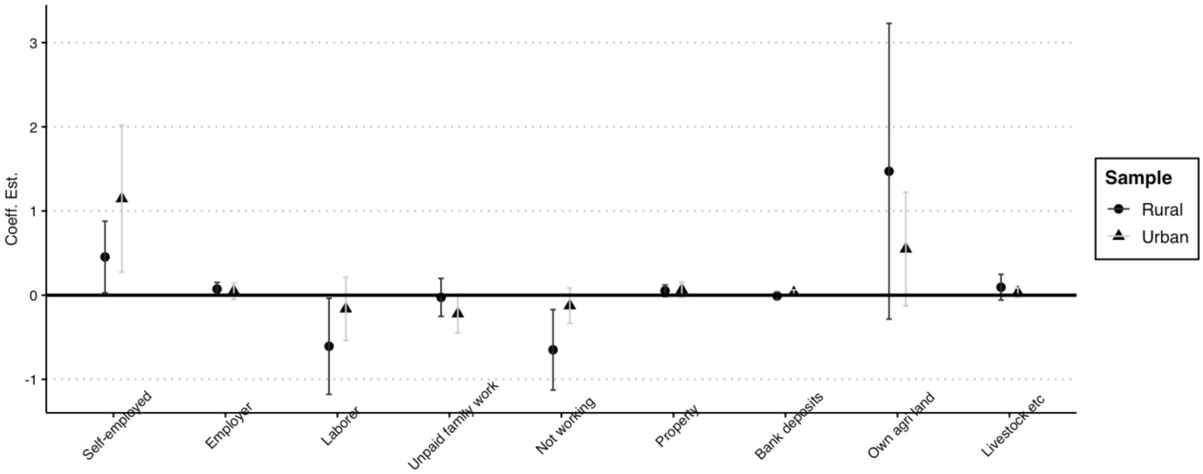
While the average effects of migration that we have measured so far in Tables 3 and 4 have shown it to be welfare enhancing, we are interested to see how the benefits are accruing across different segments of society. We ask whether the gains are primarily going to more privileged groups and relatedly, and whether traditionally more vulnerable groups are being helped or harmed by migration. We consider four main observable characteristics that would be predetermined at the time of migration: the rural or urban location of the household, the gender of the individuals left behind, the education of the individuals left behind, and the gender of the household head. We categorize 'vulnerable' as a subgroup that has been historically constrained in terms of availability of economic opportunities due to resources, social, educational, or cultural barriers; these are households in rural areas, women and women-headed households, and individuals with at most a primary-level of education (five years of schooling or less) who will struggle with basic literacy and numeracy. We use the baseline summary statistics (Appendix C) to identify more constrained and vulnerable social groups based on their endowment of labor market choices and investment decisions.

5.1 Heterogeneous impact of Migration by Urban/Rural Residence

The summary statistics broken down by residence (Appendix C.A.1) show that, on average, a greater number of individuals are self-employed or employers/entrepreneurs in urban areas, which can be attributed primarily to the availability of better opportunities in urban areas. The number of individuals employed in jobs as laborers—usually more risky, rigorous work—tends to be higher in rural areas. Similarly, the incidence of unpaid family work is also higher in rural areas, which can be explained by the choices individuals make under a limited opportunity scenario in order to subsist. In terms of endowments of investments, we see that this is also location-specific: individuals in rural areas invest more in agricultural land, livestock, poultry, forestry and fisheries, whereas we see higher investment in property (rental income) by individuals living in urban areas.

We start by exploring the differential impact of migration in terms of the first observable characteristic—the rural/urban divide—on labor market activities and investments in Figure 4. We report the estimates (including by IV and OLS specifications) in Appendix E, Tables A1 and B1.

Figure 4: Impact of Migration on Labor and Investment Outcomes by Urban/Rural Status



The results from labor outcomes show that there are important gains in migrant-sending households for those living in the poorer rural areas in terms of: increases in self-employment and becoming an employer and reductions in lower-status laborer, and not working at all. In rural areas, there were larger reductions in working as a laborer and not working at all. On the other hand, those in richer urban areas had even larger gains for self-employment and reducing unpaid family work. The results show that there are important gains in migrant-sending households in rural areas in terms of ownership of agricultural land. Only in urban areas is there a modest increase in income from bank deposits. Altogether, those from the more vulnerable segments, rural households, were not harmed and shared substantially – sometimes more, sometimes less - in the gains of having a migrant in their household.

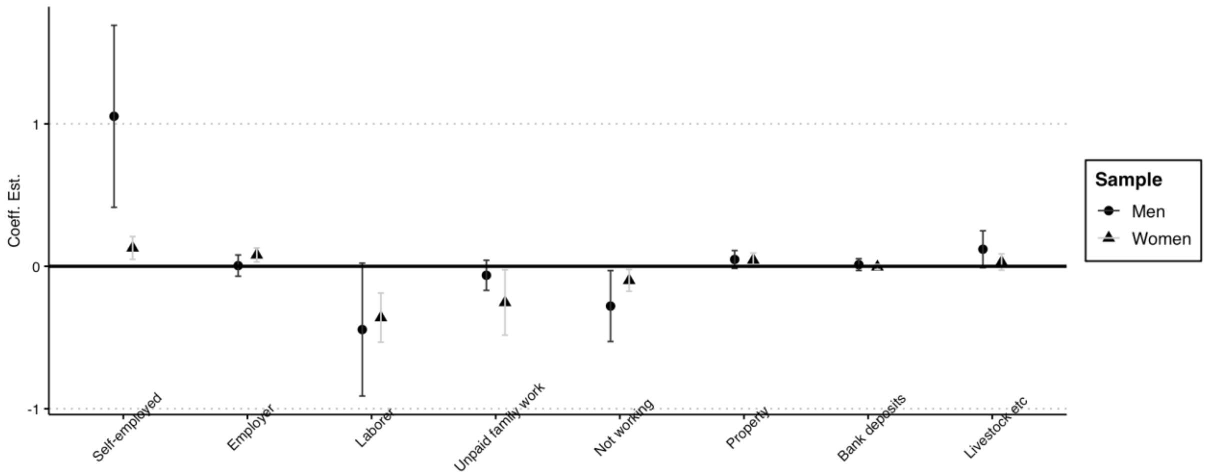
The results of our study reveal that the labor market benefits associated with migration can be substantial for individuals living in rural areas. The marginal elimination of constraints due to migration encourages rural individuals to switch from low-status jobs like daily labor—as well as those with no jobs at all—to being self-employed or becoming employers by opening small businesses. (Note, however, that the raw percentage point increase in self-employment due to migration is higher in urban than rural areas, which is likely due to greater opportunities related to higher population density, larger markets, and lower start-up costs.) This change in both attitude and motivation might be attributable to a better set of ideas, cross-border skills transfer, and increased marginal productivity due to migration. Our results show that households are also more likely to invest in agricultural land and have higher land holdings in response to migration when they are located in rural areas.

5.2 Heterogeneous impact of Migration by Gender

We anticipate that migration may affect women differently due to discrimination, and that unpaid family work may increase due to the migrant missing from the household. The summary statistics by gender (Appendix C.A.2) reveal that women are, on average, more constrained in their work options than men. We see more women engaged in unpaid family work and investing in livestock, poultry, fisheries or forestry, while relatively more men are self-employed, employers, or laborers. On average, men possess a larger number of investments in property, bank deposits and agriculture as well.

We now look at the differential impact of migration by gender of the household member in the home country on labor market activities and investments in Figure 5. We report the estimates (including by IV and OLS specifications) in Appendix E, Tables A2 and B2.

Figure 5: Impact of Migration on Labor and Investment Outcomes by Gender



The results show that there are important gains in migrant-sending households for women in terms of: increases in self-employment and becoming an employer and reductions in lower-status laborer, and not working at all. Women and men decreased their laborer/salaried work at about the same rates. Men had larger gains than women for self-employment and reducing unemployment while, unexpectedly, women reduced their unpaid family labor by more. Men were more likely to invest in livestock and other animals. Altogether, those from the more vulnerable segments, women, were not harmed and shared substantially – sometimes more, sometimes less - in the gains of having a migrant in their household.

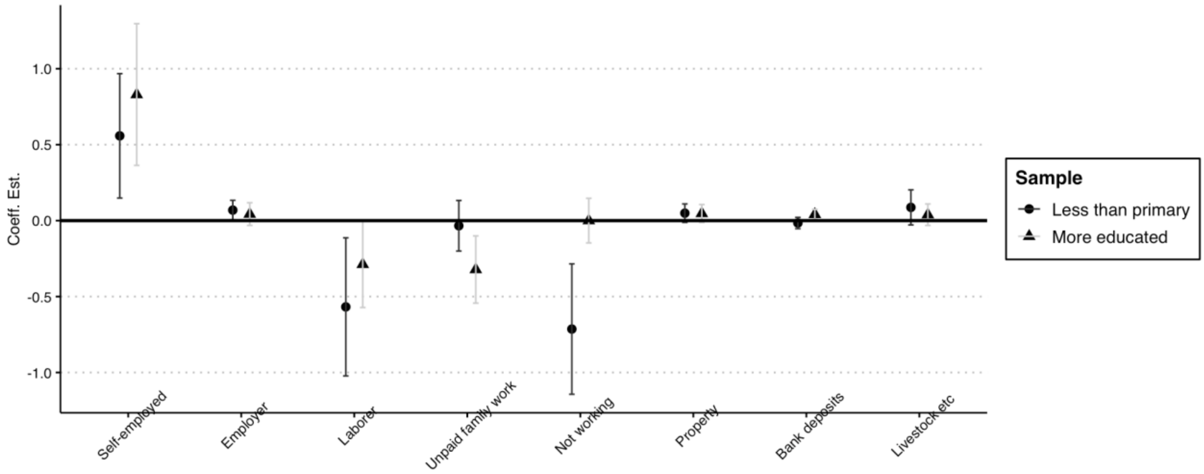
The results of our study indicate that, in response to migration, the probability of being an employer increases more for the women than the men left behind in migrant households, and that women from migrant households also enter into self-employment in larger numbers than women in nonmigrant households (though less than men from migrant households do), both of which reflect a dramatic change in attitudes in migrant-sending households. Women in migrant household also decrease unpaid work and other low-status labor. One plausible explanation for these results is that if a husband and wife run a household business, the latter may have been counted as an unpaid family worker or a laborer until the husband emigrated, after which the wife became an employer, thereby formalizing her status in society as an employer. We see that women are responsible at slightly higher rates than men for the increased investments in property (rental income) among migrant-sending households. Migration has had a profound impact on women's entrepreneurship due to the lower costs associated with home-based businesses, for example, stitching. Not only has it likely ushered in more ideas, but it has also brought about greater social acceptance of women taking the lead in more sophisticated forms of work.

5.2 Heterogenous Impacts by Level of Education

Initial endowments show that individuals with less education are more likely to be laborers and to invest in livestock, poultry, fisheries or forestry, likely due to lower human capital and the limited opportunities available to them (Appendix C.A.3). We see that larger numbers of educated individuals are self-employed or decide to be an employer or possess investments in property or bank deposits.

We explore the differential impact of migration in terms of the education of the individuals left behind on labor market activities and investment in Figure 6. We report the estimates (including by IV and OLS specifications) in Appendix E, Tables A3 and B3.

Figure 6: Impact of Migration on Labor and Investment Outcomes by Education



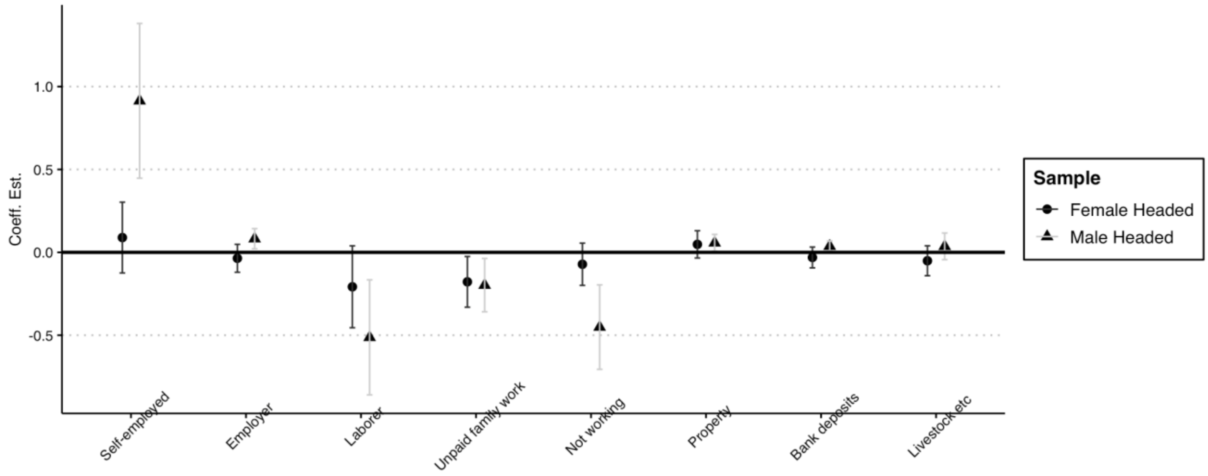
The results show that there are important gains in migrant-sending households for the less educated in terms of: increases in self-employment and becoming an employer and reductions in lower-status labor/salaried employment and not working at all. Those who were more educated also advanced significantly in self-employment and reductions in labor/salaried work and unpaid family work. The more educated are more likely to get income from banking deposits due to migration. Overall, the gains of migration in the labor market were similar by educational level.

Again, we see that eliminating the constraints associated with migration positively affects the less-educated at least as strongly (and sometimes more) as compared to more educated individuals along a number of dimensions including becoming an employer and reducing the probability of being a low-status laborer or not working. This impact can be linked to the better ideas and opportunities availed by less-educated individuals in migrant-sending households that push individuals not working at all and individuals with risky jobs (laborers) toward actively participating in the labor market either through self-employment or entrepreneurship. Those who were more educated had an even larger boost to their self-employment status as a result of migration, probably because the more educated tend to live in urban areas, although both groups experienced substantial increases.

5.3 Heterogeneous Effects by Gender of Household Head

At the same time, the dynamics in female-headed households can be very different from male-headed households, especially in Pakistan. There are two main reasons that make female-headed households more vulnerable: (i) less security due to the absence of a male household head in the context of a patriarchal society such as Pakistan, and (ii) fewer economic opportunities and even greater responsibilities on the shoulders of the women. The summary statistics (Appendix C.A.4) show that the proportion of individuals not working at all is significantly higher in female-headed households. The proportion of self-employed individuals and those employed as laborers is significantly higher in male-headed households. Larger numbers of individuals in female-headed households employ others and get income from property and bank deposits compared to individuals in male-headed households. However, we see more individuals in male-headed households engaged in self-employment, working as laborers and even engaging in unpaid family work. Investment in agriculture and livestock is also higher in male-headed households. Here we explore the differential impact of migration in terms of the gender of the household head—on labor market activities and investments in Figure 7. We report the estimates (including by IV and OLS specifications) in Appendix E, Tables A4 and B4.

Figure 7: Impact of Migration on Labor and Investment Outcomes by HH Head Gender

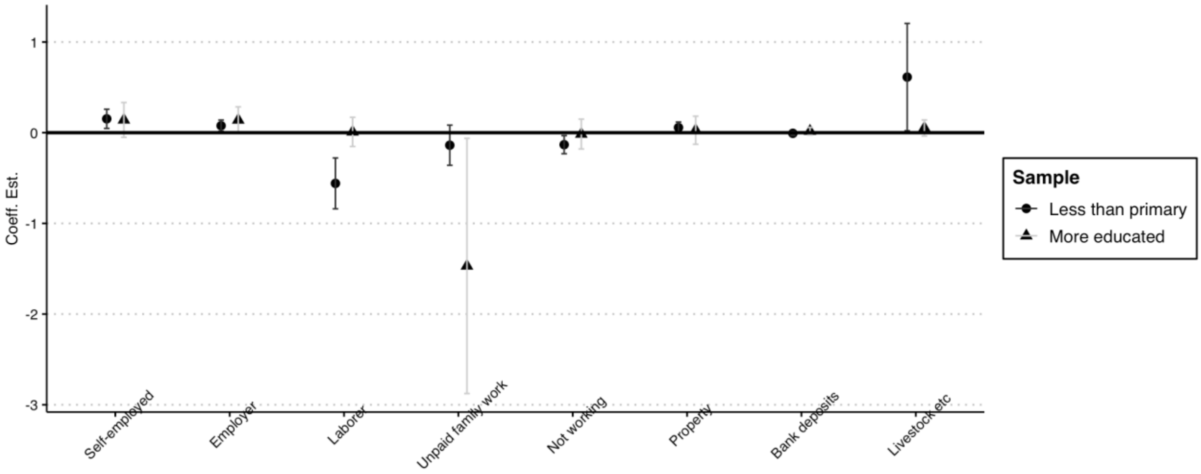


The results show that in women-headed households, there were reductions in labor/salaried employment and unpaid family work. The gains in male-headed households were larger in nearly all work categories. However, male-headed households have increased their banking deposits to a larger extent than women-headed ones, and have increased their ownership of other types of property as well. While female-headed households did not lose ground in terms of asset ownership, they accumulated less due to migration than traditionally more privileged groups. In summary, male-headed households benefited more than woman-headed ones, but there did not seem to be any harm of migration for the more vulnerable group. Interestingly, the results show that female-headed households— which we identify as a vulnerable group—are deprived of many of the gains from migration. Almost all investment decisions and labor market transitions from being a laborer or not working at all to being self-employed or an employer are driven by male-headed households, implying that greater policy attention is needed to ensure that female-headed households gain as much from migration.

5.4 Heterogeneous Effects by Women's Education

Lastly, upon identifying the relevance of migration for women and educated households, we explore if migration has any significantly different impact on women based upon their level of education. Figure 8 reports the results for the impact of emigration on the women in migrant-sending households by education.

Figure 8: Impact of Migration on Labor and Investment Outcomes by Education of Women



Interestingly, the results show that as far as the educated women are concerned, they benefit more than the less educated from migration only in terms of reduced unpaid family work. Nevertheless, most of the benefits that women accrue from migration are associated with the ones who are not educated. Significant declines in low-status daily labor, along with increases in self-employment, being an employer, and investments in livestock have been identified for women without education.

5.5 Robustness Checks

We run several robustness checks to validate the new triple-interaction instrument proposed in the study. We start by arguing that, of the three interacted terms, nighttime light intensity data and historic migration rates both qualify as the most exogenous drivers of emigration in the home country (Mayer et al., 2021). However, to conduct an analysis at the individual worker level, we need to generate an instrument that creates variation in the decision to migrate at a more micro-level, at least at the household level. Accordingly, we interact it with the number of adult males in a household.

For the robustness checks, we attempt to identify if both these exogenous shifters perform any differently if they are used individually. First, we show the second-stage results for the specification, using the interaction of historic migration rates with the number of adult males as an instrumental variable instead and controlling with the two interacted variables separately in the first and second stages (Appendix G.A.1). Next, we use the deviation in the weighted average of nighttime light intensity data from its mean interacted with the number of adult males as an instrument, controlling for the two interacted terms separately in the first and second stages (Appendix G.A.2).

To justify that the instrument works well under the condition that there is substantial variation in data for economic activity in the destination countries, such that they have experienced both troughs and peaks, we compare our standard results with a case in which we drop the year 2008 (Appendix G.A.3). We confine our analysis only to the survey years where economic activity was above the mean. The results reveal that the first-stage F-statistic falls tremendously; implying that substantial variation (both above and below the mean) in economic activity is a prerequisite for the instrument to qualify as a strong and valid instrument.[23] In addition, if we were to also include double-interaction terms separately in the first stage, they would dilute the power of the triple interaction IV, because there are not particularly strong trends in migration associated with the double interactions. This over-controlling inflates the standard errors in the first and second stage and reduces the first-stage F-statistics of the 2SLS, implying that the additional instruments have not improved the

[23] We test three more forms of the triple interaction instrument (the results can be provided on request): i) normalizing the instrument components into z-scores, ii) including all combinations of the cross-terms of the three instrument components, and iii) disaggregating the analysis by individual survey years. First, if we normalize the three interacted terms individually to their respective z-scores and interact them to create a normalized instrument or if we normalize the triple interaction directly into a z-score, this does not change the results from the main results we have already reported. Second, if we include all the cross-terms of the three instrument components, the instrument is weakened according to the first-stage F-stat and the second stage coefficients fall in significance. Third, if we disaggregate the analysis into individual survey years, again the first-stage statistics fall precipitously, implying that variation over time is an important ingredient in this analysis.

precision of the estimation (Appendix G.A.4). The results are highly sensitive to changes in the instrument as indicated by the first-stage F-statistics, which fall significantly, implying that changing the instrument does not improve the precision of the estimation. Finally, if we try to illustrate the exclusion restriction using subsample regressions of the different time periods controlling for double-interaction cross products (in addition to the triple interaction IV and individual terms), we run into the problem that the regression equations are not even identified.

6. Conclusions

This study confirms the positive impact of the presence of the diaspora on migrant-sending households in Pakistan. Based on data on a large number of individuals and households over time, the analysis shows that, on average, there is a significant shift in activity in the labor market from not working at all, unpaid family work and basic/manual labor to relatively higher-status forms of employment such as self-employment and becoming an employer for individuals from migrant-sending households.

It is interesting to note that having a migrant in the household not only encourages individuals to switch to more stable earning streams (self-employment and employer), but also reduces their unpaid family work significantly and motivates individuals not working at all to enter the labor force. In addition, we see a considerable increase in investments in property, bank deposits, agricultural land, and livestock and poultry by individuals from migrant-sending households. These results are mainly net of the remittances to the household, as the amount received is controlled for in all specifications. In other words, the amount remitted cannot be solely responsible for the impact of migration on the individuals who remain, so that there may be a variety of channels through which this impact takes place, including knowledge, psychosocial, behavioral, and cultural spillovers.

We see that much of the effect is masked due to the heterogeneity present among the household members left behind. Our analysis shows that there are specific types of individuals in the household who benefit more from having a migrant, and these effects are concentrated among individuals usually considered vulnerable, including females, less-educated individuals, and individuals living in rural areas. Female-headed households, on the other hand, do not benefit as much from migration.

With a novel identification strategy, this study contributes to the literature by providing relatively more accurate evidence for the link between migration and the motivation of different types of individuals left behind in terms of supplying labor and investing locally. The results confirm that emigration strengthens the economic position of women, brings about rural development and stability to those with less education by helping them to participate in more high status labor market activities.

Our results indicate positive returns associated with migration in labor market and investment outcomes, thus ensuring the gains that migrant-sending households in Pakistan obtain. From eliminating constraints via knowledge flows and attitudinal changes (motivation, capacity to take risks, ability to accept new cultures) to improvements in marginal productivity, we have reviewed a number of studies that link emigration to development in the home country even after the amount of remittance is partialled out from the net effect of migration. Furthermore, the results show that these impacts are largely heterogeneous among the individuals. On comparing the sign and magnitude of the coefficients, we report that, in general, the vulnerable group in many cases drive or at least reinforce the average (positive) effects.

Our study identifies the significance of the presence of a male figure as the household head in reaping the benefits of emigration. It also highlights those individuals who have not been as positively affected in certain categories, for example, female-headed households in general, while unpaid family work is not reduced for individuals in rural areas or for those who are less educated. This implies that, for these individuals, migration alone cannot bring about the larger benefits associated with information, knowledge and motivation flows. This implies that some policy intervention may be necessary to complement migration if such individuals are to benefit from it.

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Paper II: Emigration's Heterogeneous Impact on Children's Wellbeing in Punjab, Pakistan

1. Introduction

Emotional connectedness, monitoring and supporting children are deeply rooted in the institution of the family. In spite of the financial benefits afforded by remittances, we argue that splitting families across borders due to the migration of a potential caregiver can alter the family system considerably, complicating the impact of migration on children left behind. Pakistan failed to achieve the Millennium Development Goals (MDGs) prioritizing the wellbeing of children and is still far from achieving the Sustainable Development Goals (SDGs) that absorbed the main agenda of MDGs. In such situations, it is important to know whether migration will help or harm children. The literature is divided about evaluating the developmental impacts of migration on the family members left behind, especially the children who depend upon the migrating individual, making them more vulnerable to the changes. Therefore, estimating the overall wellbeing of children[24] in migrant-sending households becomes crucial. We attempt to measure the causal net impact of migrating caregivers on children's wellbeing, measured by the nutritional outcomes of younger children and schooling of the older age group of children, to identify whether the net impact of migration is positive or negative in the case of Punjab, Pakistan.

Early migration-related research focused on remittances and their usage. Remittances of course directly augment the income of households and could be spent in a variety of ways, ranging from accumulating assets to investing in children's education and health through better

[24] Although child's wellbeing is a more complex multidimensional aspect that comprise of both self-assessed and externally assessed outcomes. The data source that we use for our analysis only collects consistent information in all rounds of MICS on only two domains of externally assessed outcomes of child's wellbeing, i.e., nutritional outcomes and educational outcomes and hence these are the focus of the study.

nutrition and preventive medical services. A substantial literature reports how household expenditures are buttressed due to the inflow of remittances (Adams & Cuecuecha, 2010; Azam & Gubert, 2006; Massey et al., 1987; Durrand et al., 1996; de Haas, 2006), which can and often does improve the financial status of the migrant-sending households and benefit the children due to relaxed income constraints.

The New Economics of Labor Migration (NELM) argues that the act of migration not only provides additional income but provides other benefits, such as insurance against production risk and market failures and access to "social remittances" including knowledge flows and technology, but there are also negatives associated with the disruptions caused by missing household members; therefore, measuring the returns for migration purely based on remittances does not capture the overall effect of migration on individuals at the micro-level (Andersson et al., 2022; Gassman et al., 2013; Taylor, 1999).

Migration may lead to disruptions in emotional attachments and reduce the sense of security that may have adverse effects on the health of the younger children left behind. The 'Attachment Theory' proposed by Ainsworth (1969) suggests that the bonds formed in the early days of life evolve as children mature, which means that the absence of physical proximity of a caregiver due to migration may potentially affect children of different age groups differently (Gassman et al., 2013). The physical absence of the migrant from the household may have negative psychosocial effects on their spouse and children left behind (Meng & Yamauchi, 2017). However, if only one parent is absent, the harm is usually less (Zhang et al., 2014).

Moreover, the prevalence of the joint family system in Pakistan results in a tight interconnectedness and interdependency of the family members, and this not only leads to the pooling of resources but also the division of responsibilities among household members. This cooperation, enabling the joint production of household goods, might be hampered due to the migration of adult household members, making the case for the absence of caregivers much more relevant in the case of Pakistan. The migration of an adult family member is in many instances likely reduce the supervision of school-age children and increase the burden of unpaid household chores carried out by women and children (de Brauw & Mu, 2011).

Econometrically, in recent years, studies have attempted to address the problem of endogeneity that may bias estimates of the impact of migration on the wellbeing of children since the estimated coefficient on the migrant indicator variable is likely to be biased upward largely due to unobservable family characteristics (Arif & Chaudhry, 2015; Hanson & Woodruff, 2003; Mansuri, 2006). For instance, well-informed households will tend to have healthier children, invest more in education, while also being more likely to explore prospects abroad and decide to migrate. Due to this bias-causing simultaneity problem, we therefore employ an instrumental variable approach to explore the causal impact of a migrating member on: first, on the nutritional wellbeing of younger children (ages 5 and less) and second, on the educational attainment of older children (ages 5-17) in a household in Punjab, Pakistan. We identify the net impact of migration on children using a large, individual-level dataset that we created by pooling multiple rounds of the UN supported Multiple Indicator Cluster Survey (MICS) for the survey years 2008, 2011, 2014 and 2018, which gives us a sample size of almost 700,000 children aged 17 and less.

We contribute to the literature in three distinct ways: First, we use a new instrumental variable that we argue not only satisfies the orthogonality condition but also provides more precise estimates since it contains variation at the household level. Second, we provide a detailed picture of the children's wellbeing that captures the health of the younger children as well as the educational outcomes of the older children in the households. Last, we explore heterogeneity in the impact of migration across various dimensions and show that the average impact masks the true effects of migrating caregivers on demographically different types of children.

The study is organized as follows: The introduction in section 1 is followed by a literature review in section 2. Section 3 describes the data, methodology and empirical strategy. The descriptive statistics and empirical results are presented and discussed in section 4. We conclude in section 5.

2. Literature Review

2.1 Impact of Migration on Education and Health: Current Findings

In this section, we discuss how the literature on migration affecting the left behind children has evolved. As far as the financial aspect is concerned, researchers have argued that migration may bring benefits via financial remittances, which can improve the health outcomes of younger children by enabling better nutritional intake, better health care, and increased expenditures on health inputs among migrant-sending households. Migration in a number of contexts has indeed had positive long term impacts on development through investments in education and health (Berloffa & Giunti, 2019; Kapri & Jha, 2020).

Investments in education as a result of migration have been widely documented in a number of countries (Acosta, 2006; Arif & Chaudhry, 2015; Hanson & Woodruff, 2003; Khanna et al, 2022; Theoharides, 2018). By boosting expenditures on education, migration can lead to better school performance (Edwards & Ureta, 2003; Acosta, 2006; de la Garza, 2010; Edillon, 2008;

Yang, 2008; Macours & Vakis, 2010; Lu and Treiman, 2011). In a similar focused strand of literature on schooling and emigration by Cox et al. (2003), Yang (2005), de Braw and Giles (2017) and Hanson and Woodruff (2003), the authors mostly found positive effects. Further, Mobarak et al. (2020) finds that migration empowers women to make household decisions, including decisions regarding children, which could lead to more equitable educational and health outcomes for girls.

Migration increases health expenditures (Amuedo-Dorantes & Pozo, 2011) and when combined with remittances reduces low birth weight (Frank & Hummer, 2002) and improves some anthropomorphic outcomes for under-5 children (Antón, 2010). Similar studies for children aged 5 years and less, such as Mansuri (2006) for the case of Pakistan, Hildebrandt and McKenzie (2005) for the case of Mexico, and De & Ratha (2012) for the case of Sri Lanka, confirmed the positive impact of emigration on the health outcomes of the respective children: BMI, HAZ, WAZ, and mortality rates.

In Pakistan specifically, positive impacts of migration have been observed by Arif and Chaudhry (2015) for schooling and Arif and Islam (2022) for height-for-age and weight-for-age of children under age five. Mansuri (2006), using a cross-sectional dataset of the Pakistan Rural Household Survey (PRHS) 2001-02, estimated the impact of migration on school outcomes of children in rural Pakistan and concluded that although the impact was highly positive, the gains were much larger for girls.

In contrast, the literature has also argued that the physical absence of a caregiving member in a household might bring instability due to the increased responsibilities and emotional distress experienced by the family members who were earlier under the migrating member's care. The absence of the caregiver may create psychological distress, especially for the children of younger age groups, that can in turn damage the health of the younger children directly. A study conducted for the case of Mexico concluded that less health care was received by the children in migrant households in the form of vaccinations and breastfeeding, although infant mortality and maternal health knowledge improved (Hildebrandt and McKenzie, 2005). Other studies also report a negative impact on the health of children in terms of weight (de Brauw & Mu, 2011), likelihood of illness (Adhikari et al, 2012), and birthweight and breastfeeding (Robson et al., 2008). The long absence of a mother is especially difficult on children (Brockerhoff, 1994), but the impact of the absence of a household member due to migration is not always harmful (Gassman et al, 2013).

A negative impact on educational outcomes might also be expected for a number of reasons. First, there is an increased amount of responsibility faced by older children taking part in home production (de Brauw & Mu, 2011). Further, children may also suffer from fewer role models in migrant households, less parental time inputs and monitoring, and anticipation of low returns to education associated with migrants in the host country (Hanson and Woodruff, 2003; McKenzie and Rapoport, 2011). McKenzie and Rapoport (2011) and Meza Gonzalez and Pederzini Villarreal (2008) report a negative impact on the schooling outcomes of boys in migrant-sending households.

2.2 Empirical Approaches

We will next consider the types of econometric techniques used to study migration's impacts. While a few studies employ methods like propensity score matching (Acosta, 2006; De & Ratha, 2012; Esquivel & Huerta-Pineda, 2007) to name a few, the majority of studies apply an instrumental variable approach, with pre-existing migration networks one of the most popular sources of exogenous variation. For instance, Hanson and Woodruff (2003) and Acosta (2006) used historic migration at the state or village level, which has the benefit of strict exogeneity although it is limited for variation generated at the household level. Similarly, although Mansuri (2006) introduced more variation in the instrument by interacting current migration rates with the number of adult males in a household, the instrument they used is not exogenous with respect to the dependent variable in the same period. In Pakistan, instrumental variable approaches have included Arif & Chaudhry (2015), who adapted Mansuri (2006) by interacting historic migration rates with the number of adult males to study emigration’s impacts on schooling and Arif & Aslam (2022), who built on Calero et al. (2009) and Antón's (2010) to interact the number of banks with the number of adult males in the household to study the impact on child anthropomorphic outcomes.

In other cases, studies have either used short term or long term exogenous shocks as an instrument to correct for the problem of endogeneity. Mesnard (2004) used exogenous policy changes in destination countries as an instrument to assess their impact on Tunisian migration. Likewise, Munshi (2003) used rainfall shocks and Yang (2005) used the Asian currency crisis to create an exogenous shock to migration in Filipino families. On the other hand, Woodruff and Zenteno (2007) used distance from rail lines as an instrument built on longer-term exogenous variation to capture the impact on migration.

Recent literature has continued to explore the drivers of migration, both international and national with new data and methodologies. Several of these works integrate the role of migrant networks in promoting emigration with push and pull factors to create additional variation. Theoharides (2018) predict demand from abroad for migrants from different areas of the Philippines based on historic migration. Mahajan and Yang (2020) consider the interaction of migrant networks with the push-factor of a negative home-country shock in the form of hurricanes that propel migrants to the United States from around the developing world.

McKenzie et al. (2014) demonstrate that international migration of workers from the Philippines is highly sensitive to host-country GDP shocks.

2.3 Our Empirical Approach

In this study, we build upon the previous literature to construct a new instrumental variable that incorporates three types of variation. Our new instrument is a triple interaction of: (i) historic diaspora rates at the district level, (ii) the number of adult males in the household, and (iii) the weighted average deviation of nighttime light intensity from its trend in migrant-receiving countries over time. It corrects the endogenous migration decision that qualifies as being strong and precise because it is highly correlated with the decision to migrate (migration networks plus the pull factor of economic activity at destination), varies at the household level (and is therefore closer to the smallest unit of analysis), and fulfills the condition of orthogonality with respect to measures the child's wellbeing.

This study adds to the literature by using a more sophisticated analysis to capture the impact of external migration on the wellbeing of children in Pakistan by addressing the problem of endogenous migration decisions and omitted variable bias. We incorporate a full range of key control variables together with a new instrument that we argue could provide precise and efficient estimates. To the best of our knowledge, none of the studies conducted so far, especially for the case of Pakistan has addressed these issues.

3. **Data & Methodology**

In this section, we discuss the multiple sources of the datasets used in the paper as well as the empirical strategy employed to estimate the causal relation between the migrating potential caregiver and the wellbeing of the child in a household.

3.1 Data

We use the Multiple Indicator Cluster Survey (MICS) collected for the province of Punjab, Pakistan for the analysis in this study. First, only in Punjab have MICS data been collected in four waves over a 10-year period; for the remaining provinces there are only one or two waves of data, but either the time horizon of data available is too short (Sindh, Khyber Pakhtunkhwa, and Baluchistan) or the quality is suspect (Baluchistan). Second, Punjab is the largest province of Pakistan, with nearly 60 percent of the total population of Pakistan residing in it, which is why it is broadly representative at the national level.

We create two separate longitudinal datasets for children, first for the age group of underage five (to conduct an analysis on anthropometric measures) and second for children of the age 5 to 17 years (to conduct an analysis on the schooling outcomes) by using multiple waves of the Multiple Indicator Cluster Survey (MICS) for the survey years 2008, 2011, 2014 and 2018. The Multiple Indicator Cluster Survey (MICS) contains data on more than 1,900,000 individuals from households selected randomly across Punjab’s 35 districts. The data cover child-level information on anthropometric measures, schooling outcomes, household-level information, and geographical information. MICS also collect information on the asset ownership of the households and whether an individual has migrated from the household or not.

Two additional datasets are used in this study to construct the instrumental variable that has been used to correct for the endogenous decision to migrate in a household. We use data provided by the Pakistan Bureau of Emigration and Overseas Employment (BEOE) to construct historic migration rates at the district level, survey year-wise. We use data from the National Centre for Economic Activity (NCEA) to provide information on the nighttime light intensity data that have been used in this study to construct measures for the economic activity in the three main emigrant destination countries for Pakistan for each respective survey year.

3.2 Empirical Strategy

We estimate the following equation to measure the impact of having a migrating potential caregiver in a household separately for the health outcomes (of children under age five) and for the schooling outcomes of children (of age group 5-17 years).

3.2.1 Specification

The equation for estimating the impact of migration on child *I* in household *h*, district *g* for survey year *t* is as follows:

$$C_{ight} = \alpha_o + \alpha_m M_{ght} + \alpha_s \text{ Mother Ctrls}_{ht} + \alpha_w \text{ HH Ctrls}_h + \alpha_v \text{ Individual Ctrls}_i + \alpha_g \text{ District Dummies}_g + \alpha_t \text{ Time Dummies}_t + \eta_{ght} + \mu_{ight} \qquad (1)$$

$E(u_{ight})=0$ and $E(M_{ght}, \eta_{ght}) \neq 0$

Where C_{ight} is the dependent variable that is either a health outcome (for children under-five years) or an educational outcome (for children of aged 5-17 years). For health outcomes, we use two anthropometric measures for nutritional status measured by whether a child is stunted, severely stunted, underweight, or severely underweight. A child is categorized as stunted if their height-for-age z score is two standard deviations or more below the mean of the global reference population of the same age and gender as determined by the WHO (2010)[25]. The child is categorized as severely stunted if they fall three standard deviations or more below the mean of the global reference population of the same age and gender. Similarly, the weight-for-age z-score can be used to identify whether a child is underweight (>2 standard deviations below the mean) and severely underweight (>3 standard deviations below the mean).

Similarly, for educational outcomes, we use three educational measures as dependent variables for the children aged 5-17: whether a child is currently enrolled, the current level of schooling of a child, and whether the child is a school dropout.

The right-hand side variable that estimates the impact of a migrating household member in the equation is M_{ght}, which takes a value of 1 if an individual has emigrated from a household. All the rounds of MICS contain information on whether there is an external migrant belonging to the household; unfortunately, they do not report the migrant's relationship with the children. Since we do not know whether the migrant from the household was the child's father or another male relative, we confine our analysis to the migration of a "potential caregiver" in a household.

[25] The WHO (2010) proposed standardized measures of the height-for-age z-scores and weight-for-age z-scores. Therefore, we follow World Health Organization (WHO, 2010) to create measures for a fair comparison among children of different genders and ages worldwide. The standard formula used to calculate these z-scores is Z=(x-p)/n, where x is the original value of the height-for-age and weight-for-age, p. is the mean of the global reference population set by WHO (2010) and n is the standard deviation of the original value from the mean of the global reference population (sex- and age-specific). The appropriate range identified by WHO (2010) for a valid value of height-for-age z-scores is $-6<HAZ<6$ and weight-for-age z-scores is $-6<WAZ<6$. The rest of the flagged values are dropped from the analysis. Additionally, the criteria have been set by NHS (2010) and WHO (2010) regarding categorizing whether each type of child qualifies into extreme health conditions.

3.2.2 Control variables

The key control variables comprise household characteristics, child's characteristics and assets in a household to measure the impact of migration on schooling outcomes. The mother's characteristics and health inputs are used as additional controls in the specifications measuring the impact of migration on the child's health outcomes. A substantial literature has reported the relevance of these control variables determining the health and schooling outcomes of children both at national and international level, as will be discussed in more detail below.

Child-level characteristics comprise of the child's gender, age, birth order, and birth spacing[26]. The literature argues that the gender and age of the children also play a vital role in determining whether more resources are spent on them to achieve better health and schooling. Birth order has been argued to play a vital role in determining the higher amount of devoted resources towards the older children since they have less competition with their siblings (Lindert (1977)). Similarly, higher birth order is associated with constrained resources shared amongst more number of children negatively affecting them (Chaudhry et al., 2021; Elliot, 1992; Jayachandran & Pande, 2017; Pruckner et al., 2021). Similarly, gender discrimination may also play a pivotal role in determining whether more resources will be spent on a child to access more education and health facilities (Rammohan & Vu, 2018; Dercon & Singh, 2013; Klasen, 2002; Colclough, Rose & Tembon, 2000).

[26] Birth Spacing is defined as the birth space between two successive children, we control it by generating three a dummy variables: dummy=1 if the spacing between two children is less than 12 months and less, 0 for longer birth spacing or the first born, dummy=1 if birth spacing between two children is 24 months and less, 0 for longer birth spacing or the first born and dummy=1 if birth spacing between two children is 33 months and less, 0 for longer birth spacing or the first born.

Mother-level characteristics such as the mother's age, age of the first-born child, a dummy variable equal to 1 if the mother has ever breastfed, number of years married, and a dummy variable equal to 1 if the mother is pregnant are also important for accessing the health of children, especially infants. Glewwe (1999), Hamilton & Choi (2015) and Afzal (2013) argue that better-informed mothers can raise children using better child rearing practices. Since we only have this information for the children of age group 5 years and less we control this variable only for the specification measuring the impact of migration on health outcomes.

Health-related variables include a dummy equal to 1 if the child is delivered in a health care facility, a dummy equal to 1 if mother has ever used contraceptives, and a dummy equal to 1 if postnatal care at health facility has been used (only for the specification measuring health outcomes). These controls again directly augment the health status of the children due to the exposure of the children in their early days to better health facilities that can later feed into their wellbeing (McKenzie & Sasin (2007)). This data is again available for the children of age group 5 years and less that is why it is only controlled in the specification for health outcomes.

Household characteristics comprise of the gender of the household head, location of the household, total number of the households, assets owned by the households and the education of the household head has been argued to have direct effect on the child's upbringing due to better access to resources (Kuehnle, 2014, Glewwe, 1999; Afzal, 2013). In addition, we control for location and time by including district controls (urban versus rural controls, year controls) as a proxy for the supply-side factors that may have an effect on health & schooling outcomes.

3.2.3 Endogenous Migration Decision & Instrumental variable

The corresponding error terms in the specification are η_{ght} and μ_{ight}. The latter is the random error term, whereas η_{ght} encompasses unobservable characteristics that could be at the household level, district level or even over time that can affect the child's wellbeing and the decision of the caregiver to migrate simultaneously. For instance, well-informed households will tend to have healthier children, invest more in education, while also being more likely to explore prospects abroad and decide to migrate. Failure to control for such factors results in the OLS estimated coefficient of interest being biased.

To correct for the bias introduced in the estimation due to the endogenous migration decision, we use an instrumental variable approach. The instrumental variable used to correct the endogenous migration decision in this paper is calculated as follows:

$$Z_{hgt} = \sum_{h=1}^{n} M_{gt-5} S_{gt} A_h \quad (2)$$

where *M* is the historic migration rates that comprise the aggregate number of people migrating from 1980 until at least five years prior to the year of the survey in district *g*. *S* is the sum of the weighted average *deviations* of nighttime light intensity data from its detrended means in Pakistan's top three migrant-receiving countries and *A* is the number of adult males in a household *h*. The three main destination countries for the Pakistani diaspora are Saudi Arabia, Oman and the U.A.E. We use the data from the Bureau of Emigration and Overseas Employment to construct the weights, dividing the number of emigrants sent to Saudi Arabia, U.A.E and Oman by the total number of emigrants from each district.

The literature supports strong links between each of the three variables used in the construction of the new instrument and the migration decision from the home country. The first component, historic migration rates have been used in a number of prior studies and measure the strength of the networks formed between the home and host regions (Acosta, 2006; Arif & Chaudhry, 2015; Hanson & Woodruff, 2003; Mansuri, 2006; Woodruff & Zenteno, 2007). Prior migration arguably reduces the cost of migration. For example, Blumenstock et al. (2019) use rich cell phone data to conclude that social support through embedded and interconnected migration networks drives migration within Rwanda. The second component is based on nighttime light intensity, which is used in the literature as a proxy for current economic activity (Henderson, et al., 2003). We use positive deviations of nighttime lights from their detrended means in migrant-receiving countries as a signifier of greater economic activity and therefore higher demand for migrant labor, serving as a pull factor for migration. The third component is the number of adult males in a household, indicates both an excess of available labor supply at home and a higher level of comfort in terms of the household members' physical safety in case of migration, therefore also facilitating movement abroad (Mansuri, 2006).

Intuitively, the triple interaction term i.e., our instrumental variable, is not only strong correlated with the individual's decision to migrate but also varies at the household level (as opposed to just the district level), providing more precise estimates. The positive deviation from the mean in the nighttime light intensity of the destination countries imply that the economic activity in the destination countries is above the average. This signals better job prospects for the potential migrants in the home countries. Therefore, it is in the periods when potential migrants in the districts with strong diaspora networks and belonging to households with more adult males will have a higher probability of migrating abroad.

We argue that the instrumental variable is highly correlated with the decision to migrate, i.e., E(Mght, Zght)≠0, but orthogonal to the nutritional health and schooling outcomes of the children, implying that E(Cight, Zght) = 0, hence yielding unbiased estimates of the coefficient of interest. Mansuri (2006), Hanson and Woodruff (2003), and Arif & Chaudhry (2015) have already successfully used two of the same components that we are using here, historic migration, with or without interactions with the number of adult males, as an plausibly exogenous instrument for migration. Given Pakistan's narrow manufacturing base (and even narrower export base), it is difficult to imagine how host country business cycles, measured as deviations in trends of nighttime light intensity, would have an effect on child nutrition and education except through migration.

4. Descriptive Statistics & Empirical Results

In this section, we discuss the descriptive statistics of key variables and the empirical strategy used in our estimations.

4.1 Descriptive Statistics

The number of children that are younger than five years in our sample is almost 185,000 of which almost 11% have a household member that has migrated. Table 1 shows differences in some key variables between households who have a migrant and those without a migrant.

Table 1: Inferential and descriptive statistics

	Migrant Households		Non-migrant Households		
Dependent Variables for Health Outcomes					
Variables	Observations	Mean (1)	Observations	Mean (2)	Mean Difference
Height-for-age Z Score (Age <5 years)	19659	-1.1935	164425	-1.5204	0.3269***
Weight-for-age Z Score (Age <5 years)	19903	-1.1642	167974	-1.4303	0.2661***
Stunted (Age <5 years)	19659	0.2753	164425	0.3742	-0.0989***
Severe Stunted (Age <5 years)	19659	0.1063	164425	0.1695	-0.0632***
Underweight (Age <5 years)	19903	0.2323	167974	0.3143	-0.0820***
Severe Underweight (Age <5 years)	19903	0.0686	167974	0.1014	-0.0328***
Dependent Variables for Educational Outcomes					
Enrolled (Age 5-17 years)	42741	0.7971	319805	0.7292	0.0679***
Current Level of education (Age 5-17 years)	42741	1.1755	319805	0.9947	0.1808***
School Dropout Age (5-17 years)	42741	0.0171	319805	0.0173	-0.0002

Household's Characteristics					
Household Situated in Urban Area	27195	0.287	221841	0.3354	-0.0484***
Female Household Head	27193	0.2704	221835	0.031	0.2394***
Total Number of HH Member	27195	9.3208	221841	8.0639	1.2570***
Own Agricultural Land	27195	1.5715	221841	1.6929	-0.1214***
Wealth Score	27195	0.3591	221841	-0.1176	0.4767***
Household Head's Education Level	27171	2.2114	221524	2.174	0.0374***

Source: Authors' own calculations. ***p<0.01, **p<0.05, *p<0.1

The table shows the means in the variables in both migrant and non-migrant households in the sample as well as tests the significance of the differences in these means. Some of the key takeaways from Table 1 are:

- The average height-for-age z-score (HAZ) of children under age five in both migrant and non-migrant households is negative, which shows that the children's nutritional status lies below the median HAZ of the global reference population (set by WHO standards) regardless of migration status, although the children from migrant-sending households are taller for their age than the children in households without a migrant. In particular, the average height-for-age of children in households with a migrant is 1.19 standard deviations below the height-for-age of the global reference population while the average height-for-age of children in households without a migrant is 1.52 standard deviations below. Consequently, the probabilities of a child being stunted (defined as being at least two standard deviations below the mean value of HAZ) and severely stunted (defined as being three standard deviations below the mean value of HAZ) are significantly lower if they belong to a household with a migrant.
- The weight-for-age z-score (WAZ) on average for children under age-five is also negative for both groups of households, although the children from migrant-sending households are heavier than those households without a migrant. The average weight-for-age of children in households with a migrant is 1.16 standard deviations lower than the median WAZ of the global reference population and the average weight-for-age of children in households without a migrant is 1.42 standard deviations lower than the median WAZ of the global reference population of the same age and gender. Similarly, the statistics suggest that the probabilities of a child being underweight and severely underweight in a household with a

migrant are significantly lower than that of a child in a household without a migrant.

- Enrollment and the current level of education for children between the ages of 5-17 is significantly higher and the school dropout rate is significantly lower for children living in households with a migrant compared to the children living in households who do not have a migrant.

Table 2 shows the statistics for mothers' characteristics, health inputs and characteristics of children in households with and without a migrant.

Table 2: Inferential and descriptive statistics

	Migrant Households		Non-migrant Households		
Mother's Characteristics					
Variables	Observations	Mean (1)	Observations	Mean (2)	Mean Difference
Mother's Age	22671	30.18	182637	30.8084	-0.6284***
Age of the First-born Child	23217	6.71	190717	7.8238	-1.1138***
Number of Years Married	20009	9.2581	133974	10.4678	-1.2097***
Ever Breast fed	27195	0.5661	221841	0.5077	0.0584***
If Mother is Pregnant	27195	0.094	221841	0.113	-0.0190***
Mothers Without Education	27806	0.315	235833	0.5398	-0.2248***
Mothers with Primary Level of Education	27806	0.2	235833	0.1722	0.0278***
Mothers with Middle Level of Education	27806	0.1271	235833	0.0864	0.0407***
Mothers with Secondary Level of Education	27806	0.1912	235833	0.1096	0.0816***
Mothers with Higher level of Education	27806	0.1667	235833	0.0921	0.0746***
Health Inputs					
Delivery in Health Care Facility	27195	0.2031	221841	0.1623	0.0408***
Postnatal Care at Health Care Facility	27195	0.1679	221841	0.1392	0.0286***
Ever used Contraceptives	27195	0.0872	221841	0.1484	-0.0613***
Characteristics of Children (Age 5 years and less)					
Child's Birth Order	27195	2.34	221841	2.8227	-0.4827***
Gender (If the Child is Girl)	27195	0.4906	221841	0.4878	0.0028
Age of the child	27195	2.3368	221841	2.365	-0.0282***
If Child has Vaccination Card	27195	0.3371	221841	0.4518	-0.1147***
Received vitamin A dose	27195	0.4237	221841	0.491	-0.0674***
birth spacing less than 12 months	23958	0.0243	161687	0.0288	-0.0045***
birth spacing less than 24 months	23958	0.2191	161687	0.2488	-0.0298***
Characteristics of Children (Age 5-17 years)					
Age of the Child	46885	11.5253	346403	11.2477	0.2776***
Gender (if the child is Girl)	46885	0.5055	346397	0.5148	-0.0093***
Assets					
TV	27087	0.7756	219584	0.6286	0.1469***
Refrigerator	27099	0.7209	219539	0.4431	0.2778***
Washing Machine	27071	0.726	219192	0.5147	0.2113***
Air cooler	27089	0.9614	219472	0.9046	0.0568***
Microwave	27075	0.1568	219198	0.072	0.0848***
Water filter	27064	0.0379	219240	0.0198	0.0181***
Turbine	27079	0.7595	219475	0.5923	0.1672***
Air conditioner	27079	0.1457	43615	0.064	0.0817***
Sewing machine	27077	0.6679	219432	0.5421	0.1258***
Watch	27185	0.6568	221674	0.5844	0.0724***
Bicycle	27154	0.342	221452	0.3659	-0.0239***
Motorcycle	27175	0.5281	221554	0.4091	0.1190***

Animal cart	27149	0.1237	221431	0.1069	0.0167***
Car	27185	0.1029	221470	0.0628	0.0401***
Boat	23866	0.0023	153466	0.0015	0.0007***
Tractor	23848	0.0701	153321	0.0575	0.0125***
Computer	27186	0.1889	221623	0.0786	0.1102***

Source: Authors' own calculations. ***p<0.01, **p<0.05, *p<0.1

Some key takeaways from this table are:

- Mothers are younger, more educated and married for fewer years in households with a migrant as compared to households who do not have a migrant.
- Households with a migrant have significantly more assets and access to better health facilities than households who do not have a migrant.
- The children in households with a migrant are significantly younger, have shorter birth spacings between successive children, a significantly lower probability of receiving vitamin A dose as well as a significantly lower probability of holding vaccination cards as compared to children in non-migrant households.

In addition to the statistics discussed above, this sample contains data for multiple survey rounds. Therefore, we have analyzed the means of the key variables for households with and without migrants for each individual years of our sample, 2008, 2011, 2014 and 2018. The statistics show that the means (and their differences) in each year follow the same patterns as the results for the entire sample pooled. The statistics for individual survey rounds are found in Appendix A.

4.2 Results

We report the results for measuring the impact of migration on the child health outcomes of children (age 5 years and less) and the impact of migration on the schooling outcomes (5-17 years old) in this section.

4.2.1 Estimating the Impact of the Migration of Potential Caregivers on Child Health Outcomes

In this section, we discuss the results for the impact of migration on our health outcomes of interest: being stunted, being severely stunted, being underweight, and being severely underweight for children under-five years of age.

4.2.1.1 First-stage Results

In table 3A, we report the results for the first-stage regression that tests the relationship between our instrumental variable and the decision of a household member (and potential caregiver) to migrate in households with children younger than five years. In these specifications, the dependent variable is an indicator variable that takes a value =1 if the household has a migrant and =0 otherwise. The migrant indicator variable is regressed on the instrumental variable and other covariates. As discussed in more detail earlier, the instrumental variable is the product of three variables that drive migration abroad; first, the mean deviation of nighttime data in the destination countries (measured as the sum of the weighted average of the three main destination countries of the Pakistani diaspora); second, the district-level migration rates from 1980 to five years prior to the survey year (taken from the Bureau of Emigration and Overseas Employment), and third, the number of adult males at the household level.

The covariates are child characteristics and include the child's gender, age, age squared, birth order, and birth spacing, which is represented by three dummy variables. The birth spacing variables are a dummy =1 if the birth spacing between two children is 12 months or less, a dummy =1 if the birth spacing between two children is 24 months or less, and a dummy =1 if the birth spacing between two children is 33 months or less and =0 otherwise. The birth spacing indicators take values of 0 for first-born children. We also include the characteristics of a child's mother, which are the mother's age, age of the first-born child, a dummy = 1 (=0 otherwise) if the mother has ever breastfed, the number of years that the mother has been married, and a dummy = 1 (=0 otherwise) if the mother is pregnant. We have also included variables representing health inputs that comprise of a dummy = 1 (=0 otherwise) if the child was delivered in health care facility, a dummy =1 (=0 otherwise) if the mother ever used contraceptives and a dummy =1 (=0 otherwise) if the mother received post-natal care at a health facility. We have included geographical and time controls including district fixed effects that are represented by dummy variables for each district in Punjab, a dummy variable if the child's household is located in an urban area, and a survey year-fixed effect, represented by a dummy =1 for each of the years 2008, 2011, 2014 and 2018.

Table 3A: First-stage results to estimate the impact of the Instrumental Variable on the Migration decision in the households of children for age group under-5

Dependent Variable: Dummy=1 if Potential Caregiver has Migrated			
Instrumental Variable: Triple Interaction (Mean Deviation of Nighttime Intensity in the Destination Countries * Historic Migration Networks * Number of Adult males)	0.471*** [0.028]	0.474*** [0.028]	0.284*** [0.029]
Observations	160,831	160,831	106,571
1st F test	20.381	20.381	20.381
1st P value	0.000	0.000	0.000
1st partial R2	0.013	0.019	0.168
Hansen J0	0.000	0.000	0.000
Individual controls			X
Household controls			X
District F.E.		X	X
Time F.E.		X	X

Note: Standard errors are clustered at the household level. ***p<0.01, **p<0.05, *p<0.1

Column (1) of Table 3A give the results for the specifications with just the instrumental variable without any control variables. Column (2) give the results for the specification that includes the instrumental variable and controls for district and year fixed effects and column (3) gives the results for the specification with the instrumental variable as well as the covariates representing child characteristics, household characteristics, mother characteristics, health inputs, district fixed effects, and year fixed effects. Our results show that our instrumental variable remains consistent and significantly positive across these different specifications, and the results from the third specification imply that a one standard deviation increase in the instrument increases the probability of a household member migrating by 28.4 percentage points.

4.2.1.2 Second-stage Results

In this section, we report the results from an OLS specification along with the second-stage results of the instrumental variable analysis. The results in Table 3B examine the impact of a household having a migrant, who was potentially a caregiver, on the health outcomes of children under age five. In these specifications, we use four different dependent variables: (i) a dummy variable equal to one if the child is stunted, (ii) a dummy variable equal to one if the child is severely stunted, (iii) a dummy variable equal to one if the child is underweight and (iv) a dummy variable equal to one if the child is severely underweight.

The covariates are child characteristics and include the child's gender, age, age squared, birth order, and birth spacing that is represented by three dummy variables. The birth spacing variables are a dummy =1 if the birth spacing between two children is 12 months or less, a dummy =1 if the birth spacing between two children is 24 months or less, and a dummy =1 if the birth spacing between two children is 33 months or less and =0 otherwise. The birth spacing indicators take values of 0 for first-born children. We also include the characteristics of a child's mother, which are the mother's age, age of the first-born child, a dummy = 1 (=0 otherwise) if the mother has ever breastfed, the number of years that the mother has been married, and a dummy = 1 (=0 otherwise) if the mother is pregnant. We have also included variables representing health inputs that comprise of a dummy = 1 (=0 otherwise) if the child was delivered in health care facility, a dummy =1 (=0 otherwise) if the mother ever used contraceptives and a dummy =1 (=0 otherwise) if the mother received post-natal care at a health facility. We have included geographical and time controls including district-fixed effects that are represented by dummy variables for each district in Punjab, a dummy variable if the child's household is located in an urban area, and a survey year-fixed effect, represented by a dummy =1 for each of the years 2008, 2011, 2014 and 2018.

The baseline specifications (col 1, 5, 9 and 13) report the value of the OLS coefficients of each nutritional outcome regressed on an indicator variable if a household has a migrant (=1) or not (=0) without controlling for any other variables. Next, we add controls for survey year fixed effects (col 2, 6, 10 and 14). In the third set of specifications (col 3, 7, 11 and 15), we control for child, mother and household characteristics. Finally, in the fourth set of specifications (col 4, 8, 12, and 16), we report our main results, using instrumental variable which corrects for the bias caused by the endogeneity of the decision to migrate. Comparing the first three sets of OLS results with our IV results, we see a consistent positive bias in all the coefficients measuring the impact of having a migrant in a household on health outcomes that justify the use of the instrument.

The instrumental variable results in col (8) and (16) show that the probability of children being underweight significantly increases by 28.9 percentage points and that being severely underweight increases by 12 percentage points respectively for the children in households with a migrant as compared to households without a migrant. The instrumental variable results in col (4) and (12) show that the probability of children being stunted is not significantly affected by migration. Combined, these results imply that migration tends to have a negative impact on short-term measures of nutritional health outcomes (being underweight) and not on long-term nutritional health (being stunted).

Table 3B: Second Stage IV and OLS results of Emigrating Caregiver and Health Outcomes of Children (Age group under-5 years), Average Effects

	Dependent Variable: Dummy=1 if child is Stunted				Dependent Variable: Dummy=1 if child is Underweight			
	OLS (1)	OLS (2)	OLS (3)	IV (4)	OLS (5)	OLS (6)	OLS (7)	IV (8)
Dummy=1 if Potential Caregiver has Migrated	-0.099***	-0.069***	-0.026***	0.007	-0.082***	-0.075***	-0.023***	0.289***
	[0.004]	[0.004]	[0.004]	[0.075]	[0.004]	[0.004]	[0.004]	[0.081]
Observations	184,084	184,084	126,703	105,591	187,877	187,877	128,253	106,949
1st F test				92.468				57.263
1st p-value				0.000				0.000
1st partial R2				0.091				0.024
Hansen J0				0.000				0.00
	Dependent Variable: Dummy=1 if child is Severely Stunted				Dependent Variable: Dummy=1 if child is Severely Underweight			
	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Dummy=1 if Potential Caregiver has Migrated	-0.063***	-0.056***	-0.013***	-0.070	-0.082***	-0.075***	-0.023***	0.120**
	[0.003]	[0.003]	[0.003]	[0.056]	[0.004]	[0.004]	[0.004]	[0.048]
Observations	184,084	184,084	126,703	105,591	187,877	187,877	128,253	106,949
1st F test				45.088				28.758
1st p value				0.000				0.000
1st partial R2				0.057				0.021
Hansen J0				0.000				0.000
Year F.E.		X	X	X		X	X	X
District F.E.			X	X			X	X
Mother's Characteristics			X	X			X	X
Child's Characteristics			X	X			X	X
Household's Characteristics			X	X			X	X
Instrument				X				X

Note: Standard errors are clustered at the household level. ***p<0.01, **p<0.05, *p<0.1

4.2.2 Estimating the Impact of the Migration of Potential Caregivers on Children's Schooling Outcomes

In this section, we discuss the results for the impact of migration on our schooling outcomes of interest: being enrolled in school, school dropout, and the current level of schooling of children 5 to 17 years old.

4.2.2.1 First-stage Results

Again, we begin by reporting the first stage regression results, shown in Table 4A, which test the relationship between migration and education for children between the ages of 5 and 17. As in the first stage regressions in the previous analysis, the dependent variable is a dummy variable which is equal to 1 if the household has a migrant and 0 otherwise and with the instrument as the main explanatory variable and the covariates are child characteristics, mother characteristics, household characteristics, district fixed effects, and survey year fixed effects. The definitions of these variables are the same as the ones used in the previous analysis.

Table 4A: First-stage results to estimate the impact of the Instrumental Variable on the Migration decision of the households for children for age group 5-17 years

Dependent Variable: Dummy=1 if Potential Caregiver has Migrated			
	(1)	(2)	(3)
Instrumental Variable: Triple Interaction (Mean Deviation of Nighttime Intensity in the Destination Countries * Historic Migration Networks * Number of Adult males)	0.369***	0.386***	0.353***
	[0.021]	[0.021]	[0.019]
Observations	443,067	443,067	442,323
1st F test	20.381	20.381	20.381
1st P value	0.000	0.000	0.000
1st partial R2	0.009	0.013	0.160
Individual controls			X
Household controls			X
District F.E.		X	X
Year F.E.		X	X

Note: Standard errors are clustered at the household level. ***p<0.01, **p<0.05, *p<0.1

Column (1) of Table 4A presents the results for the specification with just the instrumental variable without any control variables. Column (2) adds controls for district and year fixed effects and column (3) includes the covariates representing child characteristics, household characteristics, mother characteristics, district fixed effects and year fixed effects. Our results show that our instrumental variable remains consistent and significantly positive across these different specifications, and the results from the third specification imply that a one standard deviation increase in the instrument increases the probability of a household member migrating by 35.3 percentage points.

4.2.2.2 Second-stage Results

In this section, we report the results from OLS specifications along with the second-stage results of the instrumental variable analysis. The results in Table 4B examine the impact of the household having a migrant, who is a potential caregiver, on the schooling outcomes of children between the ages of 5 and 17. In these specifications, we use three different dependent variables: (i) a dummy variable equal to one if the child is enrolled in school (=0 otherwise), (ii) a dummy variable equal to one if the child has dropped out of school (=0 otherwise), and (iii) the current level of education of a child in years completed. We use the same set of household covariates as in the previous analysis, but we lack information on mother characteristics and health inputs for the children aged 5-17, and child characteristics are limited to age and gender.

The baseline specifications (in col 1, 5, and 9) report the value of the OLS coefficients of a schooling outcome regressed on an indicator representing if a household has a migrant without controlling for any other variables. Next (in col 2, 6, and 10), we report the results when we control only for year fixed effects alone. In the third set of specification (col 3, 7, and 11), we control for child and household characteristics. Finally, in the fourth set of specifications (col 4, 8 and 12), we report our main results, using instrumental variable which corrects for the bias caused by the endogeneity of the decision to migrate. Comparing the first three sets of OLS results with our IV results, we again see differences in the coefficients measuring the impact of having a migrant in a household on schooling outcomes. Looking at the results more closely, the instrumental variable results imply that the probability of a child between the ages of 5 and 17 being enrolled in a school is 25 percentage points higher in a household with a migrant. At the same time, the probability of a child between the ages of 5-17 dropping out of school and the current level of schooling of children in this age group are unaffected by having a migrant in the household[27].

[4] We also estimate the specifications for the health and schooling outcomes for individual years as opposed to all the years combined and the results are in Appendix B.

Table 4B: Second Stage IV and OLS results of Emigrating Caregiver and Schooling Outcomes of Children (Age group 5 -17 years), Average Effects

	Enrolled (Age 5-17 years)				Dropout (Age 5-17 years)				Current Level of education (Age 5-17 years)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dummy=1 if Potential Caregiver has Migrated	0.037***	0.043***	-0.002	0.250**	0.003***	0.001	0.001	-0.002	0.144***	0.152***	0.023***	0.050
	[0.003]	[0.003]	[0.002]	[0.123]	[0.001]	[0.001]	[0.001]	[0.021)	[0.007]	[0.007]	[0.006]	[0.207]
Observations	510,405	510,405	509,539	440,984	555,464	555,464	554,022	484,525	511,168	511,168	510,112	441,548
R-squared	0.001	0.015	0.216	0.211	0.000	0.005	0.014	0.014	0.002	0.006	0.323	0.331
1st F test				40.936				44.274				40.991
1st P value				0.000				0.000				0.000
1st partial R2				0.001				0.001				0.001
Year F.E.		X	X	X		X	X	X		X	X	X
District F.E.			X	X			X	X			X	X
Mother's Characteristics			X	X			X	X			X	X
Child's Characteristics			X	X			X	X			X	X
Household's Characteristics			X	X			X	X			X	X
Instrument				X				X				X

Note: Standard errors are clustered at the household level. ***p<0.01, **p<0.05, *p<0.1

4.2.3 Heterogeneous Effects of Emigration

Given the demographic diversity of households in Punjab, we next consider whether the effects of migration on children is heterogeneous across population subgroups. We test to see if the impact of migration on nutritional health and schooling outcomes differs based on the geographic location of households, the gender of the child, the wealth of households, and the mother's level of education. First, we divide the sample based on rural/urban residence of the household to see if migration affects children in these two populations differently. Next, we consider the differential impacts of migration based on of the gender of the child. Then, we divide the population on wealth, where the lowest two wealth quintiles are defined as poor and the three upper quintiles are defined as relatively wealthier. Finally, we consider the impact of migration when the mother has some education (defined as at least one year of schooling) as compared to mothers who never went to school. This final analysis based on the mother's education can only be performed for the child nutritional outcomes, since we lack information on mother's education for the older children in the sample.

4.2.3.1 Nutritional Health Outcomes

First, we report the IV impact of a migrating potential caregiver based upon whether a household is located in a rural or urban area in Table 5A.

The results show a significant difference in the rural and urban households of having a migrant in the household: urban households with a migrant have a significantly lower chance of having a child that is underweight while rural households with a migrant have a significantly higher chance of having a child that is underweight and severely underweight. Focusing on the IV results, the probability of children in a rural household with a migrant being underweight is 28.3 percentage points higher than that of non-migrant households and the probability of a child being severely underweight increases by 13.0 percentage points in these same households. It is interesting to note that the probability of children being underweight in migrant households is 48.4 percentage points lower as compared to non-migrant households, implying that migration can have a positive effect on nutritional health outcomes, but only in urban areas. As far as the rural and urban divide is concerned, the IV results do not show any significant impacts on the probability of children being stunted and severely stunted in either urban or rural areas (Table 5B).

Table 5A: Impact of external migration on children's probability of being underweight and severely underweight by rural/urban divide

Dependent Variables	Urban				Rural			
	Underweight		Severe Underweight		Underweight		Severe Underweight	
	OLS with all controls (1)	IV with all Controls (2)	OLS with all controls (3)	IV with all Controls (4)	OLS with all controls (5)	IV with all Controls (6)	OLS with all controls (7)	IV with all Controls (8)
Dummy=1 if Potential Caregiver has Migrated	0.115***	-0.484**	-0.030***	-0.217	-0.020***	0.283***	-0.009***	0.130**
	[0.022]	(0.580)	[0.007]	[0.173]	[0.005]	[0.086]	[0.003]	[0.052]
Observations	44,134	38,241	43,621	37,766	84,119	69,723	84,119	69,723
1st F test		31.349		950.60		40.676		20.938
1st P value		0.000		0.000		0.000		0.000
1st partial R2		0.003		0.063		0.029		0.020

***p<0.01, **p<0.05, *p<0.1. Source: Author's own calculations.

Table 5B: Impact of external migration on children's probability of being stunted and severely stunted by rural/urban divide

Dependent Variables	Urban				Rural			
	Stunted		Severe Stunted		Stunted		Severe Stunted	
	OLS with all controls (1)	IV with all Controls (2)	OLS with all controls (3)	IV with all Controls (4)	OLS with all controls (5)	IV with all Controls (6)	OLS with all controls (7)	IV with all Controls (8)
Dummy=1 if Potential Caregiver has Migrated	-0.030***	0.217	-0.012**	0.447	-0.024***	0.126	-0.015***	0.013
	[0.007]	[0.173]	[0.005]	[0.570]	[0.005]	[0.080]	[0.004]	[0.062]
Observations	43,621	37,766	43,621	37,766	83,082	68,805	83,082	68,805

1st F test	95.598	48.617	63.641	33.014
1st P value	0.000	0.000	0.000	0.000
1st partial R2	0.063	0.108	0.083	0.060

***p<0.01, **p<0.05, *p<0.1. Source: Author's own calculations.

Next, we report the test the impact of migration on the nutritional health outcomes of children when we differentiate by gender of the child. In table 6A, focusing on the IV results, we see that the probability of girls being underweight increases by 38.8 percentage points, and the probability of being severely underweight increases by 24.3 percentage points if they belong to a migrant household compared to a non-migrant household. The probability of boys being underweight also increases significantly by 19.5 percentage points, but this impact is approximately half that of girls. Additionally, we do not see any significant increase in the probability of boys being severely underweight when belonging to a migrant household, implying that although migration affects both genders, girls are affected more severely. Table 6B tests to see if the probability of being stunted or severely stunted because of belonging to a migrant household varies by gender. Looking at the IV specifications, we do not see any significant differences in the probability of being stunted or severely stunted if the child belongs to a migrant household due to child gender.

Table 6A: Impact of external migration on children's probability of being underweight and severely underweight by gender

Dependent Variables	Boys				Girls			
	Underweight		Severe Underweight		Underweight		Severe Underweight	
	OLS with all controls (1)	IV with all Controls (2)	OLS with all controls (3)	IV with all Controls (4)	OLS with all controls (5)	IV with all Controls (6)	OLS with all controls (7)	IV with all Controls (8)
Dummy=1 if Potential Caregiver has Migrated	-0.029*** [0.006]	0.195** [0.096]	-0.013*** [0.003]	0.018 [0.059]	-0.017*** [0.006]	0.388*** [0.113]	-0.004 [0.003]	0.243*** [0.072]
Observations	65,690	55,360	65,690	55,360	62,563	52,604	62,563	52,604
1st F test		36.829		19.079		32.397		14.790
1st p value		0.000		0.000		0.000		0.000
1st partial R2		0.046		0.040		-0.003		0.030

***p<0.01, **p<0.05, *p<0.1. Source: Author's own calculations.

Table 6B: Impact of external Migration on Child's probability of being stunted and severely stunted, by gender

Dependent Variables	Boys				Girls			
	Stunted		Severe Stunted		Stunted		Severe Stunted	
	OLS with all controls (1)	IV with all Controls (2)	OLS with all controls (3)	IV with all Controls (4)	OLS with all controls (5)	IV with all Controls (6)	OLS with all controls (7)	IV with all Controls (8)
mmy=1 if Potential egiver has Migrated	-0.027*** [0.006]	0.001 [0.097]	-0.017*** [0.004]	-0.116 [0.072]	-0.025*** [0.006]	0.060 [0.101]	-0.010** [0.004]	-0.021 [0.074]

servations	64,819	54,561	64,819	54,561	61,884	52,010	61,884	52,010
F test		52.496		26.910		53.865		26.649
p value		0.000		0.000		0.000		0.000
partial R2		0.088		0.052		0.094		0.061

***p<0.01, **p<0.05, *p<0.1. Source: Author's own calculations.

Next, we test to see if there is a significant difference in the impact of having a migrant on nutritional health outcomes depending on the wealth level of the household. The IV results in Table 7A show that the probability of child being underweight in a migrant sending household is 54.1 percentage points higher than that of a non-migrant household if the household is poor. Similarly, the probability of a child being severely underweight is 29.8 percentage points higher than that of a non-migrant household if the child is from a poor household in the IV specification. Alternately, the impact of having a migrant on child health outcomes is insignificant for wealthier households. We perform a similar analysis to see if the household wealth level affects the impact of having a migrant on long-term nutritional health outcomes. The IV results in table 7B show that there is no significant difference in the probability of being stunted or severely stunted in migrant sending households when one compares wealthier to poorer households.

Table 7A: Impact of external migration on children's probability of being underweight and severely underweight by wealth

Dependent Variables	Wealthy (top three wealth quintiles)				Poor (lower two wealth quintiles)			
	Underweight		Severe Underweight		Underweight		Severe Underweight	
	OLS with all controls (1)	IV with all Controls (2)	OLS with all controls (3)	IV with all Controls (4)	OLS with all controls (5)	IV with all Controls (6)	OLS with all controls (7)	IV with all Controls (8)
Dummy=1 if Potential Caregiver has Migrated	-0.030***	0.070	-0.009***	0.013	-0.032***	0.541***	-0.018***	0.298***
	[0.005]	[0.074]	[0.003]	[0.039]	[0.007]	[0.165]	[0.004]	[0.106]
Observations	50,983	44,529	50,983	44,529	77,270	62,420	77,270	62,420
1st F test		92.605		22.776		16.858		13.375
1st p value		0.000		0.000		0.000		0.000
1st partial R2		0.037		0.037		0.074		0.044

***p<0.01, **p<0.05, *p<0.1. Source: Author's own calculations.

Table 7B: Impact of external migration on children's probability of being stunted and severely stunted by wealth

Dependent Variables	Wealthy (top three wealth quintiles)				Poor (lower two wealth quintiles)			
	Stunted		Severe Stunted		Stunted		Severe Stunted	
	OLS with all controls (1)	IV with all Controls (2)	OLS with all controls (3)	IV with all Controls (4)	OLS with all controls (5)	IV with all Controls (6)	OLS with all controls (7)	IV with all Controls (8)

Dummy=1 if Potential Caregiver has Migrated	-0.033*** [0.005]	-0.096 [0.072]	-0.010*** [0.003]	-0.006 [0.072]	-0.034*** [0.007]	0.119 [0.157]	-0.029*** [0.005]	-0.037 [0.129]
Observations	50,394	44,007	50,394	44,007	76,309	61,584	76,309	61,584
1st F test		337.627		26.910		40.090		22.192
1st p value		0.000		0.000		0.000		0.000
1st partial R2		0.082		0.052		0.053		0.039

***p<0.01, **p<0.05, *p<0.1. Source: Author's own calculations.

Finally, we compare the impact of migration on child nutritional health outcomes in households when the mothers are uneducated as compared to households where the mothers have some education. In Table 8A, we see a significantly larger effect of migration on the probability of a child being underweight and severely underweight in households with uneducated mothers. The IV results show that the impact of migration on the probability of a child being underweight is almost doubled (95.1 percentage points higher) if the mother is uneducated. Similarly, the probability of being severely underweight is 58.3 percentage points higher in migrant-sending households when we restrict the sample to uneducated mothers. In Table 8B, we do not see any significant differences in rates stunting and severe of stunting of children in migrant sending households differentiated by mothers' education.

Table 8A: Impact of external migration on children's probability of being underweight and severely underweight by mother's education

Dependent Variables	Mother has Some Education				Uneducated Mother			
	Underweight		Severe Underweight		Underweight		Severe Underweight	
	OLS with all controls (1)	IV with all Controls (2)	OLS with all controls (3)	IV with all Controls (4)	OLS with all controls (5)	IV with all Controls (6)	OLS with all controls (7)	IV with all Controls (8)
Dummy=1 if Potential Caregiver has Migrated	-0.025*** [0.005]	0.103 [0.076]	-0.009*** [0.003]	0.001 [0.040]	-0.018** [0.008]	0.951*** [0.252]	-0.009* [0.006]	0.583*** [0.161]
Observations	70,670	59,802	70,670	59,802	57,583	47,147	57,583	47,147
1st F test		21.457		11.337		11.880		9.438
1st P value		0.000		0.000		0.000		0.000
1st partial R2		0.027		0.018		0.220		0.163

***p<0.01, **p<0.05, *p<0.1. Source: Author's own calculations.

Table 8B: Impact of external migration on children's probability of being stunted and severely stunted by mother's education

Dependent Variables	Educated Mother				Uneducated Mother			
	Stunted		Severe Stunted		Stunted		Severe Stunted	
	OLS with all controls (1)	IV with all Controls (2)	OLS with all controls (3)	Iv with all Controls (4)	OLS with all controls (5)	IV with all Controls (6)	OLS with all controls (7)	IV with all Controls (8)

Dummy=1 if Potential Caregiver has Migrated	-0.031*** [0.005]	-0.013 [0.076]	-0.013*** [0.003]	-0.069 [0.048]	-0.015* [0.009]	0.229 [0.195]	-0.017*** [0.007]	0.034 [0.157]
Observations	69,885	59,126	69,885	59,126	56,818	46,465	56,818	46,465
1st F test		31.615		12.681		30.880		17.668
1st P value		0.000		0.000		0.000		0.000
1st partial R2		0.057		0.024		0.045		0.040

***p<0.01, **p<0.05, *p<0.1. Source: Author's own calculations.

Overall, the results show that the health of the children who are already resource constrained, which could either be due to economic or cultural barriers, is more prone to be affected adversely by the caregiver's migration, and any positive effects of caregiver migration are experienced on average by the children in urban areas. These findings are contrary to the findings in previous literature on Punjab. In both studies, Arif & Aslam (2022) and Mansuri (2006) concluded that the impact of migration on the health outcomes is positive, and especially for girls, whereas in our study we have concluded the opposite, so that migration rather has a negative impact on the nutritional status of children, especially girls, those living in rural areas, and those whose mothers are without education.

4.2.3.2 Educational outcomes

Finally, we explore whether the impacts of emigrating potential caregivers on schooling outcomes are also heterogeneous according to household demographics.

The IV results in Table 9A show that only children in rural households are affected negatively by the migration of a family member. The results show that the dropouts in migrant-sending households increase by 4.7 percentage points if they reside in rural areas. Table 9B shows the estimates for the level of education of the child when the sample is divided between children in rural and urban areas. According to the IV results, we see no significant difference between the years of education that children have attained based upon the rural urban divide.

Table 9A: Impact of external migration on children's enrollment and dropout by rural/urban divide

Dependent Variables	Urban				Rural			
	Enrolled (Age 5-17 years)		Dropout (Age 5-17 years)		Enrolled (Age 5-17 years)		Dropout (Age 5-17 years)	
	OLS with all controls (1)	IV with all Controls (2)	OLS with all controls (3)	IV with all Controls (4)	OLS with all controls (5)	IV with all Controls (6)	OLS with all controls (7)	IV with all Controls (8)
Dummy=1 if Potential Caregiver has Migrated	0.015*** [0.005]	0.359 [0.680]	0.001 [0.001]	0.031 [0.032]	-0.011*** [0.003]	0.182* (0.108)	0.001 [0.001]	0.047** [0.021]
Observations	116,867	149,273	189,792	169,235	327801	259,303	364230	289,812
1st F test		1.538		27.994		49.309		53.185
1st p value		0.015		0.000		0.000		0.000
1st partial R2		0.147		0.010		0.245		0.002

***p<0.01, **p<0.05, *p<0.1. Source: Author's own calculations.

Table 9B: Impact of external migration on Children's Level of Education, by rural/urban divide

Dependent Variables	Level of Education (Age 5-17 years)			
	Urban		Rural	
	OLS with all controls (1)	IV with all Controls (2)	OLS with all controls (3)	IV with all Controls (4)
Dummy=1 if Potential Caregiver has Migrated	0.047*** [0.010]	0.212 [1.484]	0.015** [0.007]	0.106 [0.187]
Observations	181,941	149,463	328171	259,654
1st F test		1.529		49.383
1st P value		0.216		0.000
1st partial R2		0.000		0.002

***p<0.01, **p<0.05, *p<0.1. Source: Author's own calculations.

In Table 10A, the IV results show that the higher enrollment levels in migrant-sending households are driven by the impacts on girls. The probability of a girl being enrolled in a school in a migrant-sending household is 32.8 percentage points higher than that of a non-migrant sending household. In Table 10 B, we again see that the significant increase in the years of completed education due to migration have mostly been for girls. Interestingly, we find a significant decline in the number of educational years for boys in migrant-sending households compared to non-migrant households. The results imply that the positive impact of the caregiver's migration on child education levels is primarily driven by the impact on girls in these households.

Table 10A: Impact of external migration on children's Enrollment & Dropout by gender

Dependent Variables	Boys				Girls			
	Enrolled (Age 5-17 years)		Dropout (Age 5-17 years)		Enrolled (Age 5-17 years)		Dropout (Age 5-17 years)	
	OLS with all controls (1)	IV with all Controls (2)	OLS with all controls (3)	IV with all Controls (4)	OLS with all controls (5)	IV with all Controls (6)	OLS with all controls (7)	IV with all Controls (8)
Dummy=1 if Potential Caregiver has Migrated	0.008*** [0.003]	-0.065 [0.140]	0.000 [0.001]	0.039 [0.034]	0.012*** [0.004]	0.328** [0.148]	0.000 [0.001]	-0.027 [0.028]
Observations	265,520	213,609	285,077	229,472	164,666	194,967	164,666	216,166
1st F test		30.790		32.800		42.431		45.308
1st P value		0.000		0.000		0.000		0.000
1st partial R2		0.204		0.05		0.234		0.010

***p<0.01, **p<0.05, *p<0.1. Source: Author's own calculations.

Table 10B: Impact of External Migration on Children's Level of Education, by gender

Dependent Variables	Level of Education (Age 5-17 years)			
	Boys		Girls	
	OLS with all controls (1)	IV with all Controls (2)	OLS with all controls (3)	IV with all Controls (4)
Dummy=1 if Potential Caregiver has Migrated	0.045*** [0.007]	-0.752** [0.339]	0.019** [0.008]	0.668** [0.271]
Observations	265,796	213,872	164,666	195,245
1st F test		30.854		42.410
1st P value		0.000		0.000
1st partial R2		0.001		0.001

***p<0.01, **p<0.05, *p<0.1. Source: Author's own calculations

Table 11A shows that the positive effects of migration on enrollment and dropout rates are strongest for children living in wealthier households; the probability of a child being enrolled in a school increase by 20.6% in a migrant sending household and the probability of dropping out of school falls by 6.6% in a migrant sending household according to the IV estimates. Alternately, in poorer households we find that dropouts increase by 10.8 percentage points at the 10% significance level when there is a migrant in the household. In Table 11B, our IV results show a positive impact of migration on the completed years of education for children in wealthier households, implying that children in less resource constrained households tend to benefit more from migration.

Table 11A: Impact of external migration on children's Enrollment & Dropout, by wealth

Dependent Variables	Wealthy (top three wealth quintiles)				Poor (lower two wealth quintiles)			
	Enrolled (Age 5-17 years)		Dropout (Age 5-17 years)		Enrolled (Age 5-17 years)		Dropout (Age 5-17 years)	
	OLS with all controls (1)	IV with all Controls (2)	OLS with all controls (3)	IV with all Controls (4)	OLS with all controls (5)	IV with all Controls (6)	OLS with all controls (7)	IV with all Controls (8)
Dummy=1 if Potential Caregiver has Migrated	0.020***	0.206**	0.001	-0.066*	0.034***	-0.134	-0.001	0.108*
	[0.003]	[0.098]	[0.001]	[0.036]	[0.004]	[0.272]	[0.001]	[0.062]
Observations	123,358	105,234	123,358	105,234	215,634	167,763	215,634	167,763
1st F test		27.792		27.792		10.485		10.485
1st P value		0.000		0.000		0.001		0.001
1st partial R2		0.108		0.002		0.224		0.031

***p<0.01, **p<0.05, *p<0.1. Source: Author's own calculations.

Table 11B: Impact of External Migration on Children's Level of Education, by wealth

Dependent Variables	Level of Education (Age 5-17 years)			
	Wealthy (top three wealth quintiles)		Poor (lower two wealth quintiles)	
	OLS with all controls (1)	IV with all Controls (2)	OLS with all controls (3)	IV with all Controls (4)
Dummy=1 if Potential Caregiver has Migrated	0.039***	1.514**	0.071***	-1.585
	[0.008]	[0.685]	[0.022]	[1.613]
Observations	123,358	105,234	167,788	167,763
1st F test		27.792		10.485
1st p value		0.002		0.001
1st partial R2		0.02		0.04

***p<0.01, **p<0.05, *p<0.1. Source: Author's own calculations.

Again, the overall analysis of the results for the child's educational attainment suggests that there exists substantial heterogeneity in the impact that migration has on children, depending on household demographics. Educational outcomes improve significantly for girls in wealthier households that have a migrant. We see that boys and children living in rural areas and belonging to poorer households face a substantial decline in enrollment and years of education in migrant- sending households. Previous studies analyzing data from Punjab, such as Arif & Chaudhry (2015) and Mansuri (2006), have found on average positive effects of migration on the school outcomes of children. In contrast, our study both covers a longer period of time by pooling four waves of the MICS and uniquely explores the heterogeneity of impacts in the results, finding that the impact of migration could be positive or negative based upon specific demographic characteristics. Our results provide important information to policymakers if they wish to implement programs to promote further migration or to support the households of current migrants.

5. Conclusion

The evidence in the literature is mixed in regards to exploring how external migration from developing countries affects the wellbeing of the children in home countries. These varied results may be because of cultural variation across countries, different economic opportunities available in the home countries, or differences in support structures existing in the families and communities of the home countries. What is common across the literature is a focus on a particular child outcome such as health or education. For instance, in the case of Pakistan, Arif and Chaudhry (2015) explored the impact of migration on schooling outcomes while Mansuri (2006) focused on the impact of migration on health outcomes. Both of these studies were characterized by relatively small sample sizes and both used instrumental variables (to correct for potential bias) and they found positive returns from migration on schooling outcomes (in the case of Arif and Chaudhry, 2015) and health outcomes of children (in the case of Mansuri, 2006) in rural Punjab, Pakistan.

In this study, we analyze the impact of migration on the nutritional health and schooling outcomes of children in Punjab to understand the net effect of the migration of a potential caregiver in a household on the children left in the home country. In addition to this, we improve upon the prior instrumental variables utilized by introducing the pull factor of economic activity in the host countries as measured by changes in nighttime light intensities. We also use a much larger dataset than has been used in the previous literature by combining four rounds of the Multiple Indicator Cluster Survey (MICS) from Punjab, Pakistan. Finally, with this larger data set we are able to see how demographically varied households are differently affected by the migration of a potential caregiver through sub-sample analyses.

The results we find are significantly different from the findings of the previous findings for the case of Punjab, Pakistan. We show that migration of a potential caregiver has a negative effect on the short-run nutritional health outcomes for children under age five, but mixed results for the impact of migration on the schooling outcomes of children of ages 5-17.

Our results for nutritional wellbeing mainly indicate that among younger children (under age five), the severity of both anthropometric measures, stunting (representing long-term impacts) and underweight (representing short-term impacts) increases significantly due to migration of the caregiver. On average, although the probability of being stunted remains positive but insignificant, the probability of children being underweight increases significantly by 28.9 percentage points and that of being extremely underweight increases significantly by 12 percentage points among the children in the households with a migrating caregiver. We show that the negative impact is heterogeneous and is driven by households in rural areas, girls, households that have uneducated mothers, and less wealthy households.

However, overall, we see that the educational attainment of children (age 5-17 years) is affected positively by the migration of the caregiver. The results show that the probability of being enrolled in school increases significantly by 25 percentage points, whereas the probability of children dropping out of schools remains insignificant. However, the results showing a positive impact are largely heterogeneous and are driven by girls, families living in rural areas, and wealthier households. These results may be because incomes constraints facing these households may be less binding as households receive remittances that in turn allows families to spend more on the schooling of their children. These improvements in educational outcomes of older children that result from migration are driven by the impacts on enrollment of children living in urban areas and children living in wealthier households.

We propose two potential explanations for the main results estimated in the paper, i.e., that health outcomes are affected adversely, while the schooling outcomes are improved by household migration. First, schooling usually takes place outside the household and is therefore relatively unaffected by an absent (migrant) family member. On the other hand, health outcomes rely heavily on the nutritional intake of children that primarily occur within the household that makes the absence of a family because of migration more detrimental. Second, it is possible that a family member that is abroad due to migration can more easily monitor whether a child in going to school as opposed to the nutritional intake of a child which makes health outcomes more prone to slippage.

The results in this paper also have implications for policy makers. Our results point to areas where migration benefits the wellbeing of children left behind in home countries, such as the educational outcomes of older children, they also point to those areas where policy makers can make intervention to reduce the negative impacts of migration on children left behind, such as health outcomes. Not only do our results point to out the importance of policies to reduce the negative impacts of migration on health outcomes, they also identify the specific households, like those in rural areas, those who have lower incomes and those with uneducated mothers that can be targeted for interventions. Another critical area of potential intervention by policy makers in rural areas in migrant sending households is to assist girls who are more susceptible to the negative impact of migration on nutritional health and help boys to remain in school.

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Paper III: Empowered Mothers & Coresident Paternal Grandmothers: Two Fundamental Factors Impacting Child Health Outcomes in Punjab, Pakistan

1. Introduction

The nutritional health of children when they are young can impact their cognitive skills, emotional stability, economic status and growth in adulthood, which makes childhood malnutrition a critical issue. Globally, 144 million children under age 5 are stunted, and 14.3 million are severely wasted (WHO, 2020). Although there has been a substantial reduction in poor health outcomes for children over time, the issue is still prevalent and has significant implications for human capital formation. Additionally, developing countries such as Pakistan failed to achieve the Millennium Development Goals related to the outcomes of children under 5 years of age. In this paper, we identify two intra-household mechanisms that can impact the health outcomes of children and estimate the impact of these mechanisms on the health outcomes of Pakistani children measured by the two standard anthropometric measures, height-for-age z scores (HAZ) and weight-for-age z scores (WAZ). The first mechanism is the empowerment of mothers in a household, and the second is the presence of grandmothers (one of the essential components of the family unit in Pakistan) in a household. Our research shows that households with empowered mothers have healthier children, especially girls, whereas coresident grandmothers improve the nutritional outcomes of children under 5 years of age, specifically boys, living in poor and rural households.

The positive influence of empowered mothers on the health outcomes of their children has been robustly documented in the literature (Duflo, 2012; Gaiha and Kulkarni, 2005; Shroff et al., 2009). However, there have been differences in the literature about how to measure empowerment (see

Kabeer, 1999; Duflo, 2012; and Agarwal, 1997). In this study, we construct indices to measure the empowerment of mothers in a household that include both intrinsic aspects (i.e., attitudinal dimension) and the extrinsic aspects (i.e., behavioral dimension) of the mothers (see Zimmermann, 2012; Furuta and Salway, 2006; Li and Wu, 2011; Thomas, Contreras and Frakenberg, 1999). Furthermore, to address the problem of endogeneity associated with an OLS specification, we instrument for the empowerment of mothers by using the total number of sons. The mother's empowerment index constructed in two different ways: first, we use the sum of positive responses given, and second, we use a principal component index (PCA) for ten survey questions measuring the behavioral and attitudinal dimensions of daily choices mothers make within the household. Since the Pakistan Demographic Household Survey (PDHS) contains detailed questions regarding these choices for women in addition to the nutritional outcomes of children together (along with other important demographic indicators), we use the latest 2018 survey, which has data on approximately 5000 children, to estimate our model.

We also focus on the impact of grandparents in a household on child nutritional health. The literature has found that the role of grandparents, although less discussed, may be almost as important for the wellbeing of children as that of parents because of the significant role that grandparents can play in the overall caregiving environment because of the financial assistance and emotional support that the grandparents contribute (Britto et al., 2017; Perez-Escamilla et al., 2018). As women enter the workforce in greater numbers and as families grow smaller, researchers have recognized the growing importance of grandparents as caregivers for children (Dunifon et al., 2018: Mehta and Thang, 2012; Schatz and Seeley, 2015). Although much of the previous literature has focused on the reasons why the role of grandparents has increased in households, such as high divorce rates (Gorman and Braveman, 2008; Smith, 2018), migration (Masfey et al., 2019) and increased childcare expenses (Eli et al. 2016; Hank and Buber, 2009), there has been little research done on measuring the causal impact of the presence of grandparents in a household on the wellbeing of children. We argue that compared to other (extended) family members, grandparents are more likely to take care of their grandchildren due to both emotional connectedness and the wish to extend the family line, which is sometimes referred to as the "*The Grandmothers Hypothesis". On the negative side, having more members, such as grandparents, in a joint family structure can impact constrained resources in a household, which in turn can have negative effects on the health outcomes of children. Thus, the impact of the presence of grandparents is context specific, with some studies finding a net positive impact of the presence of grandparents on the wellbeing of children (Gibson and Mace, 2005; Sear and Mace, 2008; Sear et al. 2000), while others have found a negative or insignificant impact (Mulder, 2007; Strassmann, 2011). A small number of authors have explored how the impact of grandmothers in a household differs from the impact of grandfathers in a household. Schijner and Smits (2017) found that the presence of grandmothers reduced stunting among children, while the presence of grandfathers was more important for girls in poor households (Schijner and Smits, 2017) for the case of Sub-Saharan Africa. In this chapter, we argue that the (endogenous) decision of households to include grandparents may bias the measured impact of the presence of grandparents on child health outcomes. Therefore, we use a fuzzy regression discontinuity design exploiting the relationship between the difference between the age of grandparents and the potential retirement eligibility criteria (PREC) with the exogenous presence of grandparents after retirement age to measure the causal impact of the physical presence of grandparents on child nutritional health outcomes. Duflo (2003) exploits similar variation in data for a cash transfer offered in South Africa extended to pension recipients; the findings confirmed higher weight-for-age and height-for-age of girls (under five years) ex-post the cash-transfer in the households that received the pension. The results were purely driven by the pension being offered to the grandmothers.

We divide the analysis into (i) measuring the impact of having at least one grandparent in the household, (i) measuring the impact of having only a grandfather in the household and (iii) measuring the impact of having only the grandmother in the household on the health outcomes of children in a household. We construct and use a dataset obtained by pooling multiple rounds of UN-funded Multiple Cluster Indicator Surveys (MICS) for 2008, 2011, 2014 and 2018 for this analysis. The constructed dataset contains approximately 200,000 children.

We find that an increase in the additive empowerment index of mothers in a household leads to 0.29 SD increase in the weight-for-age z scores (WAZ) of children, while an increase in the PCA empowerment index of mothers leads to a 0.51 SD increase in weight-for-age z scores (WAZ) of children. We find that this impact does not depend on the location (rural vs. urban) of the household or on the wealth level of the household. However, we do find that the impact of empowerment varies by the gender of the child; our results are driven by the significant positive impact of the empowerment of mothers on girls.

We also find that the presence of grandparents in a household improves the height-for-age z scores by 0.101 SD and weight-for-age z scores by 0.0862 SD. However, when we focus on the impact of grandfathers versus grandmothers, we find that the positive results are related to the presence of grandmothers. Our results show that the increase in weight-for-age z scores due to grandmothers primarily accrued to boys, to children in rural areas, and to lower wealth families.

The remainder of the chapter is divided into three sections. The next section discusses our methodology, where we provide a detailed discussion of the data used in the study, the empirical strategy employed, and the descriptive statistics of key variables. We discuss our results in section 3 and conclude in section 4.

2. Methodology

In this section, we discuss the datasets used in this study, provide details of our empirical strategy, and report the descriptive statistics of key variables in our samples.

2.1 Data

We use two datasets to answer the two main research questions explored in this chapter. First, to estimate the impact of empowered mothers on the health outcomes of children, we use the Pakistan Demographic Household Survey (PDHS). This is a nationally representative cross-sectional household survey that collects in-depth information on health status, nutritional status, and domestic violence against women, education, fertility preferences, and other demographic data. For our analysis, we use the data from the 2018 PDHS.

Next, we pool multiple rounds of the Multiple Indicator Cluster Survey (MICS) for the years 2008, 2011, 2014, and 2018 to answer the second research question, i.e., whether there is any positive effect of the presence of grandparents, grandfathers (alone) or grandmothers (alone) on the nutritional health outcomes of grandchildren in a household. We use data from the household surveys conducted in Punjab in Pakistan[28]; the survey collects detailed information on the location of households, education, nutritional status, employment status, and other demographic information on household members.

2.2 Empirical strategy

In this chapter, we employ two empirical strategies. First, we use an instrumental variable approach to estimate the impact of mothers' empowerment on child health outcomes using cross-sectional data from the 2018 Pakistan Demographic Health Survey (PDHS). Second, we use a fuzzy regression discontinuity design to estimate the impact of the presence of a grandparent in a household on the health outcomes of the children using data from the Multiple Indicator Cluster Survey for the years 2008, 2011, 2014 and 2018.

2.2.1 Measuring the Impact of Mother's empowerment on the health outcomes of children

[28] MICS has also collected information about two other provinces in Pakistan, Sindh and Baluchistan. In the case of Baluchistan, the quality of data is poor, especially with regards to the nutrition indicators, and therefore not much useful information can be extracted from those surveys.

To measure the impact of the empowerment of mothers on the health outcomes of children, we estimate the following specification:

$$Y_{ghi} = \beta_0 + \beta_1\, MDI_{gh} + \beta_2 Child's\ charactersitics_i + \beta_3 Household's\ charactersitics_h$$
$$+\beta_4 Mother's\ charactersitics_i + \beta_5 Geographic\ controls_g + \mu_{ghi} \qquad (1)$$

Where Y_{ghi} is the dependent variable that comprises the nutritional health for children aged 5 years and younger. Two standard anthropometric measures are used to measure the health outcomes of the children: the height-for-age z score (HAZ) and the weight-for-age z score (WAZ)[29].

The main independent variable, MDI_{gh}, is the mother's empowerment index, and we use two different methods to construct the mother's empowerment index. First, we create an additive index of the mother's empowerment, which takes values ranging from 0 to 10 that is constructed by adding up all the responses the woman has given for the ten questions that gauge her intrinsic as well as extrinsic level of empowerment. Second, we create a principal component analysis (PCA) index based upon the same set of questions used for the additive index. The additive index sums up all the questions and gives equal weight to each respective question, whereas the PCA index was generated by a principal component analysis that ranks each of the ten questions according to their relevance and attaches weights to each question to create a weighted sum.

[29] To create measures for a fair comparison among the children of different gender and age worldwide, WHO (2010) proposed standardized measures of the height-for-age z scores and weight-for-age z scores. The standard formula used to calculate these z scores is $Z=(x-\mu)/\sigma$, where x is the original value of the height-for-age and weight-for-age, respectively, μ is the mean of the global reference population set by WHO (2010) and σ is the standard deviation of the original value from the mean of the global reference population (gender and age specific).

The literature measures the intrinsic level of empowerment by measuring attitudes toward domestic violence, i.e., using responses to measure a women's level of acceptance about being beaten by her husband in the following situations: if she does not take permission from her husband when going out, if she gets into an argument with her husband, if she neglects the in-laws or her own children, if she refuses intimacy with her husband, or if wife burns the food that she cooks (Jenson and Oster, 2009; Arestoff & Diemai, 2016). We assign a value of "1" (0 otherwise) for each time a woman answers that her husband is not justified in beating her if each of the following circumstances: 1) if she her child is neglected by her child; 2) if the in-laws are neglected by her; 3) if the food is burnt by her; 4) if she does not seek permission for going out; 5) if she arguments with her husband; 6) if she refuses intimacy with her husband.

The literature also looks at the extrinsic level of empowerment, which has been defined as behavioral dimensions of female empowerment, such as the ability of women to exert control over the household's decision-making process, including household purchases, healthcare, visits to parents, etc. (Zimmermann, 2012; Furuta and Salway, 2006; Li and Wu, 2011; Thomas, Contreras and Frakenberg, 1999). For this, we again assign a "1" (0 otherwise) for each time a woman responds that she 1) is she decides on her own about her health care; 2) if she decides about her daily purchases; 3) if she decides herself to visit her family or relatives; 4) if she controls her husband's money.

To construct the empowerment indices, we use the numbers that we obtained from the intrinsic and extrinsic measures of empowerment discussed above. The additive index is simply the sum of the 10 elements so that we obtain a measure of empowerment ranging from 0 to 10. The PCA index uses principal component analysis to determine the optimal weights of the empowerment measures and forms a weighted index of empowerment.

Other important variables we control for in the regression are: child characteristics that include the child's gender, age, age squared; the mother's characteristics, which include the mother's age, age of the first-born child, a dummy equal to 1 for mothers who have ever breastfed, the number of years the mother has been married and a dummy equal to 1 if the mother is pregnant; health inputs which include a dummy equal to 1 if the child is delivered in health care facility, a dummy equal to 1 if the mother has ever used contraceptives and a dummy equal to 1 if the mother had postnatal care at a health facility; household head controls including the age of the household head, age squared of the household head, gender of the household head, education of the household head, and the household wealth index. We use locational fixed effects by incorporating district controls, provincial dummies, and a dummy equal to one if households reside in urban areas.

There are two potential reasons why OLS estimates of the coefficient measuring the impact of the mother's empowerment in equation (1) may be biased: first, there may be unobserved characteristics of the mother that may also impact the health outcomes of children, and second, there may exist reverse causation between health outcomes of children and the level of empowerment of mothers (i.e., healthier children may lead to greater empowerment of mothers). Therefore, to address this problem, we use the number of sons a woman has as an instrument for mother's empowerment. We argue that the number of sons a woman has is correlated with the empowerment of a woman, especially in the context of South Asia, where sons are given special importance in a household but are orthogonal to the health outcomes of children aged 5 years and less in a household.

The literature provides strong evidence for the link between the number of sons a woman gives birth to and her decision-making power at the household level. While the literature has also found a relationship between female empowerment and a woman having a first-born son, we argue that women in developing countries such as Pakistan tend to have more children, which makes the total number of sons a more relevant variable (see Tanvir and Arif, 2022 for a more detailed discussion). Alfano (2017) argues that women with lesser control over household income, secure a stronger bargaining position by relying more on their male off-springs. This point is further reinforced in literature by arguing that after certain age of father, mothers gain more power in terms of taking decision in a household as they become more loyal to the future decision makers of the households i.e., their sons (Gupta et al., 2003; Zimmermann, 2018).
For robustness, we also estimated the model using a dummy variable for whether a woman had a first-born son as an instrument for empowerment and found that the first stage for our instrument (the total number of sons) was stronger.

Based on this, we estimate the following first-stage regression:

$$\widehat{MDI_{hg}} = \gamma_0 + \gamma_1 Number\ of\ Sons\ born\ to\ the\ Mother_h + \gamma_2 Mother's Charactersitics_m + \gamma_2 Child's Charactersitics_i + \gamma_3 Household\ controls_h + \gamma_4 geographic\ controls_g + u_{hg}$$

(eq 2)

One can argue that having more children in a household might impose stricter resource constraints, which in turn can affect the health outcomes of children in the age group under 5 years. To address this issue, we add the total number of children as a separate variable in the first-stage regression to control for the impact that increased household size may have on the health outcomes of children directly. We also add other standard variables to control for the impact of constrained household resources.

The second-stage regression is estimated as follows:

$$Y_{ghi} = \sigma_0 + \sigma_1 \widehat{MDI}_{hg} + \sigma_2 Child's\ charactersitics_i + \sigma_3 Household's\ charactersitics_h$$
$$+\sigma_4 Mother's\ charactersitics_i + \sigma_5 Geographic\ controls_g + \xi_{ghi} \quad (3)$$

The equation above uses fitted probabilities from equation (2) to instrument for female empowerment to correct for the endogenous "empowerment of mother" variable.

2.2.2 Measuring the Impact of the Presence of a Grandmother on the Health Outcomes of Children

Next, to measure the impact of the presence of any grandparents, the presence of only grandfathers, and the presence of only grandmothers in a household on the nutritional health outcomes, we use a fuzzy-regression discontinuity design. To estimate this relationship, we estimate the following equation:

$$Y_{ghi} = \beta_0 + \beta_1 G_{gh} + \beta_2 Child's\ charactersitics_i + \beta_3 Household's\ charactersitics_h$$
$$+\beta_4 Mother's\ charactersitics_i + \beta_5 Geographic\ controls_g + \mu_{ghi} \qquad (4)$$

Where Y_{ghi} is the dependent variable that comprises the nutritional health outcomes for children aged 5 years and young. We again used two standard anthropometric measures for child health outcomes: the height-for-age z score (HAZ) and the weight-for-age z score (WAZ).

The variable *G* is a dummy variable to measure the presence of grandparents. We use three different definitions of *G* to measure three different potential impacts. First, we define *G* as equal to one if at least one grandparent is present in the household. We do this to see the net impact of the presence of one or both grandparents on child health outcomes. Next, we define *G* as equal to one in the case where only the grandfather is present in the household. We do this to see the impact of the presence of only grandfathers on child health outcomes. Finally, we define *G* as equal to one if only the grandmother is present in the household. We do this to see the impact of the presence of only grandmothers on child health outcomes.

Similar to the equation above, OLS estimates of the impact of the presence of grandparents on child health outcomes will be biased. This bias can occur for two reasons. First, families may self-select into choosing whether to live in a nuclear family system or a joint family system. Second, omitted variables, such as values and traditional beliefs, can affect the decision of grandparents to live with their children and their grandchildren and simultaneously affect the health of the grandchildren.

To address this, we use an exogenous threshold, i.e., the retirement eligibility criteria[30] (the methodology is similar to that used in Aparicio Fenoll, 2020), as a potential shifter that can impact the probability of having a grandparent present post retirement age but would not necessarily impact child health outcomes directly. The retirement cutoff age we use for male members of the household was 60 years and for female members of the household was 55 years. We argue that the probability of a grandparent being present in a household increases after this threshold, which allows us to use a regression discontinuity estimation procedure. More specifically, since there is the problem of noncompliance on each side of the cutoff (i.e., grandparents may retire before retirement age or may not retire even if they are above retirement age), we use a fuzzy regression discontinuity design.

After applying the regression discontinuity framework to our standard regression in equation (4), we estimate the following set of regressions:

The first-stage regression that we estimate is:

$$\widetilde{G_{gh}} = \gamma_0 + \gamma_1 \begin{pmatrix} Age_g - Potential \\ Retirement\ Eligibility\ Age \end{pmatrix} + \gamma_2 \begin{matrix} Child's \\ charactersitics_i \end{matrix} + \gamma_3 \begin{matrix} Household's \\ charactersitics_h \end{matrix}$$

$$+\gamma_4 \begin{matrix} Mother's \\ charactersitics_i \end{matrix} + \gamma_5 \begin{matrix} Geographic \\ controls \end{matrix}_g + \eta_{ghi} \qquad (5)$$

Where $\widetilde{G_{gh}}$ is the fitted probabilities of either (i) the presence of at least one grandparent, (ii) the presence of a grandfather only or (iii) the presence of grandmother only in a household as a

[30] The Retirement criteria is exogenously fixed for women to be at age of 55 years and for men at 60 years of age across countries and over time.

function of the difference between their respective ages from the retirement criteria and a set of control variables similar to the ones used above.

The second-stage regression is estimated as follows:

$$Y_{ghi} = \beta_0 + \beta_1 \widetilde{G_{gh}} + \beta_2 Child's\ charactersitics_i + \beta_3 Household's\ charactersitics_h$$

$$+\beta_4 Mother's\ charactersitics_i + \beta_5 Geographic\ controls_g + V_{ghi} \qquad (6)$$

The equation above is the second-stage regression that uses the fitted values for the probability of having at least one grandparent, or only the grandfather or only the grandmother to correct for endogeneity.

3. Descriptive Statistics

The summary statistics of key variables from the two datasets that have been used in the analyses are as follows:

Table 1a: Descriptive statistics of key variables from the cross-sectional dataset of the Pakistan Demographic Household Survey (PDHS) year 2018

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
Dependent Variables					
Height-for-age z scores	5,158	-1.013	1.010002	-4.658925	5.338705
Weight-for-age z scores	4,606	-1.045	1.00848	-3.829398	4.61289
Child's Characteristics					
Child's age	5,158	2.435052	1.677726	0	5
Dummy=1 if child is a boy	5,158	0.5032959	0.5000376	0	1
Mother's Characteristics					
Mother's education	5,158	0.8984102	1.123097	0	3
Dummy=1 if the First born Child is boy	5,158	0.1219465	0.3272557	0	1
If the mother is breast feeding (1=Yes)	5,158	0.5182241	0.4997162	0	1
Empowerment by Additive Index	5,158	5.536642	3.308769	0	10
Empowerment measured by PCA	5,158	0.1732208	2.150784	-3.497459	2.898862
Household Characteristics					
Total number of households	5,158	9.463552	4.915628	2	40
Dummy=1 if the household head is male	5,158	0.8955021	0.305935	0	1
Dummy=1 if the Household head is Currently working	5,156	0.1183088	0.3230047	0	1

Dummy=1 if the Households belong to 1st Wealth Quintile	5,158	0.2849942	0.4514554	0	1
Dummy=1 if the Households belong to 2nd Wealth Quintile	5,158	0.2161691	0.4116708	0	1
Dummy=1 if the Households belong to 3rd Wealth Quintile	5,158	0.1929042	0.3946167	0	1
Dummy=1 if the Households belong to 4th Wealth Quintile	5,158	0.1613028	0.3678457	0	1
Dummy=1 if the Households belong to the 5th Wealth Quintile	5,158	0.1446297	0.3517612	0	1

The highlights of the cross-sectional Pakistan Demographic Household Survey (PDHS) for 2018 are as follows:

- Out of the total sample of 50,515 individuals, 5,158 are children who lie in the age group of 5 years and less.
- The weight-for-age z score (WAZ) on average for children (age 5 years and less) in the sample is negative, implying that the weight-for-age of children in households is 1.013 standard deviations lower than the median WAZ of the global reference population (set by WHO standards) of the same age and gender.
- The height-for-age z score (HAZ) on average for the children (age 5 years and less) in the sample is negative, implying that the weight-for-age of children in households is 1.044 standard deviations lower than the median WAZ of the global reference population (set by WHO standards) of the same age and gender.
- On average, 50.3% of children in the sample aged 5 years and younger were boys, and the average age of the children from the sample in this age group was approximately 2 years.
- On average, 89.84% of the mothers in the sample had been enrolled in school and are considered educated.
- On average, 12.19% of mothers had a son as their first-born child.
- On average, 51.8% of the mothers breastfed their infants.

- On average, the total number of people in a household was 9 members.
- A total of 89.6% of the households in the sample were male headed.
- A total of 11.83% of the households in the sample had household heads that were employed in the market.
- A total of 28.5% of households in the sample were in the lowest wealth quintile, 21.6% were in the second wealth quintile, 19.3% were in the third wealth quantile, 16.1% were in the fourth wealth quantile and 14.5% were in the highest wealth quintile.

Next, we report the summary statistics of the cross-pooled Multiple Indicator Cluster Survey for data years 2008, 2011, 2014 and 2018 as follows:

Table 1b: Descriptive statistics of key variables from the cross-pooled Multiple Indicator Cluster Survey (MICS) from 2008-2018

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
Dependent Variables					
Height-for-age z scores	184124	-1.485	1.608658	-5.99	5.99
Weight-for-age z scores	187918	-1.40	1.269045	-5.99	5.98
Independent Variables					
Dummy=1 if only grandfather is present	184,124	0.1374997	0.3443751	0	1
Dummy=1 if only grandmother is present	184,124	0.0337924	0.180695	0	1
Dummy=1 if both grandparents are present	184,124	0.1712922	0.3767651	0	1
Child's Characteristics					
Age of the child	184,124	1.987074	1.417465	0	4
Dummy=1 if the child is a girl	184,124	0.4883937	0.4998666	0	1
Household Characteristics					
Families with female household head	184,121	0.0567453	0.2313559	0	1
Total number of households	184,124	8.130673	3.889894	2	50
Household Head's Education	183,893	2.187919	1.479037	0	5
Mother's Characteristics					
Mother's Education Level	184,068	2.148087	1.409148	1	5
Age of the mother	163,542	30.39269	5.977785	15	50
Age of the first-born child	171,271	7.330435	5.235559	0	39
Number of Years Married	120,760	9.775671	5.590754	0	43
Dummy=1 if the Mother Ever breast fed	150,243	0.7891549	0.40791	0	1
Dummy=1 if the mother received postnatal care	150,457	0.2172714	0.4123902	0	1
Dummy=1 if the mother ever used contraceptives	182,610	0.1596079	0.3674969	0	8
Dummy=1 if the mother is Pregnant	182,819	0.1216504	0.3268825	0	1
Mother's age at the first-born child	163,523	27.88362	5.818547	10	50
Families with 2 or more children	184,124	0.2329408	0.422706	0	1
Families with 3 or more children	184,124	0.5128718	0.4998356	0	1
Families with 2 and child being girl	184,124	0.1141731	0.3180222	0	1

Families with 3rd child being a girl	184,124	0.2505051	0.4333051	0	1
Wealth Quantile					
Family's belonging to lowest wealth quintile	184,124	0.210456	0.4076336	0	1
Families belonging to second wealth quintile	184,124	0.2017879	0.4013358	0	1
Families belonging to third wealth quintile	184,124	0.2076535	0.4056285	0	1
families belonging to fourth wealth quintile	184,124	0.2083053	0.4060974	0	1
Families belonging to highest wealth quantile	184,124	0.1717973	0.3772052	0	1

The summary statistics of key variables from the pooled dataset that was obtained from the Multiple Indicator Cluster Survey (MICS) for 2008, 2011, 2014 and 2018 found the following:

- The average weight-for-age z score (WAZ) on average for children ages 5 years and less was negative, implying that the weight-for-age of children in households is 1.1485 standard deviations lower than the median WAZ of the global reference population (set by WHO standards) of the same age and gender.
- The average height-for-age z score (WAZ) for children ages 5 years and less was negative, implying that the weight-for-age of children in households is 1.1402 standard deviations lower than the median WAZ of the global reference population (set by WHO standards) of the same age and gender.
- Of the households in the sample, 16.7% had both grandparents present, 13.4% had only grandfathers present, and 3.3% of the households had only grandmothers present.
- A total of 48.7% of the children in the sample aged 5 years and less were girls, and the average age of these younger children was approximately 2 and a half years.
- A total of 5.5% of households in the sample were headed by females, the average household size was 8 members, and the average years of education of the household head was 2 years.

- The average age of mothers in the sample was 30 years, the average years of education of mothers in the sample was 2 years, on average, the mothers had been married for 10 years, and the average age of the first-born child in the sample household was 7 years.
- A total of 50.5% of the households in the sample had at least 3 children, and 23.5% had 2 children.
- A total of 21.6% of families in the sample were from the lowest quintile, 20.4% were from the second wealth quintile, and 20.6% and 20.2% were from the third and fourth wealth quintiles, respectively. A total of 16.9% of the families in the sample belong to the highest wealth quintile.

Finally, in Table 1c, we explore the differences in the means of weight-for-age and height-for-age between (i) households with at least one grandparent and households without any grandparent, (ii) households with a grandfather and households without a grandfather and (iii) households with a grandmother and households without a grandmother, as well as a t test of the significance of these differences.

Table 1c: Inferential and descriptive Statistics of Child's Health Outcomes from cross-pooled Multiple Indicator Cluster Survey (MICS) year 2008-2018, by the Presence of at least one Grandparent, only Grandfather and only Grandmother

Dependent Variables	**HHs with Grandparents**		**HHs without Grandparents**		**Difference Between the Mean Values**
	Observations	Mean (1)	Observations	Mean (2)	Mean (1) - Mean (2)
Height-for-age (z scores)	31539	-1.3647	152585	-1.5104	0.1457***
Weight-for-age (z scores)	32197	-1.3025	155721	-1.4227	0.1202***
	HHs with Grandfathers		**HHs without Grandfathers**		
Height-for-age (z scores)	25317	-1.3589	158807	-1.5056	0.1468***
Weight-for-age (z scores)	25865	-1.2991	162053	-1.4185	0.1194***
	HHs with Grandmothers		**HHs without Grandmothers**		
Height-for-age (z scores)	6222	-1.3886	177902	-1.4888	0.1002***
Weight-for-age (z scores)	6332	-1.3164	181586	-1.4051	0.0887***

Note: *** p<0.01, ** p<0.05, * p<0.1

Table 1c shows that the height-for-age z scores and weight-for-age z scores of younger children were significantly higher in households with grandparents, grandfathers (alone) or grandmothers (alone) than in households without any grandparent.

4. Results

We begin by presenting the results for the specification that tests the relationship between the empowerment of mothers and the health outcomes of younger children as measured by two anthropometric measures: height-for-age and weight-for-age. It is worth noting that height-for-age is considered to measure health outcomes over a longer period of time, and weight-for-age is considered to be a measure of short-term health. After this, we present the results for the specifications that measure the relationship between the presence of grandparents and nutritional health outcomes of younger children.

4.1 Measuring the impact of mothers' empowerment on health outcomes

In this section, we report the results for measuring the impact of mothers' empowerment on the two anthropometric measures: height-for-age and weight-for-age for children of the age group 5 years and less. As discussed above, we constructed two different indices to measure the empowerment of mothers in a household based upon ten questions reported in DHS for survey year 2018. We start by presenting the first-stage results and then move to the second-stage results. We then present results from regressions that test to see if there are differences in this relationship based on geographic location of households, based on the genders of the children, and across the wealth distribution.

4.1.1 First-stage Results

Table 2 gives the first-stage results. We report the results for both indices of empowerment. In both cases, we instrument the women's empowerment indices with the total number of sons in a household. Specifications (1) and (3) are the first-stage results without controls, whereas specifications (2) and (4) report the results after controlling for the child's characteristics, mother's characteristics, household characteristics and geographical location of households.

Table 2: Measuring the Impact of Total Number of Sons on the Additive Woman Empowerment Index and Woman Empowerment Index Measured by PCA

Variables	Woman Empowerment (Additive Index)		Woman Empowerment (PCA)	
	Without controls (1)	With Controls (2)	Without Controls (3)	With Controls (4)
Total Number of Sons	-0.178***	0.119***	-0.121***	0.0679**
	(0.0504)	(0.0440)	(0.0329)	(0.0288)
Observations	4,606	4,604	4,606	4,604
F test	12.52	7.32	13.41	5.55
1st P value	0.0004	0.0069	0.0003	0.0186

Note: The two dependent variables are mothers' empowerment indices constructed in two different ways; the first is the additive index, and the second is the index created by principal component analysis (PCA). The instrument used in the first-stage regression is the total number of sons born to a mother in a household. Other controls include the child's characteristics: gender, age, and age squared. Household characteristics: urban, gender of the household head, total number of households, wealth score, household head education level, wealth score square. Mother's characteristics: mother's education level, mother's age, mother's age squared, age of the first born, number of years married. The geographical controls comprise district and province fixed effects. Standard errors are clustered at the household level. *** p<0.01, ** p<0.05, * p<0.1

We see that the coefficient of the instrument is significant and positive after the inclusion of important control variables, implying that the empowerment of the mother increases with the number of sons she gives birth. We see that this result holds for both indices. The results show that one extra son increases the mother's empowerment by 1.19 index points if it is measured by the additive index and by 0.0679 index points from the index generated by PCA. We argue that the number of sons become a strong instrument only when appropriate variables are controlled in the regression. Since the instrument is selected from within the household, it is only under specific setting it becomes exogenous. We argue that number of sons on its own might not pass the orthogonality condition and only if we control for other household characteristics, the number of sons become significant and exogenously determined as shown in column (4). Therefore, only controlling for number of sons is not sufficient and second-stage results in column (3) are biased. The F-Statistics of the first stage further validates our argument. However, to prove our point we use Hausman Test for endogeneity (Appendix C).

4.1.2 Second-stage Results

We report the second-stage results in Table 3 that measure the impact of the mother's empowerment (measured by both indices) on the health outcomes measured by the two anthropometric measures HFA and WFA, controlling for the child's characteristics, mother's characteristics, household characteristics, and geographical location.

Table 3: Measuring the Impact of Mother's Empowerment on the Child's Health Outcomes, on average

	Empowerment measured Using Additive Index				Empowerment measured by PCA			
	Dependent Variable: WFA							
	OLS (1)	**OLS with controls (2)**	**IV (3)**	**IV with controls (4)**	**OLS (5)**	**OLS with controls (6)**	**IV (7)**	**IV with controls (8)**
Empowered Mother	0.0331***	0.00386	0.184*	0.298**	0.0525***	0.00498	0.273*	0.511*
	(0.00690)	(0.00734)	(0.101)	(0.145)	(0.0106)	(0.0113)	(0.148)	(0.263)
Observations	4,606	4,604	4,606	4,604	4,606	4,604	4,606	4,604
1st partial R2			0.012	0.275			0.013	0.275
1st Stage F Value			23.089	6.226			24.674	6.226
	Dependent Variable: HFA							
Empowered Mother	0.0165***	0.00557	0.145	0.181	0.0263***	0.00767	0.214	0.311
	(0.00589)	(0.00752)	(0.102)	(0.133)	(0.00907)	(0.0115)	(0.149)	(0.236)
Observations	5,158	5,156	5,158	5,156	5,158	5,156	5,158	5,156
1st partial R2			0.003	0.123			0.003	0.123
1st Stage F Value			7.835	3.282			8.428	3.282

Note: The two dependent variables are height-for-age z scores and weight-for-age z scores for the children of age group 5 years and less. The main independent variable, mother's empowerment, is measured by indices constructed in two different ways: first, the additive index, and second, the index created by the principal component analysis (PCA). Controls include the child's characteristics: gender, age, and age squared. Household characteristics: urban, gender of the household head, total number of households, wealth score, household head education level, wealth score square. Mother's characteristics: mother's education level, mother's age, mother's age squared, age of the first born, number of years married. The geographical controls comprise district and province fixed effects. Standard errors are clustered at the household level. *** p<0.01, ** p<0.05, * p<0.1

The results show a positive and significant effect of greater empowerment of mothers on the short-term measure of health outcome for younger children, i.e., WFA. We report the OLS results for each respective measure of health outcome in specifications (1), (2), (5) and (6). Specification (4) using the additive index shows that the weight-for-age of children increases by 0.298 standard deviations (SD) (significant at the 5% significance level) if the empowerment index improves by 1 index point. Similarly, specification (8) shows that as we use the PCA index to measure the empowerment of the mother, the weight-for-age of younger children increases 0.511 SD for a unit increase in the mother's empowerment index. We do not find any significant increases in the value of HFA, which is considered a long-term measure of health outcomes.

Next, we divide the sample into rural and urban regions. Table 4 reports the estimation of the impact of greater empowerment of mothers on the health outcomes of younger children based on whether they live in rural or urban areas. The results show that household location plays an important role in the impact of empowerment of mothers. We see that a 1 unit increase in the additive empowerment index results in a 0.354 SD increase in WFA for children in urban areas alone. Similarly, when using the PCA index, a unit increase in the index of mothers' empowerment leads to a 0.638 SD increase in the weight-for-age of younger children in urban areas.

Table 4: Measuring the Impact of the Mother's Empowerment on the Child's Health Outcomes by Rural/Urban Divide

	Empowerment measured by Additive Index		**Empowerment Measured by PCA**	
	Urban (1)	**Rural (2)**	**Urban (3)**	**Rural (4)**
Dependent Variable: WFA				
Empowered Mother	0.354**	0.241	0.638*	0.401
	(0.168)	(0.232)	(0.331)	(0.397)
Observations	2,101	2,503	2,101	2,503
1st partial R2	,	0.188	,	0.198
Dependent Variable: HFA				

Empowered Mother	0.0163	0.318	0.311	0.0727
	(0.138)	(0.268)	(0.190)	(0.142)
Observations	2,357	2,799	2,594	2,562
1st partial R2	,	0.145		0.146

Note: The two dependent variables are height-for-age z scores and weight-for-age z scores for the children of age group 5 years and less. The main independent variable, mother's empowerment, is measured by indices constructed in two different ways: first, the additive index, and second, the index created by the principal component analysis (PCA). Controls include the child's characteristics: gender, age, and age squared. Household characteristics: urban, gender of the household head, total number of households, wealth score, household head education level, wealth score square. Mother's characteristics: mother's education level, mother's age, mother's age squared, age of the first born, number of years married. The geographical controls comprise district and province fixed effects. Standard errors are clustered at the household level. *** p<0.01, ** p<0.05, * p<0.1

Next, we test this relationship for girls and boys separately, and the results are shown in Table 5. We see that the results for the combined sample (given in Table 3) are driven by the results for girls. We find that a 1 unit increase in the additive index leads to an increase in the WFA z scores by 0.287 SD, while a 1 unit increase in the PCA index leads to an increase in WFA of 0.49 SD for girls.

Table 5: Measuring the Impact of Mother's Empowerment on the Child's Health Outcomes by gender

	Empowerment measured by Additive Index		Empowerment Measured by PCA	
	Boy	Girl	Boy	Girl
	(1)	(2)	(3)	(4)
Dependent Variable: WFA				
Empowered Mother	0.324	0.287*	0.554	0.491*
	(0.223)	(0.151)	(0.401)	(0.273)
Observations	2,311	2,293	2,311	2,293
1st partial R2	0.17	0.13	0.188	0.16
Dependent Variable: HFA				
Empowered Mother	0.311	0.0727	0.311	0.0727
	(0.190)	(0.142)	(0.190)	(0.142)
Observations	2,594	2,562	2,594	2,562
1st partial R2	0.13	0.120	0.2	0.111

Note: The two dependent variables are height-for-age z scores and weight-for-age z scores for the children of age group 5 years and less. The main independent variable, mother's empowerment, is measured by indices constructed in two different ways: first, the additive index, and second, the index created by the principal component analysis (PCA). Controls include the child's characteristics: gender, age, and age squared. Household characteristics: urban, gender of the household head, total number of households, wealth score, household head education level, wealth score square. Mother's characteristics: mother's education level, mother's age, mother's age squared, age of the first born, number of years married. The geographical controls comprise district and province fixed effects. Standard errors are clustered at the household level *** p<0.01, ** p<0.05, * p<0.1

Finally, we divided the sample of households into wealthy and poor households. We define wealthy households as those that lie in the upper two wealth quintiles and poor households as those households that lie in the lower two wealth quintiles.

Table 6: Measuring the Impact of Mother's Empowerment on the Child's Health Outcomes by wealth

	Empowerment measured by Additive Index		Empowerment Measured by PCA	
	Poor	Rich	Poor	Rich
	(1)	(2)	(3)	(4)
Dependent Variable: WFA				
Empowered Mother	0.324	0.367	0.522	3.616
	(0.208)	(0.802)	(0.344)	(37.63)
Observations	2,345	2,259	2,345	2,259
1st partial R2	0.09	0.13	0.08	0.06
Dependent Variable: HFA				
Empowered Mother	0.141	0.344	0.164	0.227
	(0.187)	(0.530)	(0.240)	(0.305)
Observations	2,585	2,571	2,571	2,585
1st partial R2	0.045	0.120	0.011	0.027

Note: The two dependent variables are height-for-age z scores and weight-for-age z scores for the children of age group 5 years and less. The main independent variable, mother's empowerment, is measured by indices constructed in two different ways: first, the additive index, and second, the index created by the principal component analysis (PCA). Controls include the child's characteristics: gender, age, and age squared. Household characteristics: urban, gender of the household head, total number of households, wealth score, household head education level, wealth score square. Mother's characteristics: mother's education level, mother's age, mother's age squared, age of the first born, number of years married. The geographical controls comprise district and province fixed effects. Standard errors are clustered at the household level. *** p<0.01, ** p<0.05, * p<0.1

In this case, we do not find significant differences in the impact based on the wealth of the households.

4.2 Measuring the impact of the presence of grandmothers on the child's health outcomes

In this section, we present the results for the relationship between the presence of at least one grandparent, only the presence of only the grandfather, and the presence of only the grandmother on two anthropometric measures of health, height-for-age and weight-for-age, for children of age group 5 years and less. First, we present the first-stage results followed by the second-stage results for the entire sample. Then, we see if the relationship is different for households in rural areas as opposed to urban areas, if the relationship is different for girls as opposed to boys and if the relationship is different for high-wealth households as opposed to low-wealth households.

4.2.1 First-stage Results

Table 7 presents the first-stage results. In this, we measure the impact of the potential retirement eligibility criteria on the probability of the presence of at least one grandparent, the presence of only a grandmother and the presence of only a grandfather in a household to create an exogenous variation in this decision at the household level.

Table 7: First Stage Results: Measuring the impact of Retirement Eligibility Criteria on the Availability of Grandparents (both or at least one), grandfather (alone) and grandmother (alone) in an HH

	(1) Without Controls	(2) With Controls	(3) Without Controls	(4) With Controls	(5) Without Controls	(6) With Controls
Dummy=1 if the household has at least one Grandparent	0.0282*** (0.000264)	0.0291*** (0.000360)				
Dummy=1 if household has only Grandfather			0.0329*** (0.000319)	0.0327*** (0.000431)		
Dummy=1 if the household has only Grandmother					0.0353*** (0.000143)	0.0358*** (0.000197)
Observations	187,918	99,218	187,918	99,218	187,918	99,218
F test	11407.7	6504.46	6504.7	5740.3	60510.7	33016.35
1st P value	0.00	0.00	0.00	0.00	0.00	0.00

Note: The dependent variables comprise a dummy variable that takes a value of 1 if both grandparents are present in specifications (1), (2) and (3). Dummy=1 if only grandfather is present in the household is used in specification (4) and dummy=1 if only grandmother is present in the household in specification (5). Instruments used in the specification are RE, which is grandparent's age minus the legal retirement age (60 years for males and 55 years for females). The controls include the child's characteristics: gender, age, and age squared. Household characteristics: urban, gender of the household head, total number of households, wealth score, household head education level, wealth score square. Mother's characteristics: mother's education level, mother's age, mother's age squared, age of the first born, number of years married, district fixed effects, year fixed effects, mother's age at the birth of child, dummy=1 if there are 2 children and above in a household, dummy=1 if there are 3 children and above in a household, dummy=1 if the second and above child is a girl, dummy=1 if the third and above child is a girl.
Standard errors are clustered at the household level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

We choose different age cutoffs for grandmother and grandfather to implement the fuzzy regression discontinuity design. The cutoff age for grandmothers is kept at 55 years, whereas the age cutoff of grandfathers is kept at 60 years of age based upon the rationale that the legal retirement age of females is different from that of males. We find that the potential retirement eligibility criteria (age minus the potential retirement age) have a significant and positive impact on the respective probabilities of the presence of at least one grandparent, the presence of only grandfathers and the presence of only grandmothers. The results show that the probability of the availability of grandparents increases by 2.91 percentage points as the age of the grandparents increases by one extra year above the retirement eligibility criteria (i.e., 55 years for grandmothers and 60 years for grandfathers). The probability of the presence of the grandfather in a household increases by 3.27 percentage points if the age of the grandfather increases by one additional year above 60 years. Similarly, one extra year above 55 years (retirement eligibility criteria for women) significantly affects the probability of the presence of grandmothers in a household by 3.58 percentage points. In Appendix A-1, we present results using different retirement age cutoffs for men and women and find that the best results are obtained in the case of a retirement age of 55 years for women and 60 years for men.

4.2.2 Second-stage Results

We report the second-stage results that measure the impact of the presence of at least one grandparent, only a grandfather, and only a grandmother on the nutritional health of younger children, as measured by WFA and HFA, in Table 8.

Table 8: Measuring the impact of the presence of grandparents on the child's health outcomes, on average

Dependent Variable: WFA					
	OLS **(1)**	**OLS with Controls** **(2)**	**IV with Controls** **(3)**	**IV with Controls** **(4)**	**IV with Controls** **(5)**
Dummy=1 if the household has at least one Grandparent	0.115*** (0.00853)	0.0264** (0.0113)	0.0862* (0.0455)		
Dummy=1 if household has only Grandfather				0.0567 (0.0541)	
Dummy=1 if the household has only Grandmother					0.0984** (0.0451)
Observations 1st partial R2	187,918 0.001	99,218 0.114	99,218 0.114	99,218 0.114	99,218 0.114
Dependent Variable: HFA					
Dummy=1 if the household has at least one Grandparent	0.146*** (0.0109)	0.0405*** (0.0137)	0.101* (0.0553)		
				0.0813	

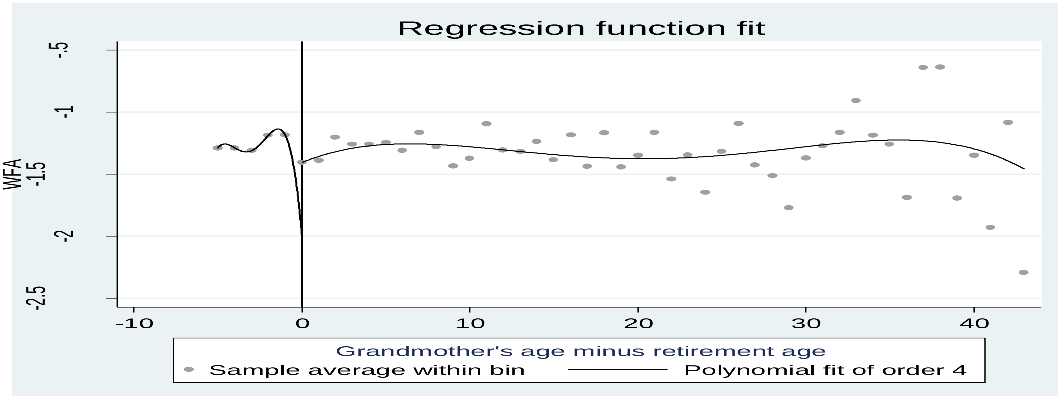
Dummy=1 if household has only Grandfather				(0.0658)	
Dummy=1 if the household has only Grandmother					0.0823 (0.0548)
Observations 1st partial R2	184,124	98,229	98,229 0.125	98,229 0.125	98,229 0.125

Note: The dependent variables are weight-for-age (WFA) and height-for-age (HFA). The independent variables comprise the main dummy variable that takes a value of 1 if both grandparents are present in specifications (1), (2) and (3). Dummy=1 if only grandfather is present in the household is used in specification (4) and dummy=1 if only grandmother is present in the household in specification (5). The instrument used in the specification is Retirement Eligibility, which is grandparent's age minus the legal retirement age (60 years for males and 55 years for females). The controls include the child's characteristics: gender, age, and age squared. Household characteristics: urban, gender of the household head, total number of households, wealth score, household head education level, wealth score square. Mother's characteristics: mother's education level, mother's age, mother's age squared, age of the first born, number of years married, district fixed effects, year fixed effects, Mothers age at the birth of child, dummy=1 if there are 2 children and above in a household, dummy=1 if there are 3 children and above in a household, dummy=1 if the second and above child is a girl, dummy=1 if the third and above child is a girl. Standard errors are clustered at the household level. *** p<0.01, ** p<0.05, * p<0.1

The OLS results reported in columns (1) and (2) show that there is a positive and significant effect of the presence of at least one grandparent in a household on the height-for-age and weight-for-age measures. The IV results reported in column (3) show that the weight-for-age increases by 0.0862 SD if at least one or both grandparents are present in a household, and similarly, the height-for-age also increases by 0.101 SD if at least one grandparent is present in a household. We see that the results remain insignificant for the households that only have grandfathers (column (4)). The final specification column (5) shows that the results of the grandparents are driven by the presence of grandmothers. The coefficient for weight for age in the specification that captures the impact of the presence of grandmothers (alone) in a household is more significant and larger in magnitude, i.e., 0.0984 SD then that obtained when we look at the presence of at least one grandparent. HFA, on the other hand, remains positive but insignificant.

Figure 1 shows the regression discontinuity around the retirement eligibility criteria. The weight for the age z score of children (age group 5 years and less) is on the y-axis, and the actual age of the grandmother minus the retirement eligibility age (55 years) is on the x-axis.

Figure 1: Regression Discontinuity Design for WFA at the Grandmother's Age cutoff at 55 years



Next, we subdivide our sample on the basis of location, gender of children and wealth of households. Table 9 reports the results for the impact of the presence of grandmothers on the HFA and WFA of child outcomes in rural and urban households.

Table 9: Measuring the impact of the presence of grandmothers in a household on children's health outcomes by rural/urban divide

	WFA				HFA			
	Rural		Urban		Rural		Urban	
	OLS (1)	IV (2)	OLS (3)	IV (4)	OLS (5)	IV (6)	OLS (7)	IV (8)
Dummy=1 if the households have only Grandmother	-0.00899 (0.0287)	0.153*** (0.0569)	-0.0509 (0.0364)	-0.0249 (0.0735)	-0.0263 (0.0349)	0.0744 (0.0692)	-0.0191 (0.0440)	0.0771 (0.0890)
Observations	64,498	64,498	34,720	34,720	63,795	63,795	34,434	34,434
1st partial R2		0.111		0.108		0.121		0.112

Note: The dependent variables are weight-for-age (WFA) and height-for-age (HFA). The independent variable comprises the main dummy variable, which takes a value of 1 if the grandmother is present in a household. Specifications (1), (3), (5) and (7) report the OLS results, whereas specifications (2), (4), (6) and (8) report the IV results. The instrument used in the specification is Retirement Eligibility, which is grandmother's age minus the potential retirement age (55 years for females). The controls include the child's characteristics: gender, age, and age squared. Household characteristics: urban, gender of the household head, total number of households, wealth score, household head education level, wealth score square. Mother's characteristics: mother's education level, mother's age, mother's age squared, age of the first born, number of years married, district fixed effects, year fixed effects, Mothers age at the birth of child, dummy=1 if there are 2 children and above in a household, dummy=1 if there are 3 children and above in a household, dummy=1 if the second and above child is a girl, dummy=1 if the third and above child is a girl. Standard errors are clustered at the household level. *** p<0.01, ** p<0.05, * p<0.1

We see that the results for WFA are driven by households living in rural areas. The weight-for-age of younger children increases by 0.153 SD if grandmothers are present in rural households. However, we do not see any significant increases in HFA.

Table 10: Measuring the Impact of the presence of grandmothers in a household on children's health outcomes by gender

	WFA				HFA			
	Boys		**Girls**		**Boys**		**Girls**	
	OLS (1)	**IV (2)**	**OLS (3)**	**IV (4)**	**OLS (5)**	**IV (6)**	**OLS (7)**	**IV (8)**
Dummy=1 if the households have only Grandmother	-0.00803 (0.0318)	0.173*** (0.0644)	-0.0395 (0.0319)	0.0237 (0.0631)	-0.0289 (0.0389)	0.109 (0.0786)	-0.0146 (0.0385)	0.0550 (0.0763)
Observations	50,859	50,859	48,359	48,359	50,285	50,285	47,944	47,944
1st partial R2		0.113		0.119		0.118		0.135

Note: The dependent variables are weight-for-age (WFA) and height-for-age (HFA). The independent variable comprises the main dummy variable, which takes a value of 1 if the grandmother is present in a household. Specifications (1), (3), (5) and (7) report the OLS results, whereas specifications (2), (4), (6) and (8) report the IV results. The instrument used in the specification is Retirement Eligibility, which is grandmother's age minus the potential retirement age (55 years for females). The controls include the child's characteristics: gender, age, and age squared. Household characteristics: urban, gender of the household head, total number of households, wealth score, household head education level, wealth score square. Mother's characteristics: mother's education level, mother's age, mother's age squared, age of the first born, number of years married, district fixed effects, year fixed effects, Mothers age at the birth of child, dummy=1 if there are 2 children and above in a household, dummy=1 if there are 3 children and above in a household, dummy=1 if the second and above child is a girl, dummy=1 if the third and above child is a girl. Standard errors are clustered at the household level. *** p<0.01, ** p<0.05, * p<0.1

Next, we look to see if the impact of grandmothers is different for boys versus girls. Table 10 shows that the positive impact of the presence of grandmothers on WFA is driven by the impact on boys. We do not see any significant effect on the HFA.

Table 11: Measuring the impact of the presence of grandmothers in a household on children's health outcomes by wealth

	WFA				HFA			
	Poor		**Rich**		**Poor**		**Rich**	
	OLS (1)	**IV (2)**	**OLS (3)**	**IV (4)**	**OLS (5)**	**IV (6)**	**OLS (7)**	**IV (8)**
Dummy=1 if the households have only Grandmother	-0.0176 (0.0415)	0.184** (0.0772)	-0.0267 (0.0268)	0.0439 (0.0554)	-0.0353 (0.0510)	0.170* (0.0950)	-0.0156 (0.0322)	0.0279 (0.0667)
Observations	38,786	38,786	60,432	60,432	38,309	38,309	59,920	59,920
1st partial R2		0.052		0.087		0.072		0.089

Note: The dependent variables are weight-for-age (WFA) and height-for-age (HFA). The independent variable comprises the main dummy variable, which takes a value of 1 if the grandmother is present in a household. Specifications (1), (3), (5) and (7) report the OLS results, whereas specifications (2), (4), (6) and (8) report the IV results. The instrument used in the specification is Retirement Eligibility, which is grandmother's age minus the potential retirement age (55 years for females). The controls include the child's characteristics: gender, age, and age squared. Household characteristics: urban, gender of the household head, total number of households, wealth score, household head education level, wealth score square. Mother's characteristics: mother's education level, mother's age, mother's age squared, age of the first born, number of years married, district fixed effects, year fixed effects, Mothers age at the birth of child, dummy=1 if there are 2 children and above in a household, dummy=1 if there are 3 children and above in a household, dummy=1 if the second and above child is a girl, dummy=1 if the third and above child is a girl. Standard errors are clustered at the household level. *** p<0.01, ** p<0.05, * p<0.1

Finally, in Table 11, we see that the results for the increase in WFA and HFA due to the presence of grandmothers in a household occur primarily in low-wealth households. The weight-for-age of younger individuals increases by 0.184 SD in poor households if the grandmother is present.

Similarly, we see a significant increase in HFA by 0.17 SD in low-wealth households if the grandmother is present.

5. Conclusion

The focus of the study was to better understand how household structure and female agency may help to alleviate the undernutrition of children, a severe problem faced by approximately 40% of children (of age group 5 years and less) in Pakistan (UNICEF, 2018). This chapter is the first of its kind to quantitatively measure and confirm the significant positive causal impact of the two most important intrahousehold aspects specifically for the case of Pakistan, empowered mothers and the presence of grandparents, on the child health outcomes of children aged 5 years and younger. Where empowered mothers provide benefits to girls by playing a vital role in eliminating gender discrimination among households, we see that the presence of grandparents, more specifically that of grandmothers, improves the health status of boys in poor families living in rural areas without having any significant negative effect on girls.

This study statistically provides insight into the relevance of family structure for the betterment of children and sheds light on new aspects that can be explored in future research. A few important questions that arise from this research are the specific role played by empowered mothers and the presence of grandmothers in these households and how it affects the health of children. Eventually, in future studies, one may want to explore how the presence of grandmothers may affect the empowerment of mothers in a household and what is the combined impact of empowered mothers and the presence of grandmothers on the wellbeing of children in a household.

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7. Conclusion

As the majority of researchers have accepted the larger gains associated with migration in a global context, recent literature centers on identifying specific areas where migration has had positive or negative impacts. It is only under these circumstances that more specific policies can be devised to ensure that marginalized groups are not affected adversely and that the country at large can gain from migration.

In this thesis, we explored three important characteristics of intrahousehold dynamics using a microlevel analysis. First, the impact of migration on labor market activity and investment decisions in Punjab, Pakistan, was examined using multiple rounds of MICS for the survey years 2003, 2008, 2011 and 2014. Second, the impact of migrating potential caregivers on the child's wellbeing in Punjab, Pakistan, was examined using a cross-pooled dataset from multiple rounds of MICS for the survey years 2008, 2011, 2014 and 2018. Third, protecting children's nutritional health via empowered mothers and the presence of grandmothers in a household was studied using two different datasets: PDHS (2018) for measuring empowerment and MICS survey years 2008, 2011, 2014 and 2018 to measure the impact of coresident grandparents.

The first chapter confirms the positive impact of the presence of the diaspora on migrant-sending households net of the amount of remittances in Pakistan. The analysis shows that, on average, there is a significant shift in activity in the labor market from not working at all, unpaid family work and basic/manual labor to relatively higher-status forms of employment such as self-employment and becoming an employer for individuals from migrant-sending households. Additionally, migration significantly reduces unpaid family work and motivates individuals not working at all to enter the labor force. Investments in property, bank deposits, agricultural land, and livestock and poultry also increase significantly by the individuals from migrant-sending households. Last, we show that these results are driven by the individuals categorized into vulnerable groups, such as females, less educated individuals, and individuals in rural areas. The results also show that female-headed households do not derive any additional benefits from migration.

The second chapter discusses the impact of migrating caregivers on all age groups of children to provide an overall picture of how the wellbeing of the left behind children is affected in migrating-caregiver households. We show that migration of the caregiver has a negative effect on all the health outcomes (for children of ages 5 years and less), but we see a mixed impact on the schooling outcomes (for children of ages 5-17 years). The impact of migration is detrimental for girls, those in rural areas, those who are from relatively poorer households, and those with mothers without education. Next, we show that the impact of migrating caregivers is positive for the individuals in the 5-17 year age group in terms of their present schooling decisions in the households where the caregiver has migrated driven by richer households and those in urban areas.

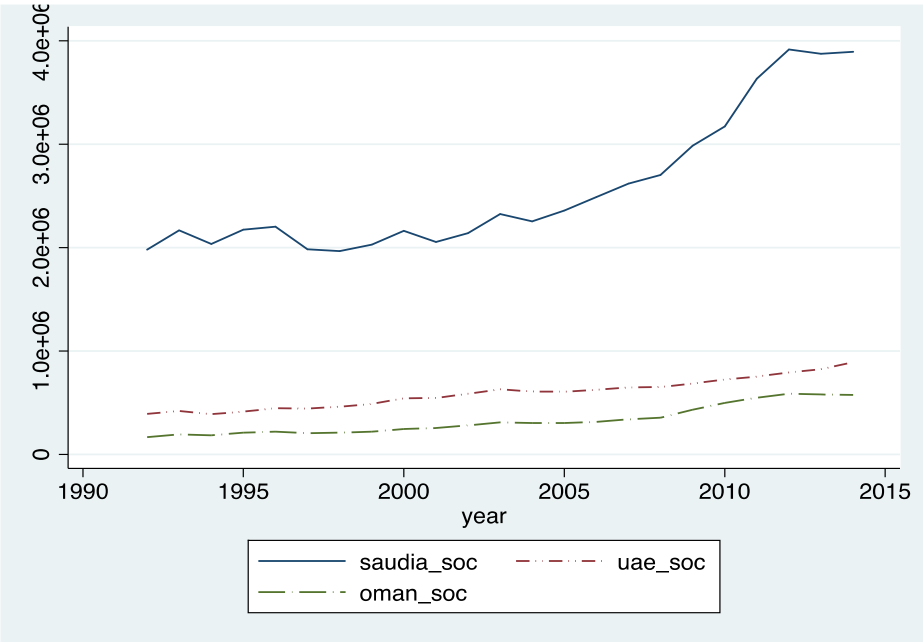
In the third chapter, we show how empowered mothers and coresident grandmothers support the nutritional health outcomes of children reflected in their respective height-for-age z scores and weight-for-age z scores. For the first time, we quantitatively measure and confirm the significant positive causal impact of empowered mothers and the presence of grandparents on the child health outcomes of children aged 5 years and younger in Pakistan. Where empowered mothers provide benefits to girls by playing a vital role in eliminating gender discrimination among households, we see that the presence of grandparents, more specifically that of grandmothers, improves the health status of boys, in poor families, and those living in rural areas without having any significant negative effect on girls.

Appendices

Appendices related to Paper 2

Appendix A

Aggregate of nighttime light intensity data for Oman, Saudi Arabia and UAE over time (1992–2014)



Source: NOAA satellite night imagery data from 1992 to 2013, 2014 (projected), World Bank.

Appendix B

Table B.1: First-stage results using old instrument to identify predicted probability of emigration

Dependent Variable: Dummy = 1 if Household Has an External Migrant				
	(1)	(2)	(3)	(4)
	Aggregate	2003	2008	2011 and 2014
Instrument 1: Historic Migration Rates at District Level * Number of Adult Males	0.488***	0.768***	1.144***	0.283***
	(0.0473)	(0.239)	(0.138)	(0.0356)
Observations	539,049	91,976	58,189	388,889
R-squared	0.12	0.16	0.36	0.07
1st F-test	106.637	10.283	69.141	62.895
1st P-value	0.000	0.000	0.000	0.000
1st partial R2	0.012	0.016	0.036	0.007
District FE	X	X	X	X
Year FE	X			

Note: The dependent variable is a binary variable = 1 if an overseas migrant is present in the household. This information is provided in all rounds of the MICS (2003, 2008, 2011 and 2014). Each specification is different in terms of the two different instruments used. Instrument 1 = historic migration networks (aggregate of diaspora from 1980 until five years prior to the survey year) measured at district level using the information provided by the Bureau of Emigration and Overseas Employment. Instrument 2 = mean deviation of nighttime light intensity in the destination country interacted with historic migration rates and number of adult males.

The standard independent variables controlled for in the specification for aggregate estimations comprise a dummy = 1 if the household is in an urban area, district controls comprising all districts (n – 1) in Punjab (Bahawalpur, Rahimyar Khan, Dera Ghazi Khan, Layyah, Muzaffargarh, Rajanpur, Faisalabad, Jhang, Toba Tek Singh, Gujranwala, Gujrat, Hafizabad, Mandi Bahauddin, Narowal, Sialkot, Kasur, Sheikhupura, Multan, Khanewal, Lodhran, Vehari, Sahiwal, Pakpattan, Okara, Rawalpindi, Attock, Chakwal, Jhelum, Sargodha, Bhakkar, Khushab, Mianwali, Lahore and Chiniot), and year controls comprising a dummy = 1 for each year (2003, 2008, 2011 and 2014).

Standard errors are clustered at the household level. *** p < 0.01, ** p < 0.05, * p < 0.1.

Source: Author's calculations.

Table B.2: Correlation between interacted terms (used to construct IV)

Correlation Matrix			
	Total Number of Adult Males (Z-scores)	**Historic Migration Rates (Z-scores)**	**Weighted Average of the Deviation of Nighttime Light Intensity Data From its Mean**
Total Number of Adult Males (Z-scores)	1		
Historic Migration Rates (Z-scores)	-0.282	1	
Weighted Average of the Deviation of Nighttime Light Intensity Data From its Mean	-0.1928	-0.0078	1

Source: Author's calculations.

Table B.3: Second-stage IV and OLS results of emigration and labor market activity using Double Interaction, average effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	IV_{double}	IV_{double}	IV_{double}	IV_{double}	IV_{double}	IV_{double}	IV_{double}	IV_{double}	IV_{double}	IV_{double}

	Dependent Variable: Subsistence Small Business (Self-Employed)		Dependent Variable: Employer		Dependent Variable: Wage and Salary Earners (Laborer)		Dependent Variable: Unpaid Family Work		Dependent Variable: Not Working At All	
Dummy = 1 if HH has Overseas Migrant	0.316	0.587	0.046	0.081	-1.115*	-1.973	-0.566*	-1.012	-0.505*	-0.908
	(0.270)	(0.567)	(0.056)	(0.102)	(0.588)	(1.408)	(0.324)	(0.747)	(0.277)	(0.660)
Observations	525,062	525,062	525,062	525,062	525,062	525,062	525,062	525,062	525,062	525,062
1st F-test	4.538	2.220	4.538	2.220	4.538	2.220	4.538	2.220	4.538	2.220
Individuals and Household Controls	X	X	X	X	X	X	X	X	X	X
District FE and Time FE	X	X	X	X	X	X	X	X	X	X
Remittance Amount and Remittance Sq.		X		X		X		X		X

Source: Author's calculations.

Table B.4: Second-stage IV and OLS results of emigration and investment decisions using Double Interaction, average effects

	(1) IV_{double}	(2) IV_{double}	(3) IV_{double}	(4) IV_{double}	(5) IV_{double}	(6) IV_{double}	(7) IV_{double}	(8) IV_{double}	(9) IV_{double}	(10) IV_{double}
	Dependent Variable: Property		Dependent Variable: Bank Deposits		Dependent Variable: Own Agricultural Land		Dependent Variable: Total Agricultural Land Owned (in Acres)		Dependent Variable: Livestock, Poultry and Fishery	
Dummy = 1 if HH has Overseas Migrant	0.068	0.119	0.054	0.094	1.811*	3.147	101.572*	179.756	0.076	0.133
	(0.044)	(0.097)	(0.037)	(0.080)	(0.978)	(2.304)	(53.386)	(127.046)	(0.084)	(0.163)
Observations	525,062	525,062	525,062	525,062	525,062	525,062	525,062	525,062	525,062	525,062
1st F-test	4.538	2.220	4.538	2.220	4.538	2.220	4.538	2.220	4.538	2.220
Individuals and Household Controls	X	X	X	X	X	X	X	X	X	X
District FE and Time FE	X	X	X	X	X	X	X	X	X	X
Remittance Amount and Remittance Sq.		X		X		X		X		X

Source: Author's calculations.

Appendix C

Table A.1: Exploring the base effects of labor market activity and investment decisions between individuals in rural and urban areas

Base Effects by Rural/Urban Divide					
	Rural		**Urban**		
Variables	**Observations**	**Mean**	**Observations**	**Mean**	**Mean Difference**
Self-Employed	220930	0.0829	135836	0.1971	-0.1142***
Employer	220930	0.0036	135836	0.0087	-0.0051***

Laborer	220930	0.216	135836	0.1877	0.0282***
Unpaid Family Work	236618	0.065	148649	0.0587	0.0063***
Not Working at All	327072	0.0306	211977	0.0379	-0.0074***
Rents	220930	0.0023	135836	0.0047	-0.0025***
Interest and Profits	220930	0.0021	135836	0.0018	0.0003*
Own Agricultural Land	207553	0.1523	128237	0.024	0.1283***
Own Agricultural Land (in Acres)	327072	2.7059	211977	1.0981	1.6078***
Livestock, Poultry, Fishery and Forestry	220930	0.0455	135836	0.0057	0.0398***

Source: Author's calculations.

Table A.2: Exploring the base effects of labor market activity and investment decisions between males and females

Base Effects by Gender					
	Females		**Males**		
Variables	**Observations**	**Mean**	**Observations**	**Mean**	**Mean Difference**
Self-Employed	117706	0.0217	239060	0.178	-0.1563***
Employer	117706	0.0054	239060	0.0056	-0.0001
Laborer	117706	0.0884	239060	0.2627	-0.1743***
Unpaid Family Work	247011	0.0863	138256	0.0203	0.0660***
Not Working at All	266929	0.0052	272120	0.0611	-0.0559***
Rents	117706	0.0013	239060	0.0041	-0.0028***
Interest and Profits	117706	0.0013	239060	0.0023	-0.0011***
Own Agricultural Land	112212	0.0111	223578	0.1495	-0.1384***
Own Agricultural Land (in Acres)	266929	2.1199	272120	2.0283	0.0916***
Livestock, Poultry, Fishery and Forestry	117706	0.0325	239060	0.0292	0.0033***

Source: Author's calculations.

Table A.3: Exploring the base effects of labor market activity and investment decisions between more-educated and less-educated individuals

Base Effects by Education					
	Education > 5 years		**Education < 5 years**		
Variables	**Observations**	**Mean**	**Observations**	**Mean**	**Mean Difference**
Self-Employed	121309	0.1876	235457	0.0949	0.0927***
Employer	121309	0.0063	235457	0.0052	0.0012***
Laborer	121309	0.1589	235457	0.2291	-0.0702***
Unpaid Family Work	113512	0.073	271755	0.0583	0.0147***
Not Working at All	190645	0.0514	348404	0.0236	0.0277***
Rents	121309	0.0047	235457	0.0025	0.0022***
Interest and Profits	121309	0.0025	235457	0.0017	0.0007***
Own Agricultural Land	112829	0.1055	222961	0.1021	0.0034***
Own Agricultural Land (in Acres)	190645	2.4762	348404	1.8534	0.6228***
Livestock, Poultry, Fishery and Forestry	121309	0.017	235457	0.0372	-0.0201***

Source: Author's calculations.

Table A.4: Exploring the base effects of labor market activity and investment decisions between individuals in male-headed and female-headed households

Base Effects by Gender of Household Head					
	Female-headed HH		**Male-headed HH**		
Variables	**Observations**	**Mean**	**Observations**	**Mean**	**Mean Difference**
Self-Employed	25658	0.0867	331108	0.1295	-0.0427***
Employer	25658	0.0073	331108	0.0054	0.0019***
Laborer	25658	0.1694	331108	0.208	-0.0386***
Unpaid Family Work	31531	0.0609	353736	0.0628	-0.0019
Not Working at All	39385	0.0425	499664	0.0328	0.0097***
Rents	25658	0.0062	331108	0.003	0.0032***
Interest and Profits	25658	0.0057	331108	0.0017	0.0040***
Own Agricultural Land	21696	0.0557	314094	0.1066	-0.0509***
Own Agricultural Land (in Acres)	39385	1.0117	499664	2.1574	-1.1457***
Livestock, Poultry, Fishery and Forestry	25658	0.0296	331108	0.0304	-0.0008

Source: Author's calculations.

Appendix D

Robustness Test: Second-Stage Results with Sample Size Restricted to the Individual's Age from 17 to 30 years						
	OLS	**OLS + Simple Controls**	**IV double interaction + Simple Controls**	**IV double interaction + remitt**	**IV Triple Interaction + Simple Controls**	**IV Triple Interaction +remitt**

Dependent Variable: Subsistence Small Business (Self-Employed)						
Dummy = 1 if HH has Overseas Migrant	-0.008***	-0.005**	-0.012***	-0.008***	0.442***	0.520***
	[0.002]	[0.002]	[0.002]	[0.003]	(0.154)	(0.183)
Observations	267,975	263,042	260,534	260,534	260,534	260,534
R-squared	0.000	0.093	0.102	0.102	-0.118	-0.113
1st F-test					16.793	15.891
1st P-value					0.000	0.000
1st partial R2					0.001	0.001
Hansen J0					0.000	0.000
Dependent Variable: Employer						
Dummy = 1 if HH has Overseas Migrant	-0.000	-0.000	-0.001***	-0.002**	0.055**	0.063**
	[0.000]	[0.000]	[0.000]	[0.001]	(0.027)	(0.030)
Observations	267,975	263,042	260,534	260,534	260,534	260,534
R-squared	0.000	0.001	0.004	0.004	-0.073	-0.072
1st F-test					16.793	15.891
1st P-value					0.000	0.000
1st partial R2					0.001	0.001
Hansen J0					0.000	0.000
Dependent Variable: Wage and Salary Earners (Laborers)						
Dummy = 1 if HH has Overseas Migrant	-0.086***	-0.033***	-0.001	-0.003	-0.267*	-0.313*
	[0.002]	[0.002]	[0.002]	[0.003]	(0.144)	(0.170)
Observations	267,975	263,042	260,534	260,534	260,534	260,534
R-squared	0.006	0.157	0.193	0.193	0.151	0.152
1st F-test					16.793	15.891
1st P-value					0.000	0.000
1st partial R2					0.001	0.001
Hansen J0					0.000	0.000
Individual and Household Controls		X	X	X	X	X
District FE and Time FE		X	X	X	X	X
Remittance Amount and Remittances Sq.		X		X		X
Instrument 1			X	X		
Instrument 2					X	X

Source: Author's calculations.

Appendix E

Table A.1: Impact of external migrant on labor market activities, by rural/urban divide

	Urban					Rural				
Dependent Variable	Self-Employed									
	OLS Simple controls	OLS + FE	OLS + remitt	IV	IV+ remitt	OLS Simple controls	OLS + FE	OLS + remitt	IV	IV+ remitt
Dummy = 1 if Overseas Migrant is Present in the Household	-0.013***	-0.023***	-0.016***	0.832***	1.147**	-0.006***	-0.014***	-0.011***	0.557	0.454**
	[0.004]	[0.004]	[0.005]	(0.265)	(0.445)	[0.002]	[0.002]	[0.003]	(0.355)	(0.217)
Observations	211,977	206,564	206,564	206,564	206,564	327,072	319,204	319,204	319,204	319,204
R-squared	0.000	0.154	0.154	-0.314	-0.492	0.000	0.063	0.064	-0.380	-0.147
1st F-test				13.379	8.619				3.343	8.860
1st P-value				0.000	0.003				0.068	0.003
1st partial R2				0.001	0.001				0.000	0.000
Hansen J p value				0.000	0.000				0.000	0.000
Dependent Variable	Employer									
Dummy = 1 if Overseas Migrant is Present in the Household	0.002	-0.003**	-0.003*	0.034	0.047	0.000	-0.001	-0.001	0.089	0.073*
	[0.001]	[0.001]	[0.002]	(0.037)	(0.049)	[0.000]	[0.000]	[0.001]	(0.063)	(0.040)
Observations	211,977	206,564	206,564	206,564	206,564	327,072	319,204	319,204	319,204	319,204
R-squared	0.000	0.008	0.008	-0.010	-0.016	0.000	0.002	0.002	-0.239	-0.113
1st F-test				13.379	8.619				3.343	8.860
1st P-value				0.000	0.003				0.068	0.003
1st partial R2				0.001	0.001				0.000	0.000
Dependent Variable	Wage and Salary Earners (Laborers)									
Dummy = 1 if Overseas Migrant is Present in the Household	-0.071***	-0.003	-0.004	-0.120	-0.162	-0.086***	-0.003	-0.004	-0.737	-0.607**
	[0.003]	[0.003]	[0.004]	(0.139)	(0.192)	[0.003]	[0.003]	[0.003]	(0.480)	(0.291)
Observations	211,977	206,564	206,564	206,564	206,564	327,072	319,204	319,204	319,204	319,204
R-squared	0.005	0.191	0.192	0.182	0.179	0.006	0.174	0.175	-0.138	0.024
1st F-test				13.379	8.619				3.343	8.860
1st P-value				0.000	0.003				0.068	0.003
1st partial R2				0.001	0.001				0.000	0.000
Hansen J p value				0.000	0.000				0.000	0.000
Dependent Variable	Unpaid Family Work									
Dummy = 1 if Overseas Migrant is Present in the Household	0.004**	0.007***	0.006**	-0.159*	-0.220*	0.007***	0.008***	0.005**	-0.037	-0.026
	[0.002]	[0.002]	[0.002]	(0.087)	(0.117)	[0.002]	[0.002]	[0.002]	(0.142)	(0.115)
Observations	211,977	206,564	206,564	206,564	206,564	327,072	319,204	319,204	319,204	319,204
R-squared	0.000	0.067	0.067	0.018	-0.001	0.000	0.062	0.062	0.059	0.061
1st F-test				13.379	8.619				3.343	8.860
1st P-value				0.000	0.003				0.068	0.003
1st partial R2				0.001	0.001				0.000	0.000
Hansen J p value				0.000	0.000				0.000	0.000
Dependent Variable	Not Working at All									
Dummy = 1 if Overseas Migrant is Present in the Household	0.012***	0.016***	0.013***	-0.084	-0.124	0.019***	0.015***	0.013***	-0.794*	-0.649***
	[0.002]	[0.002]	[0.002]	(0.074)	(0.107)	[0.001]	[0.001]	[0.002]	(0.450)	(0.244)
Observations	211,977	206,564	206,564	206,564	206,564	327,072	319,204	319,204	319,204	319,204
R-squared	0.000	0.070	0.071	0.051	0.043	0.001	0.077	0.077	-1.536	-0.696
1st F-test				13.379	8.619				3.343	8.860
1st P-value				0.000	0.003				0.068	0.003

1st partial R2				0.001	0.001				0.000	0.000
Hansen J p value				0.000	0.000				0.000	0.000
Individual and Household Controls	X	X	X	X	X	X	X	X	X	X
District and Time FE		X	X	X	X		X	X	X	X
Remittance Amount and Remittances Sq.			X		X			X		X
Instrument				X	X				X	X

Source: Author's calculations.

Table A.2: Impact of external migrant on labor market activities, by gender

	Males					Females				
ndent Variable	Self-Employed									
	OLS Simple controls	OLS + FE	OLS + remitt	IV	IV+ remitt	OLS Simple controls	OLS + FE	OLS + remitt	IV	IV+ remitt
ny = 1 if Overseas Migrant sent in Household	0.000	-0.029***	-0.021***	0.830***	1.053***	-0.004***	-0.004***	-0.003***	0.116***	0.129***
	[0.004]	[0.004]	[0.005]	(0.242)	(0.326)	[0.001]	[0.001]	[0.001]	(0.038)	(0.041)
vations	272,120	266,132	266,132	266,132	266,132	266,929	259,636	259,636	259,636	259,636
ared	0.000	0.087	0.087	-0.294	-0.361	0.000	0.008	0.008	-0.107	-0.093
est				20.264	17.360				20.547	25.207
value				0.000	0.000				0.000	0.000
rtial R2				0.001	0.001				0.001	0.001
n J p value				0.000	0.000				0.000	0.000
ndent Variable	Employer									
ny = 1 if Overseas Migrant sent in Household	0.003***	-0.001	-0.002	0.005	0.005	-0.001***	-0.001***	-0.001**	0.072***	0.080***
	[0.001]	[0.001]	[0.002]	(0.030)	(0.038)	[0.000]	[0.000]	[0.000]	(0.025)	(0.025)
vations	272,120	266,132	266,132	266,132	266,132	266,929	259,636	259,636	259,636	259,636
ared	0.000	0.006	0.006	0.006	0.006	0.000	0.010	0.011	-0.159	-0.137
est				20.264	17.360				20.547	25.207
value				0.000	0.000				0.000	0.000
rtial R2				0.001	0.001				0.001	0.001
n J p value				0.000	0.000				0.000	0.000
ndent Variable	Wage and Salary Earners (Laborers)									
ny = 1 if Overseas Migrant sent in Household	-0.116***	0.001	0.001	-0.354*	-0.444*	-0.032***	-0.005***	-0.006***	-0.326***	-0.360***
	[0.004]	[0.004]	[0.005]	(0.186)	(0.238)	[0.001]	[0.001]	[0.002]	(0.087)	(0.088)
vations	272,120	266,132	266,132	266,132	266,132	266,929	259,636	259,636	259,636	259,636
ared	0.007	0.174	0.174	0.126	0.117	0.003	0.066	0.067	-0.146	-0.120
est				20.264	17.360				20.547	25.207
value				0.000	0.000				0.000	0.000
rtial R2				0.001	0.001				0.001	0.001
n J p value				0.000	0.000				0.000	0.000
ndent Variable	Unpaid Family Work									
ny = 1 if Overseas Migrant sent in Household	0	0.002**	0.003**	-0.05	-0.063	0.005**	0.017***	0.011***	-0.227**	-0.254**
	[0.001]	[0.001]	[0.001]	-0.044	-0.054	[0.002]	[0.002]	[0.003]	(0.111)	(0.117)
vations	272120	266132	266132	266132	266132	266,929	259,636	259,636	259,636	259,636
ared	0	0.034	0.034	0.016	0.012	0.000	0.064	0.064	0.002	0.012
est				20.264	17.36				20.547	25.207
value				0	0				0.000	0.000
rtial R2				0.001	0.001				0.001	0.001
n J p value				0	0				0.000	0.000
ndent Variable	Not Working at All									
ny = 1 if Overseas Migrant sent in Household	0.040***	0.032***	0.027***	-0.213**	-0.279**	-0.000	-0.001	-0.001	-0.090**	-0.099**
	[0.002]	[0.002]	[0.003]	-0.097	-0.127	[0.000]	[0.001]	[0.001]	(0.035)	(0.039)
vations	272120	266132	266132	266132	266132	266,929	259,636	259,636	259,636	259,636
ared	0.003	0.081	0.082	0.009	-0.003	0.000	0.016	0.016	-0.102	-0.087

est				20.264	17.36				20.547	25.207
value				0	0				0.000	0.000
rtial R2				0.001	0.001				0.001	0.001
n J p value				0	0				0.000	0.000
dual and Household ols	X	X	X	X	X	X	X	X	X	X
t and Time FE		X	X	X	X		X	X	X	X
tance Amount and tances Sq.			X		X			X		X
ment				X	X				X	X

Source: Author's calculation

Table A.3: Impact of external migrant on labor market activities, by education

	Schooling 5 Years or Less					Schooling 5 Years or More				
Dependent Variable	Self-Employed									
	OLS Simple controls	OLS + FE	OLS + remitt	IV	IV+ remitt	OLS Simple controls	OLS + FE	OLS + remitt	IV	IV+ remitt
Dummy = 1 if Overseas Migrant is Present in Household	-0.010***	-0.019***	-0.012***	0.561**	0.558***	-0.018***	-0.017***	-0.014***	0.611***	0.830***
	[0.002]	[0.002]	[0.003]	(0.234)	(0.209)	[0.003]	[0.003]	[0.004]	(0.161)	(0.238)
Observations	348,404	341,084	341,084	341,084	341,084	190,645	184,684	184,684	184,684	184,684
R-squared	0.000	0.099	0.099	-0.260	-0.149	0.000	0.122	0.122	-0.202	-0.320
1st F-test				8.734	13.103				29.937	22.163
1st P-value				0.003	0.000				0.000	0.000
1st partial R2				0.000	0.000				0.001	0.001
Hansen J p value				0.000	0.000				0.000	0.000
Dependent Variable	Employer									
Dummy = 1 if Overseas Migrant is Present in Household	0.000	-0.001**	-0.001	0.069*	0.069**	0.001	-0.001	-0.002	0.032	0.043
	[0.001]	[0.001]	[0.001]	(0.037)	(0.033)	[0.001]	[0.001]	[0.002]	(0.028)	(0.038)
Observations	348,404	341,084	341,084	341,084	341,084	190,645	184,684	184,684	184,684	184,684
R-squared	0.000	0.005	0.005	-0.087	-0.058	0.000	0.006	0.006	-0.019	-0.028
1st F-test				8.734	13.103				29.937	22.163
1st P-value				0.003	0.000				0.000	0.000
1st partial R2				0.000	0.000				0.001	0.001
Hansen J p value				0.000	0.000				0.000	0.000
Dependent Variable	Wage and Salary Earners (Laborers)									
Dummy = 1 if Overseas Migrant is Present in Household	-0.094***	-0.006**	-0.011***	-0.570**	-0.568**	-0.051***	0.002	0.003	-0.215**	-0.288**
	[0.003]	[0.003]	[0.003]	(0.259)	(0.232)	[0.003]	[0.003]	[0.003]	(0.105)	(0.145)
Observations	348,404	341,084	341,084	341,084	341,084	190,645	184,684	184,684	184,684	184,684
R-squared	0.006	0.198	0.198	0.041	0.089	0.003	0.139	0.139	0.094	0.078
1st F-test				8.734	13.103				29.937	22.163
1st P-value				0.003	0.000				0.000	0.000
1st partial R2				0.000	0.000				0.001	0.001
Hansen J p value				0.000	0.000				0.000	0.000
Dependent Variable	Unpaid Family Work									
Dummy = 1 if Overseas Migrant is Present in Household	0.002	0.008***	0.006***	-0.035	-0.034	0.012***	0.007***	0.005**	-0.236***	-0.322***
	[0.002]	[0.002]	[0.002]	(0.088)	(0.085)	[0.002]	[0.002]	[0.002]	(0.079)	(0.113)

Observations	348,404	341,084	341,084	341,084	341,084	190,645	184,684	184,684	184,684	184,684
R-squared	0.000	0.053	0.053	0.051	0.052	0.000	0.089	0.089	-0.033	-0.077
1st F-test				8.734	13.103				29.937	22.163
1st P-value				0.003	0.000				0.000	0.000
1st partial R2				0.000	0.000				0.001	0.001
Hansen J p value				0.000	0.000				0.000	0.000
Dependent Variable	**Not Working at All**									
Dummy = 1 if Overseas Migrant is Present in Household	0.007***	0.010***	0.009***	-0.717***	-0.714***	0.023***	0.023***	0.020***	0.009	0.000
	[0.001]	[0.001]	[0.001]	(0.259)	(0.219)	[0.002]	[0.002]	[0.002]	(0.056)	(0.075)
Observations	348,404	341,084	341,084	341,084	341,084	190,645	184,684	184,684	184,684	184,684
R-squared	0.000	0.066	0.067	-1.414	-0.977	0.001	0.084	0.084	0.084	0.083
1st F-test				8.734	13.103				29.937	22.163
1st P-value				0.003	0.000				0.000	0.000
1st partial R2				0.000	0.000				0.001	0.001
Hansen J p value				0.000	0.000				0.000	0.000
Individual and Household Controls	X	X	X	X	X	X	X	X	X	X
District and Time FE		X	X	X	X		X	X	X	X
Remittance Amount and Remittances Sq.			X		X			X		X
Instrument				X	X				X	X

Source: Author's calculations.

Table A.4: Impact of external migrant on labor market activities, by gender of household head

	Female-Headed Households					**Male-Headed Households**				
Dependent Variable	**Self-Employed**									
	OLS Simple controls	OLS + FE	OLS + remitt	IV	IV+ remitt	OLS Simple controls	OLS + FE	OLS + remitt	IV	IV+ remitt
Dummy = 1 if Overseas Migrant is Present in Household	-0.009**	-0.018***	-0.012**	0.006	0.027	-0.003	-0.018***	-0.013***	1.335*	1.092**
	[0.004]	[0.005]	[0.006]	(0.065)	(0.096)	[0.002]	[0.002]	[0.003]	(0.695)	(0.425)
Observations	39,385	37,799	37,799	37,799	37,799	499,664	487,969	487,969	487,969	487,969
R-squared	0.000	0.082	0.083	0.081	0.080	0.000	0.113	0.113	-1.414	-0.643
1st F-test				44.520	31.187				4.103	8.229
1st P-value				0.000	0.000				0.043	0.004
1st partial R2				0.006	0.004				0.000	0.000
Hansen J p value				0.000	0.000				0.000	0.000
Dependent Variable	**Employer**									
Dummy = 1 if Overseas Migrant is Present in Household	-0.003***	-0.004*	-0.003	-0.011	-0.013	0.001*	-0.001	-0.001	0.129*	0.106**
	[0.001]	[0.002]	[0.002]	(0.024)	(0.036)	[0.001]	[0.001]	[0.001]	(0.077)	(0.050)
Observations	39,385	37,799	37,799	37,799	37,799	499,664	487,969	487,969	487,969	487,969
R-squared	0.000	0.016	0.018	0.016	0.016	0.000	0.004	0.004	-0.308	-0.154
1st F-test				44.520	31.187				4.103	8.229
1st P-value				0.000	0.000				0.043	0.004
1st partial R2				0.006	0.004				0.000	0.000
Dependent Variable	**Wage and Salary Earners (Laborers)**									
Dummy = 1 if Overseas Migrant is Present in Household	-0.085***	-0.011**	-0.014**	-0.101	-0.151	-0.078***	0.001	-0.000	-0.556	-0.456*
	[0.005]	[0.005]	[0.006]	(0.071)	(0.107)	[0.002]	[0.002]	[0.003]	(0.357)	(0.246)
Observations	39,385	37,799	37,799	37,799	37,799	499,664	487,969	487,969	487,969	487,969
R-squared	0.016	0.162	0.162	0.150	0.142	0.004	0.180	0.180	0.008	0.095
1st F-test				44.520	31.187				4.103	8.229
1st P-value				0.000	0.000				0.043	0.004

1st partial R2				0.006	0.004				0.000	0.000
Hansen J p value				0.000	0.000				0.000	0.000
Dependent Variable	**Unpaid Family Work**									
Dummy = 1 if Overseas Migrant is Present in Household	-0.002	-0.001	-0.006	-0.018	-0.030	0.007***	0.010***	0.007***	-0.242	-0.196
	[0.003]	[0.003]	[0.004]	(0.042)	(0.061)	[0.001]	[0.001]	[0.002]	(0.175)	(0.120)
Observations	39,385	37,799	37,799	37,799	37,799	499,664	487,969	487,969	487,969	487,969
R-squared	0.000	0.070	0.071	0.070	0.070	0.000	0.061	0.061	-0.036	0.014
1st F-test				44.520	31.187				4.103	8.229
1st P-value				0.000	0.000				0.043	0.004
1st partial R2				0.006	0.004				0.000	0.000
Hansen J p value				0.000	0.000				0.000	0.000
Dependent Variable	**Not Working at All**									
Dummy = 1 if Overseas Migrant is Present in Household	0.010***	0.017***	0.015***	-0.034	-0.060	0.017***	0.015***	0.013***	-0.653*	-0.533**
	[0.003]	[0.003]	[0.003]	(0.039)	(0.059)	[0.001]	[0.001]	[0.001]	(0.345)	(0.214)
Observations	39,385	37,799	37,799	37,799	37,799	499,664	487,969	487,969	487,969	487,969
R-squared	0.001	0.106	0.106	0.097	0.092	0.001	0.072	0.072	-0.861	-0.390
1st F-test				44.520	31.187				4.103	8.229
1st P-value				0.000	0.000				0.043	0.004
1st partial R2				0.006	0.004				0.000	0.000
Hansen J p value				0.000	0.000				0.000	0.000
Individual and Household Controls	X	X	X	X	X	X	X	X	X	X
District and Time FE		X	X	X	X		X	X	X	X
Remittance Amount and Remittances Sq.			X		X			X		X
Instrument				X	X				X	X

Source: Author's calculations.

Table B.1: Impact of external migrant on investment decisions, by rural/urban divide

	Urban					**Rural**				
Dependent Variable	**Property**									
	OLS Simple controls	OLS + FE	OLS + remitt	IV	IV+ remitt	OLS Simple controls	OLS + FE	OLS + remitt	IV	IV+ remitt
Dummy = 1 if Overseas Migrant is Present in Household	0.004***	0.002**	0.002*	0.047	0.064	0.001	0.000	0.000	0.064	0.053
	[0.001]	[0.001]	[0.001]	(0.031)	(0.045)	[0.000]	[0.001]	[0.001]	(0.050)	(0.035)
Observations	211,977	206,564	206,564	206,564	206,564	327,072	319,204	319,204	319,204	319,204
R-squared	0.000	0.009	0.009	-0.040	-0.058	0.000	0.003	0.003	-0.190	-0.090
1st F-test				13.379	8.619				3.343	8.860
1st P-value				0.000	0.003				0.068	0.003
1st partial R2				0.001	0.001				0.000	0.000
Hansen J p value				0.000	0.000				0.000	0.000
Dependent Variable	**Bank Deposits**									
Dummy = 1 if Overseas Migrant is Present in Household	0.001*	0.000	0.000	0.022*	0.029*	0.002***	0.001*	0.001	-0.011	-0.009
	[0.000]	[0.000]	[0.000]	(0.011)	(0.017)	[0.000]	[0.000]	[0.001]	(0.029)	(0.023)
Observations	211,977	206,564	206,564	206,564	206,564	327,072	319,204	319,204	319,204	319,204
R-squared	0.000	0.002	0.002	-0.025	-0.036	0.000	0.003	0.003	-0.004	-0.000
1st F-test				13.379	8.619				3.343	8.860
1st P-value				0.000	0.003				0.068	0.003

1st partial R2				0.001	0.001				0.000	0.000
Hansen J p value				0.000	0.000				0.000	0.000
Dependent Variable	**Own Agricultural Land**									
Dummy = 1 if Overseas Migrant is Present in Household	0.045***	0.025***	0.027***	0.337*	0.549	0.148***	0.067***	0.065***	1.236	1.472
	[0.005]	[0.006]	[0.007]	(0.183)	(0.334)	[0.007]	[0.007]	[0.008]	(0.766)	(0.896)
Observations	56,158	55,332	55,332	55,332	55,332	89,721	88,615	88,615	88,615	88,615
R-squared	0.002	0.115	0.115	0.057	0.004	0.008	0.173	0.173	0.176	0.186
1st F-test				22.675	10.947				5.165	6.248
1st P-value				0.000	0.001				0.023	0.012
1st partial R2				0.001	0.000				0.000	0.000
Hansen J p value				0.000	0.000				0.000	0.000
Dependent Variable	**Total Agricultural Land Owned (in Acres)**									
Dummy = 1 if Overseas Migrant is Present in Household	0.277***	-0.219**	0.044	6.371*	11.554*	0.862***	-0.360*	-0.199	72.314*	87.070*
	[0.086]	[0.108]	[0.195]	(3.465)	(6.227)	[0.101]	[0.197]	[0.180]	(39.492)	(44.738)
Observations	56,158	55,332	55,332	55,332	55,332	89,721	88,615	88,615	88,615	88,615
R-squared	0.000	0.097	0.102	0.007	-0.098	0.001	0.097	0.097	3.509	3.599
1st F-test				22.675	10.947				5.165	6.248
1st P-value				0.000	0.001				0.023	0.012
1st partial R2				0.001	0.000				0.000	0.000
Dependent Variable	**Livestock, Poultry, Fishery and Forestry**									
Dummy = 1 if Overseas Migrant is Present in Household	-0.001	0.001**	0.001**	0.023	0.032	-0.011***	0.005***	0.005***	0.114	0.095
	[0.001]	[0.001]	[0.001]	(0.020)	(0.028)	[0.001]	[0.001]	[0.001]	(0.106)	(0.078)
Observations	211,977	206,564	206,564	206,564	206,564	327,072	319,204	319,204	319,204	319,204
R-squared	0.000	0.006	0.006	-0.003	-0.007	0.000	0.022	0.022	-0.007	0.008
1st F-test				13.379	8.619				3.343	8.860
1st P-value				0.000	0.003				0.068	0.003
1st partial R2				0.001	0.001				0.000	0.000
Hansen J p value				0.000	0.000				0.000	0.000
Individual and Household Controls	X	X	X	X	X	X	X	X	X	X
District and Time FE		X	X	X	X		X	X	X	X
Remittance Amount and Remittances Sq.			X		X			X		X
Instrument				X	X				X	X

Source: Author's calculations.

Table B.2: Impact of external migrant on investment decisions, by gender

	Males					Females				
Dependent Variable	**Property**									
	OLS Simple controls	OLS + FE	OLS + remitt	IV	IV+ remitt	OLS Simple controls	OLS + FE	OLS + remitt	IV	IV+ remitt
Dummy = 1 if Overseas Migrant is Present in Household	0.002**	0.001	0.001	0.039	0.048	0.002***	0.001*	0.001**	0.040*	0.044*
	[0.001]	[0.001]	[0.001]	-0.025	-0.032	[0.001]	[0.000]	[0.001]	(0.023)	(0.025)
Observations	272120	266132	266132	266132	266132	266,929	259,636	259,636	259,636	259,636

R-squared	0	0.006	0.006	-0.021	-0.026	0.001	0.008	0.009	-0.188	-0.162
1st F-test				20.264	17.36				20.547	25.207
1st P-value				0.00	0.00				0.000	0.000
1st partial R2				0.001	0.001				0.001	0.001
Hansen J p value				0.00	0.00				0.000	0.000
Dependent Variable	**Bank Deposits**									
Dummy = 1 if Overseas Migrant is Present in Household	0.002***	0.001	0.001	0.009	0.012	0.001***	0.000**	0.000*	-0.003	-0.004
	[0.001]	[0.001]	[0.001]	-0.017	-0.021	[0.000]	[0.000]	[0.000]	(0.008)	(0.009)
Observations	272120	266132	266132	266132	266132	266,929	259,636	259,636	259,636	259,636
R-squared	0	0.002	0.002	0.00	-0.001	0.000	0.005	0.005	0.003	0.003
1st F-test				20.264	17.36				20.547	25.207
1st P-value				0.00	0.00				0.000	0.000
1st partial R2				0.001	0.001				0.001	0.001
Hansen J p value				0.00	0.00				0.000	0.000
Dependent Variable	**Livestock, Poultry, Fishery and Forestry**									
Dummy = 1 if Overseas Migrant is Present in Household	-0.005***	0.006***	0.007***	0.097*	0.120*	-0.008***	-0.000	0.000	0.027	0.030
	[0.001]	[0.001]	[0.002]	-0.052	-0.066	[0.001]	[0.001]	[0.001]	(0.026)	(0.029)
Observations	272120	266132	266132	266132	266132	266,929	259,636	259,636	259,636	259,636
R-squared	0	0.023	0.023	0.001	-0.003	0.001	0.030	0.030	0.026	0.027
1st F-test				20.264	17.36				20.547	25.207
1st P-value				0.00	0.00				0.000	0.000
1st partial R2				0.001	0.001				0.001	0.001
Hansen J p value				0.00	0.00				0.000	0.000
Individual and Household Controls	X	X	X	X	X	X	X	X	X	X
District and Time FE		X	X	X	X		X	X	X	X
Remittance Amount and Remittances Sq.			X		X			X		X
Instrument				X	X				X	X

Source: Author's calculations.

Table B.3: Impact of external migrant on investment decisions, by education

	Schooling 5 Years or Less					Schooling 5 Years or More				
Dependent Variable	**Property**									
	OLS Simple controls	OLS + FE	OLS + remitt	IV	IV+ remitt	OLS Simple controls	OLS + FE	OLS + remitt	IV	IV+ remitt
Dummy = 1 if Overseas Migrant is Present in Household	0.002**	0.001*	0.001	0.049	0.049	0.002**	0.001	0.001	0.036	0.047
	[0.001]	[0.001]	[0.001]	(0.033)	(0.031)	[0.001]	[0.001]	[0.001]	(0.022)	(0.030)
Observations	348,404	341,084	341,084	341,084	341,084	190,645	184,684	184,684	184,684	184,684
R-squared	0.000	0.004	0.004	-0.086	-0.059	0.000	0.008	0.008	-0.027	-0.040
1st F-test				8.734	13.103				29.937	22.163

1st P-value				0.003	0.000				0.000	0.000
1st partial R2				0.000	0.000				0.001	0.001
Hansen J p value				0.000	0.000				0.000	0.000
Dependent Variable	**Bank Deposits**									
Dummy = 1 if Overseas Migrant is Present in Household	0.001***	0.000	0.000	-0.016	-0.016	0.002***	0.001***	0.001**	0.031**	0.041**
	[0.000]	[0.000]	[0.001]	(0.019)	(0.019)	[0.001]	[0.000]	[0.001]	(0.013)	(0.017)
Observations	348,404	341,084	341,084	341,084	341,084	190,645	184,684	184,684	184,684	184,684
R-squared	0.000	0.003	0.003	-0.012	-0.008	0.000	0.003	0.003	-0.044	-0.062
1st F-test				8.734	13.103				29.937	22.163
1st P-value				0.003	0.000				0.000	0.000
1st partial R2				0.000	0.000				0.001	0.001
Hansen J p value				0.000	0.000				0.000	0.000
Dependent Variable	**Livestock, Poultry, Fishery and Forestry**									
Dummy = 1 if Overseas Migrant is Present in Household	-0.009***	0.004***	0.004***	0.088	0.087	-0.002*	0.003***	0.003***	0.030	0.039
	[0.001]	[0.001]	[0.001]	(0.061)	(0.059)	[0.001]	[0.001]	[0.001]	(0.027)	(0.036)
Observations	348,404	341,084	341,084	341,084	341,084	190,645	184,684	184,684	184,684	184,684
R-squared	0.000	0.026	0.026	0.007	0.013	0.000	0.016	0.016	0.010	0.008
1st F-test				8.734	13.103				29.937	22.163
1st P-value				0.003	0.000				0.000	0.000
1st partial R2				0.000	0.000				0.001	0.001
Hansen J p value				0.000	0.000				0.000	0.000
Individual and Household Controls	X	X	X	X	X	X	X	X	X	X
District and Time FE		X	X	X	X		X	X	X	X
Remittance Amount and Remittances Sq.			X		X			X		X
Instrument				X	X				X	X

Source: Author's calculations.

Table B.4: Impact of external migrant on investment decisions, by gender of household head

	Female-Headed Households					Male-Headed Households				
Dependent **Variable**	**Property**									
	OLS Simple controls	OLS + FE	OLS + remitt	IV	IV+ remitt	OLS Simple controls	OLS + FE	OLS + remitt	IV	IV+ remi
Dummy = 1 if Overseas Migrant is Present in Household	0.004**	0.002	0.002	0.027	0.041	0.001***	0.001	0.001	0.071	0.059*
	[0.002]	[0.001]	[0.002]	(0.029)	(0.043)	[0.000]	[0.001]	[0.001]	(0.048)	(0.034)
Observations	39,385	37,799	37,799	37,799	37,799	499,664	487,969	487,969	487,969	487,96
R-squared	0.001	0.017	0.017	-0.007	-0.021	0.000	0.005	0.005	-0.160	-0.078
1st F-test				44.520	31.187				4.103	8.229
1st P-value				0.000	0.000				0.043	0.004
1st partial R2				0.006	0.004				0.000	0.000
Hansen J p value				0.000	0.000				0.000	0.000
Dependent Variable	**Bank Deposits**									
Dummy = 1 if Overseas Migrant is Present in Household	0.000	0.001	0.001	-0.019	-0.029	0.001***	0.001*	0.001	0.034	0.028
	[0.001]	[0.001]	[0.001]	(0.014)	(0.020)	[0.000]	[0.000]	[0.000]	(0.025)	(0.018)
Observations	39,385	37,799	37,799	37,799	37,799	499,664	487,969	487,969	487,969	487,969
R-squared	0.000	0.011	0.011	-0.005	-0.014	0.000	0.002	0.002	-0.063	-0.030
1st F-test				44.520	31.187				4.103	8.229

1st P-value				0.000	0.000				0.043	0.004
1st partial R2				0.006	0.004				0.000	0.000
Hansen J p value				0.000	0.000				0.000	0.000
Dependent Variable	**Livestock, Poultry, Fishery and Forestry**									
Dummy = 1 if Overseas Migrant is Present in Household	0.159	-0.173	-0.050	7.371	11.034	0.748***	-0.542	-0.372	78.504	64.327*
	[0.124]	[0.127]	[0.125]	(4.733)	(7.049)	[0.124]	[0.342]	[0.334]	(49.442)	(32.985)
Observations	39,385	37,799	37,799	37,799	37,799	499,664	487,969	487,969	487,969	487,969
R-squared	0.000	0.123	0.125	-0.234	-0.433	0.000	0.070	0.070	-2.613	-1.262
1st F-test				44.520	31.187				4.103	8.229
1st P-value				0.000	0.000				0.043	0.004
1st partial R2				0.006	0.004				0.000	0.000
Hansen J p value				0.000	0.000				0.000	0.000
Individual and Household Controls	X	X	X	X	X	X	X	X	X	X
District and Time FE		X	X	X	X		X	X	X	X
Remittance Amount and Remittances Sq.			X		X			X		X
Instrument				X	X				X	X

Source: Author's calculations.

Appendix F

Unrestricted fractional polynomial comparisons: (Fitting 44 models)

Dependent Variable: Dummy=1 if Overseas migrant is Present in Household		
Amount of Remittances	deviance	P-value
omitted	191261.04	7458.092
Linear	183648.21	-154.733
m=1	182876.26	-929.683
m=2	183802.95	0
Number of Observations		539049
F-Statistics		526.36

(*) P = sig. level of model with m = 2 based on F with 539043 denominators' degree of freedom.

Restricted fractional polynomial comparisons (higher order of dimension 4): Fitting 494 Models)

Dependent Variable: Dummy=1 if Overseas migrant is Present in Household		
Amount of Remittances	deviance	P-value
omitted	191261.04	7458.092
Linear	183648.21	-154.733
m=1	182876.26	-929.683
m=2	183802.95	0.00
m=3	145166.54	XX
m=4		-

(*) P = sig. level of model with m = 4 based on F with 539042 denominator degrees of freedom.
Model comparison test xx could not be performed. The VCE of model with m = 4 is not of sufficient rank to perform test xx. This is due to numerical instability. Try specifying scale.

Note: We compare two models, the first being the unrestricted model (without imposing a specific polynomial order) that reports the results for the highest-order polynomial after fitting 44 models. All combinations of powers are fitted and the best-fitting model is found based on the minimum deviance criteria. The results show that the best model with minimum deviance is where highest-order polynomial for the remittance variable is -2. In comparison, when we restrict the model to the highest order of power 4 (second model), the final results do not change and we see that that minimum deviance is achieved where remittance is included with the highest order of power -2 and not higher than that. On dealing with higher-order polynomials for remittance manually, stata fails to provide results for the coefficient of migration.

Appendix G: Robustness checks

Table A.1 Estimating the impact of external migration on labor market activity and investment decisions using different IVs

Instrument: Weighted Average of Nighttime Light Intensity * Number of Adult Males										
	Self-employed	**employer**	**laborer**	**Unpaid family work**	**unemployed**	**rents**	**Interest & profits**	**Livestock & fishery**	**Own agricultural land**	**Total agricultural land owned in acres**
Dummy = 1 if Overseas Migrant is Present in Household	-1.560***	-0.157**	-0.364	1.031***	0.940***	0.001	0.035	-0.026	-0.311	-25.011
	(0.498)	(0.071)	(0.233)	(0.323)	(0.296)	(0.034)	(0.030)	(0.058)	(0.402)	(48.836)
Observations	525,768	525,768	525,768	525,768	525,768	525,768	525,768	525,768	525,768	525,768
R-squared	-1.551	-0.354	0.119	-1.241	-1.359	0.005	-0.046	0.021	0.225	-0.157
1st F-test	11.015	11.015	11.015	11.015	11.015	11.015	11.015	11.015	11.015	11.015
1st p-value	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
1st partial R2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Source: Author's calculations.

Table A.2 Estimating the impact of external migration on labor market activity and investment decisions using different IVs

Instrument: Historic Migration Rates * Number of Adult Males										
	Self-employed	**employer**	**laborer**	**Unpaid family work**	**unemployed**	**rents**	**Interest & profits**	**Livestock & fishery**	**Own agricultural land**	**Total agricultural land owned in acres**
Dummy = 1 if Overseas Migrant is Present in Household	0.737	0.073	-2.225	-1.183	-1.065	0.132	0.111	0.159	3.585	106.998*
	(0.747)	(0.114)	(1.804)	(0.982)	(0.875)	(0.120)	(0.102)	(0.198)	(2.956)	(58.916)
Observations	525,062	525,062	525,062	525,062	525,062	525,062	525,062	525,062	525,062	525,062
R-squared	-0.278	-0.075	-2.046	-1.675	-1.848	-0.427	-0.492	-0.041	-2.700	-5.746
1st F-test	1.682	1.682	1.682	1.682	1.682	1.682	1.682	1.682	1.682	4.026
1st p-value	0.195	0.195	0.195	0.195	0.195	0.195	0.195	0.195	0.195	0.045
1st partial R2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Source: Author's calculations.

Table A.3 Estimating the impact of external migration on labor market activity and investment decisions using the new instrument without the survey year 2008

Without year 2008										
	Self-employed	**employer**	**laborer**	**Unpaid family work**	**unemployed**	**rents**	**Interest & profits**	**Livestock & fishery**	**Own agricultural land**	**Total agricultural land owned in acres**
Dummy = 1 if Overseas Migrant is Present in Household	1.056**	0.139**	-0.663*	-0.004	-0.650**	0.089*	0.010	0.113	1.382*	48.759**
	(0.476)	(0.068)	(0.345)	(0.122)	(0.287)	(0.050)	(0.024)	(0.078)	(0.754)	(21.746)
Observations	480,865	480,865	480,865	480,865	480,865	480,865	480,865	480,865	480,865	480,865
R-squared	-0.510	-0.220	0.028	0.063	-0.529	-0.150	-0.001	-0.000	-0.077	-1.985
1st F-test	6.574	6.574	6.574	6.574	6.574	6.574	6.574	6.574	6.574	6.574
1st p-value	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
1st partial R2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Source: Author's calculations.

Table A.4 Estimating the impact of external migration on labor market activity and investment decisions controlling for the cross-products of the interacted terms and the individual interacted terms in first and second Stage

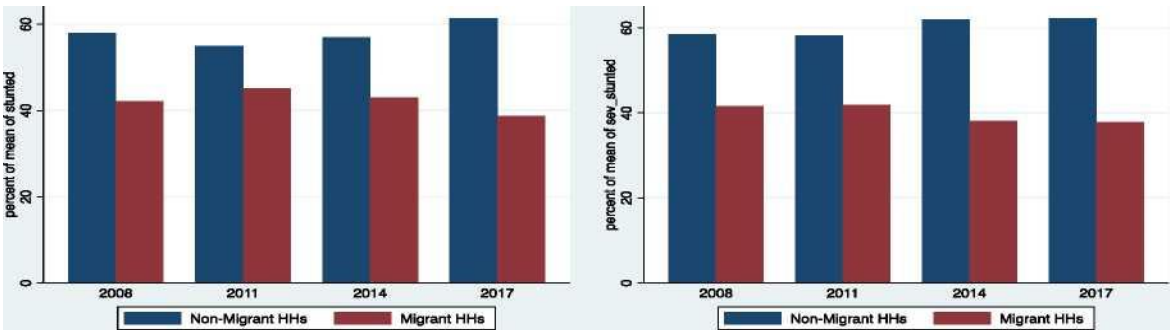
	Self-employed	employer	laborer	Unpaid family work	unemployed	rents	Interest & profits	Livestock & fishery	Own agricultural land	Total agricultural land owned in acres
Instrument : Historic Migration rates* weighted average of deviation of Night Light intensity from mean*Number of Adult males (cross products controlled as separate terms in the first and second stage										
Dummy = 1 if Overseas Migrant is Present in Household	-0.151	0.045	-0.052	0.136*	-0.003	0.014	-0.020	0.077	-0.104	-8.637
	(0.141)	(0.036)	(0.162)	(0.080)	(0.074)	(0.026)	(0.017)	(0.050)	(0.336)	(17.869)
Observations	525,768	525,768	525,768	525,768	525,768	525,768	525,768	525,768	525,768	525,768
R-squared	0.098	-0.028	0.177	0.040	0.074	0.001	-0.015	0.010	0.251	0.045
1st F-test	13.119	13.119	13.119	13.119	13.119	13.119	13.119	13.119	13.119	13.119
1st p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1st partial R2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Source: Author's calculations.

Appendices related to Paper 3

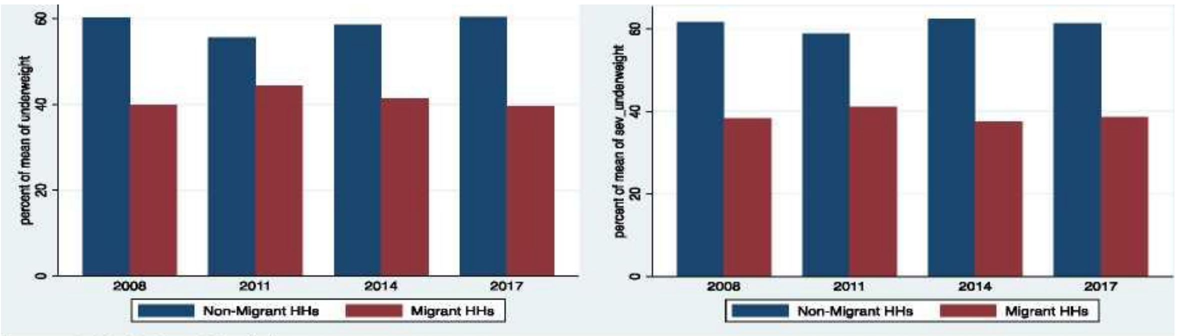
Appendix A

Figure A1: Percentage of stunted and severely stunted children (age 5 years and less) in migrant and non-migrant HHs by data year



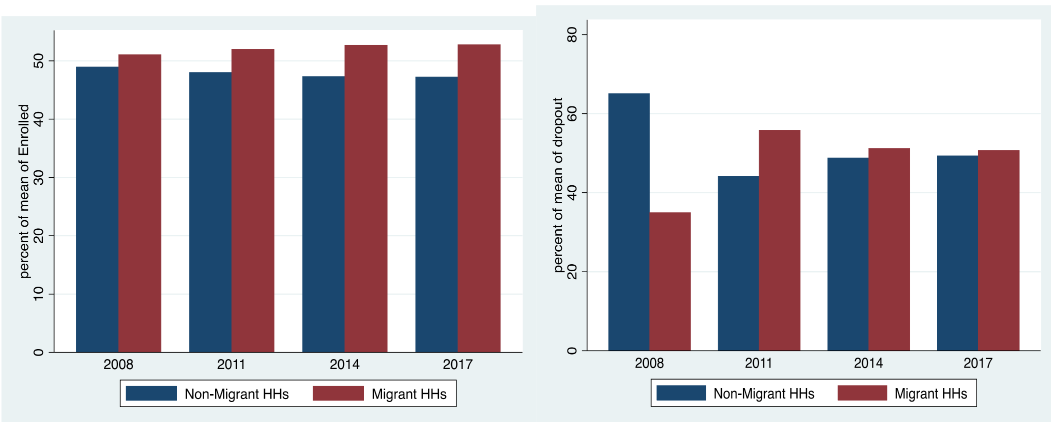
Source: Author's Own Calculations.

Figure A2: Percentage of Underweight and Severe Underweight Children (Age 5 years and less) in Migrant and Non-migrant HHs by data year



Source: Author's Own Calculations.

Figure A3: Percentage of children enrolled and dropouts (age 5-17 years) in migrant and non-migrant HHs by data year



Source: Authors' own calculations.

Appendix B

Table B1: IV Results for Measuring the Impact of Caregiver Emigration on Health Outcomes by Data Year

	Year 2008				Year 2011			
	stunted	severely stunted	underweight	severely underweight	stunted	severely stunted	underweight	severely underweight
Dummy=1 in a migrant sending household	-0.047	0.151	-0.524**	-0.105	0.092	0.062	-0.075	0.053
	(0.231)	(0.191)	(0.237)	(0.136)	(0.095)	(0.067)	(0.087)	(0.056)
Observations	9,455	9,455	9,870	9,870	46,622	46,622	47,151	47,151
R-squared	0.060	0.031	-0.013	0.022	0.084	0.056	0.060	0.037
1st F test	6.961	4.280	7.337	4.202	48.770	24.965	30.665	17.569
1st p value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1st partial R2	0.060	0.031	-0.013	0.022	0.084	0.056	0.060	0.037
Hansen J0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	year2014				**year2017**			
	stunted	severely stunted	underweight	severely underweight	stunted	severely stunted	underweight	severely underweight
Dummy=1 in a migrant sending household	0.303**	0.123	0.077	0.108	0.234	0.205	-0.106	0.025
	(0.133)	(0.094)	(0.132)	(0.083)	(0.257)	(0.179)	(0.195)	(0.112)
Observations	20,136	20,136	20,312	20,312	29,378	29,378	29,616	29,616
R-squared	0.076	0.059	0.066	0.035	0.055	0.009	0.041	0.024
1st F test	28.073	13.772	17.101	9.902	26.840	11.014	13.422	6.646
1st p value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1st partial R2	0.076	0.059	0.066	0.035	0.055	0.009	0.041	0.024
Hansen J0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

***p<0.01, **p<0.05, *p<0.1. Source: Author's own calculations.

Table B2: IV Results for Measuring the Impact of Emigration of the Caregiver on the Schooling outcomes by Data Year

	Year 2008			year 2011		
Dummy=1 if Child is from a HH if Caregiver has Migrated	Enrolled	Level of education	dropout	Enrolled	Level of education	dropout
	0.232***	0.022	-0.049***	-0.396	-1.030	0.133
	(0.067)	(0.157)	(0.010)	(0.410)	(0.806)	(0.088)
Observations	143,452	144,016	186,993	153,607	153,607	153,607
R-squared	0.190	0.440	-0.023	0.154	0.209	-0.104
1st F test	91.325	91.189	92.078	4.498	4.498	4.498
1 st p value	0.000	0.000	0.000	0.034	0.034	0.034
1st partial R2	0.006	0.006	0.006	0.000	0.000	0.000
Hansen J0	0.000	0.000	0.000	0.000	0.000	0.000
	year 2014			year 2017		
Dummy=1 if Child is from a HH if Caregiver has Migrated	Enrolled	Level of education	dropout	Enrolled	Level of education	dropout
	-0.174	-0.184	-0.019	-0.573	-6.352	0.724
	(0.153)	(0.273)	(0.030)	(2.241)	(16.353)	(1.869)
Observations	61,362	61,362	61,362	83,902	83,902	83,902
R-squared	0.224	0.308	0.017	0.064	-2.560	-1.741
1st F test	27.199	27.199	27.199	0.159	0.159	0.159
1 st p value	0.000	0.000	0.000	0.690	0.690	0.690
1st partial R2	0.004	0.004	0.004	0.000	0.000	0.000
Hansen J0	0.000	0.000	0.000	0.000	0.000	0.000

***p<0.01, **p<0.05, *p<0.1. Source: Author's own calculations.

Appendix C

Dependent Variable: Weight For Age Z-Scores	
Fitted values (Mother's empowerment)	1.872***
	(0.674)
V (predicted error term from First-Stage)	0.00648
	(0.00517)
Constant	-6.392***
	(2.211)
Observations	4,604
R-squared	0.265
F-test	10.489

Author's Caluclations.

Note: The test attempts to identify if the instrument is valid such that Cov (instrument, error from the first-stage)=0 and Cov (instrument, First-stage Dependent variable)≠0)

We cannot observe error from the first-stage, therefore as step 1 we predict the error (v) after controlling for the instrument and other control variables in the system.

Step 2- we estimate the predicted value of dependent variable from the first stage and control it in the second stage with all the other control variables as well as the predicted error from the first stage.

Step3- If the predicted error term from the first stage is uncorrelated with the dependent variable in second stage, the null that X is exogenous i.e., H0: α=0 is validated.

The coefficient associated with the Mother's empowerment under this setting can be different from the results reported in the final results reported in the paper, since the entire procedure is done manually, after running first and second stages separately and specification controls for and extra term v (predicted error from the first stage).

Appendices related to Paper 3

Table C1: Robustness checks

Second-stage results with different cutoffs

Dependent Variable: WFA	Age cut off at 50 years	Age cutoff at 55 years	Age cut off at 60 years	Age cut off at 65 years	Age cut off at 70 years
Presence of Grandmother in a HH	0.0909**	0.0984**	0.121*	2.519	0.0288
	(0.0394)	(0.0451)	(0.0726)	(4.277)	(0.0972)
Observations	99,218	99,218	99,218	99,218	99,218
R-squared	0.114	0.114	0.114	0.001	0.114

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1