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Abstract

We follow 3,512 (of 1.4 million) applicants to a government lottery that randomly allocated visas to Bangladeshis for low-skilled, temporary labor contracts in Malaysia. Most lottery winners migrate, and their remittance substantially raises their family's standard of living in Bangladesh. The migrant's absence pauses demographic changes (marriage, childbirth, household formation), and shifts decision-making power towards females. Migration removes enterprising individuals, lowering household entrepreneurship, but does not crowd out other family members' labor supply. One group of applicants were offered deferred migration that never materialized. Improved migration prospects induce pre-migration investments in skills that generate no returns in the domestic market.

Keywords: government-intermediated international migration

JEL Codes: F22, O12, O15

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1 Introduction

3.5 percent of the world's population, currently live outside their country of birth (UNDESA, 2019). This reflects a 50% increase in the number of international migrants since 2000. They remitted $689 billion back to their home countries in 2018 (World Bank, 2019). That makes remittance the most important international financial flow into developing countries, triple the size of Official Development Assistance, and easily surpassing any reasonable estimate of the gains to removing all trade barriers. Migration contributed an estimated 9.4% of global GDP in 2015 (McKinsey, 2016). Remittances accounted for 29% of GDP in Kyrgyz Republic and Tajikistan, 27% in Nepal, and 6% in Bangladesh in 2019 (World Bank, 2021).

We report on an experiment in which the Government of Bangladesh allocated work visas in Malaysia via lottery. Migration is a popular livelihood strategy in South Asia, and 10% of the Bangladeshi male labor force works abroad (Das et al., 2018). 1.43 million Bangladeshis applied when Malaysia offered 30,000 work visas through an agreement with the Bangladesh government, which necessitated the lottery. The typical job contract was for semi-skilled work at palm oil plantations. Male migrants traveled alone on temporary contracts. We tracked down the families of a random sample of 3,512 lottery winners and losers from across Bangladesh five years after the lottery. Our sampling frame comprised three largest (of the eight) divisions of Bangladesh, which houses 57% of the country's population.

We estimate the returns to migration in an especially consequential context. South Asians moving temporarily to richer nations in Asia is one of the most popular global migration corridors. Of the 270 million migrants in the world, over 31 million are South Asians living in Asia (UNDESA, 2019). Bangladesh alone supplies almost 7 million migrants to other Asian countries. Malaysia was the fourth largest source of remittances flowing into Bangladesh during 2014-2019 (Bangladesh Bank, 2019). Our results are therefore representative of an important migration corridor. If we are to make confident inferences about the global economic effects of migration, we must investigate how South Asians fare when a family member travels to richer Asian nations.

International migration takes many forms around the world - some migrate permanently to high-income nations on the strength of their skills or employer sponsorship, others cross borders illegally with the intention to stay temporarily. Sponsored migration offers paths to residency in some countries, and in such cases workers often travel with spouse and children, expecting to stay at the destination long-term. In most countries, temporary work permits do not offer any legal path to citizenship, and workers often travel alone for a pre-specified contract period. Migrants will obviously share and remit differently if their nuclear family is left behind, and if they expect to return (Ashraf et al. 2014). There is therefore no one single estimate of returns to migration that would apply globally, and rigorous studies (e.g. Clemens and Tiongson, 2017; Gibson et al., 2010) have produced vastly different estimates. Even within temporary labor contracts, how the connection between employees and employers are mediated matter. Unscrupulous middlemen tempt desperate migrants with fraudulent opportunities and many migrants suffer large losses (Das et al., 2018).

The Bangladesh-Malaysia program we study is representative of the most common form of global migration: temporary work visas where unskilled and semi-skilled workers travel alone. Such contracts account for the lion's share of cross-border movements around the world. Over 25 million South Asian migrants work under such conditions in richer Asian nations. 45% of all Singapore residents and 88% of UAE residents at any given moment are foreign-born. The sheer volume of migration opportunities these countries provide contribute more to South Asian development than OECD economies do. However, these migrants have limited rights, working under arrangements that often puts them in precarious positions.

Against that backdrop, we study an innovative Government-to-Government (G2G) migration facilitation program with the potential to address several market failures present in private sector intermediation that create such vulnerabilities. First, migration is a complex undertaking (requires procuring a lot of hard-to-obtain paperwork, passports, visas, medical checks), and low-skilled, semi-literate workers are dependent on expensive intermediation services (ILO 2015). Credit constrained workers are forced to enter complex arrangements with middlemen and employers, in which wages are withheld to pay back fees. Given the asymmetric power dynamic, low-skilled migrants are exploited by unscrupulous agencies (UNODC 2015). Second, visas are often tied to a specific employer, transitions are not allowed, and the workers' passports are confiscated by employers as security. This gives employers monopsony power over migrant workers (Naidu et al. 2016). Female migrants working inside the homes of private employers are especially vulnerable (Beaubien 2019). Third, migration is risky. 34% of aspiring Bangladeshi migrants fail to find work abroad, and over half of these are due to fraudulent middlemen (Das et al. 2018). The loss associated with failure - US$ 818 on average - is especially difficult for low-skilled workers to bear, and insurance of a government-mediated connection may be useful. Fourth, there are over 900 recruitment agencies in the market of highly variable quality. Some falsify documents, don't provide legally mandated training and support abroad, and low-skilled migrants are not well informed about the quality of specific agencies. Beyond the risks of fraud, exploitation, and migration failure, there is also no guarantee that migrants would (be able to) save and remit enough to contribute to poverty reduction back home, or make their families better off *on net*, given the loans they have to incur to pay for high transport costs and intermediation fees, as well as any adverse social effects stemming from extended family separation and potential absence of a parent. Conducting rigorous evaluation of the full range of effects of (this very common form of) international migration is therefore critical.

In fact, Malaysia instituted a ban on migration from Bangladesh in 2009 citing recruitment malpractices in both countries, and the G2G mechanism we are studying was initiated to resume that migration flow. The program lowered intermediation fees to US$400 per migrant from the $3000-$4000 that were being charged by private recruiters prior to the ban (Wickramasekara 2016). Given the potential for G2G mechanisms to improve migration flows in a world where the inefficient spatial distribution of labor imposes trillion dollar costs on the global economy (Clemens 2011), this experimental evaluation of a G2G program has important implications for future policy design in many countries. Many countries, including

Australia, New Zealand, large hosts of migrants in the Gulf, have moved towards institutionalizing bilateral labor agreements where governments participate more intensively in the recruitment of workers. G2G arrangements regulate migration into South Korea from over 16 countries (Cho et al., 2018). A prominent early example of a G2G agreement is the 1961 'guest worker' program negotiated between the West German and Turkish governments that brought over 650,000 Turkish workers to Germany over the next 15 years. The program was replicated by other western European nations, which led to another 135,000 Turks emigrating to France, Austria, Netherlands and Belgium over that same period (Palut, 2020).

76% of the Malaysian visa lottery winners in our sample had migrated internationally by the time of our survey, compared to 19% of the lottery losers who form our control group. Quite unlike the New Zealand visa lottery studied by Gibson et al. (2010), our estimates show that winning the Malaysian lottery doubled household income in Bangladesh, and this is driven entirely by a large increase in the migrant's earnings in Malaysia and the remittance he sends back. This increases per-capita consumption and land and housing investments back home, and lowers poverty and indebtedness. Our estimates provide a well-identified, micro-data based foundation to the results found from analysis of macroeconomic data (e.g. Clemens 2011, Ashenfelter 2012, Benhabib and Jovanovic 2012), which report potential income gains that are several multiples of home income.

Beyond the direct economic impact, winning the visa lottery also produces important demographic changes. The migrant's absence delays his marriage, childbirth, and pauses new family formation. Among married migrants, there are drastic improvements in the participation of women on various aspects of household decision-making (similar to Clemens and Tiongson 2017), especially when the migrant's father is not living in that household.

Some other economic changes are a little surprising. Despite the sharp rise in household income, the other non-migrant members of the family do not change their labor supply.[1]

[1] The literature finds mixed evidence on such spillovers (see Amuedo-Dorantes and Pozo, 2006; Binzel and Assaad, 2011; Grigorian and Melkonyan, 2011; Kim, 2007; Mendola and Carletto, 2009; Mu and Van de Walle, 2011; Shrestha, 2017*a*).

Winning the visa lottery keeps household economic activities unchanged in most dimensions, except that it *lowers* the family's participation in non-farm entrepreneurial activities in Bangladesh. The migrant's departure removes the most enterprising member of the family who would have been that entrepreneur had he stayed home.

A program implementation quirk also allows us to estimate the effects of improved migration *prospects* on pre-departure investments in formal skills and language skills, as well as the returns to that investment in either the Malaysian or the domestic labor market. A (random) group of lottery winners were promised deferred intermediation, but many of them were ultimately not given visas due to administrative constraints. Like other winners, this group invests in the required vocational training, language training, and also in their own physical fitness to prepare for the trip abroad. When those applicants got stuck at home, these investments produced no returns in the domestic labor market.

2 Related Literature

Our research is related to the very large literature that estimates the returns to migration, but has to grapple with difficult selection issues (Akee 2010, Grogger and Hanson 2011, Gibson et al. 2013). Review papers by McKenzie and Yang (2010) and McKenzie (2012) cite studies that exploit exogenous variation in immigration policies to study the effects of international migration (such as Clemens 2010, Dinkelman and Mariotti 2016, Kusunose and Rignall 2018). Others make use of a variety of other non-experimental methodologies, including controls for observables, selection correction methods (Barham and Boucher 1998), matching (McKenzie et al. 2010), instrumental variables (Brown and Leeves 2007, Mckenzie and Rapoport 2007, Yang 2008, Macours and Vakis 2010), panel data techniques (Beegle et al. 2011), and natural policy experiments (Clemens and Tiongson 2017).

The positive effects of the visa lottery that we document stand in sharp contrast to Gibson et al. (2010)'s estimates of the adverse effects of winning a New Zealand migration lottery program on the family members of Tongan emigrants who remain behind. That study is the closest to ours in terms of research design and rigor, but their setting is very different. That program only takes 250 Tongans per year, which allows New Zealand to permit migrants to travel with their spouse and children. Therefore any effects measured in Tonga are on more distant household members, who naturally would not share in as much of the gains from migration. In contrast, we study migration from a large country that supplies millions of migrants, using a sampling frame that covers the majority of the 1.43 million program applicants. The program we study typifies the most common form of labor migration in the world: Male migrants travel alone on temporary contracts, and remit money back home to their nuclear family. It is then not at all surprising that our effects look very different. The positive effects we document are more reminiscent of the effects found for New Zealand's seasonal worker program on development in Tonga and Vanuatu, evaluated by Gibson and McKenzie (2014) using a propensity score matched difference-in-differences method.

Clemens and Tiongson (2017) study a G2G program using a regression discontinuity (RD) design around Filipino migrants' performance on a Korean language test. They also find that consumption increases with migration, but unlike us, do not observe household income increases that can rationalize the large cross-country gap in wages observed in macroeconomic data (Clemens et al. 2018). The difference may arise due to differences in the sample and identifying variation. Applying to the Korean employment scheme required a high school degree, work experience, and Korean language ability, and focuses on a set of applicants who invested in learning Korean, but performed marginally on the language test. In contrast, the Malaysia program had minimal requirements (only 2.5% of lottery winners were disqualified through medical screening) and drew applicants from every district in Bangladesh. We provide pure experimental estimates that apply to the entire distribution of applicants. Beyond the big differences in sampling frames, our actual sample size is about 5-10 times larger than all aforementioned evaluations, and this allows us to provide statistically precise, robust estimates even after correcting standard errors for multiple hypothesis testing, or any bias stemming from attrition or survey non-completion.

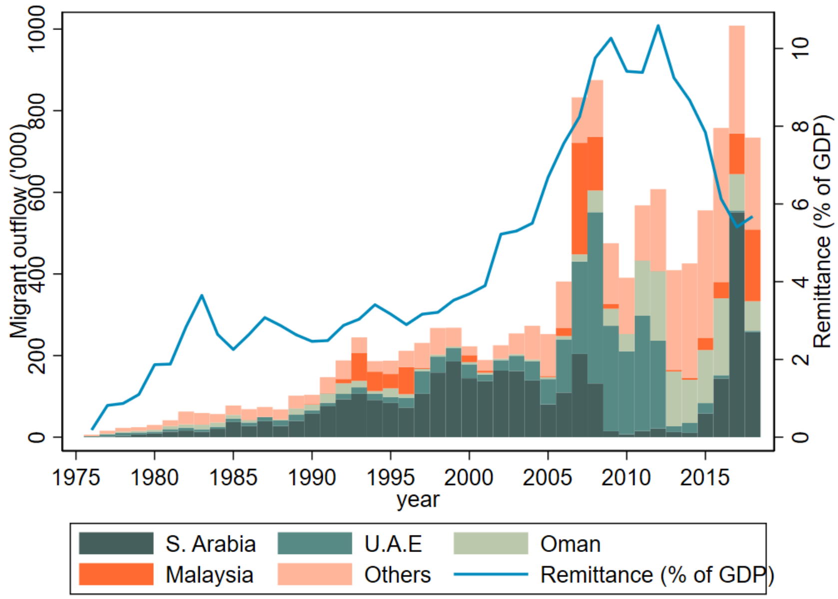
We report on demographic outcomes that connect to the literature on the broader socio-demographic effects of migration on children, health and family (Alcaraz et al. 2012, Edwards and Ureta 2003, Yang 2008, Giannelli and Mangiavacchi 2010), which is well summarized by Antman (2013). Our results on skill acquisition prior to travel contributes to the debate on brain-gain and brain-drain (Docquier et al., 2008; Beine et al., 2008; Batista et al., 2012; Shrestha, 2017*b*; Abarcar et al., 2020; Chand and Clemens, 2019; Khanna and Morales, 2017). Our study adds to this literature in two ways: we find evidence of skills acquisition even for low-skilled migration opportunities, and we document an investment response in different dimensions of skill, including developing physical strength, and investing in health, language, and vocational skills.

3 Context: Bangladesh-Malaysia G2G Program

The annual outflow of low-skilled temporary workers from Bangladesh has increased from about 0.2 million workers in 2000 to well over 0.5 million in recent years (Figure 1). Historically, Saudi Arabia, UAE, Oman, Malaysia, Qatar and Singapore have been the most popular destinations.

Remittances sent by these workers have become an important source of national income. Between 2000 and 2017, remittance inflows increased almost seven-fold. At its peak, between 2008 and 2012, remittances made up one-tenth of the national GDP. In 2015, Bangladesh was the 10th largest remittance-receiving country globally. Remittances from workers abroad have been one of the key drivers of poverty reduction, and they continue to be a large share of household income for poorer households (Hill and Endara, 2016; World Bank, 2013, 2015).

Figure 1: Migrant outflow for low-skilled work and remittance receipt



Source: BMET (2019) and World Development Indicators (2019).
Note: Figure shows annual outflows of low-skilled migrant workers from Bangladesh to the major destination countries (left axis) and the annual remittances inflow as a share of GDP (right axis).

3.1 The G2G Program

Migration recruitment agencies in Bangladesh employ an extensive chain of middlemen (dalals) to identify aspiring migrants, provide documentation services, and then place workers in jobs abroad. This is a complex undertaking: a worker seeking to migrate must procure a national identity certificate, their birth certificate, a passport, bank account, contract, visa, a smart card containing identity documents, and a medical checkup; this list is not exhaustive (ILO 2015). Lower skilled workers are more dependent on the services of middlemen and end up paying a higher fraction of their expected income for these services (UNODC 2015). The cost of private intermediation in Bangladesh are estimated to exceed $4500, which is over 3 times the GDP per-capita (World Bank, 2013; Farole et al., 2017). Most migrants borrow, often at high interest rates, to finance the high costs of migration. High indebtedness combined with fraudulent recruitment practices make migrants vulnerable to long-term indebtedness and further exploitation.

The government-to-government (G2G) recruitment system arose in response to concerns about various forms of abuse associated with private intermediation services (Wickramasekara, 2016), which led to a ban on recruitment of Bangladeshi workers to Malaysia in 2009. The governments of Bangladesh and Malaysia signed a memorandum of understanding in 2012 which lifted this ban, and introduced a new system in which labor recruitment is handled directly by government agencies. Malaysia offered temporary visas of 2-3 year duration for low-skilled manual work, where the migrants would travel alone without family.

The Bureau of Manpower, Employment and Training (BMET) in Bangladesh advertised the new migration opportunities in local newspapers, and started registering interested workers in January 2013 through 4,529 rural Union Information and Service Centers (UISCs). To be eligible, the applicant had to be male, aged between 18 and 45, at least 5 feet tall, at least 50kg or more in weight, and able to lift a weight of 20kg or more.[2] There was a small fee of BDT 50-100 (USD 0.66-1.30) to register the application.

During the two-week registration process, BMET registered 1.43 million applicants from all over rural Bangladesh. However, Malaysia had only offered a maximum of 30,000 visas. To create a fair process, BMET implemented a randomized lottery in February 2013 through a third-party - the Bangladesh University of Engineering and Technology, and drew 36,038 winning names. The probability of selection was proportional to the size of the *upazila* (subdistrict) population of the applicant.

A second lottery was conducted to split the 36,038 winners into three phases. First phase winners would be recruited immediately. The second lottery resulted in 11,758 phase-1 winners, 11,704 phase-2 winners and 12,576 phase-3 winners. All winners were notified by SMS and phase-1 winners were required to undergo a medical screening plus a 10-day training. In March 2013, BMET began sending information on potential workers to the Malaysian government and by April 2013 had already sent information on 8,500 phase-1

[2]Other eligibility criteria included basic knowledge of Malaysian culture and social life, the ability to communicate either in English or Malay, no prior criminal record, valid travel documents, and Malaysian medical fitness requirements

workers. Workers selected by the Malaysian government would then begin the migration process. We provide more details about the process in Appendix A.

4 Data and empirical strategy

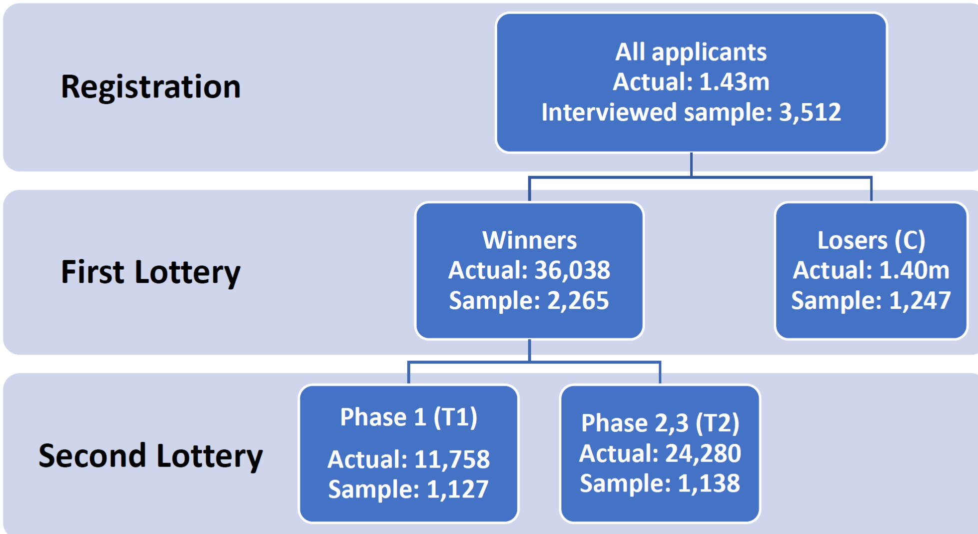
We conducted 3,512 in-depth household interviews with G2G applicants between August and December of 2018, roughly five years after program inception. We refer to the Phase 1 lottery winners who won the lottery to migrate and were put in the first phase of intermediation as **T1**. We create a joint group of Phase 2 and Phase 3 winners, who won the lottery to migrate but were put into a deferred phase of intermediation, and call them **T2**. Eventually, this group only received partial (low rates of) intermediation. The lottery losers, referred to as **C**, serve as the control group. The majority of our analysis will compare **T1** to **C**. Figure 2 shows the various steps of the lottery program and the final study sample.

The survey included detailed modules on the migration, labor and earnings of all household members including the applicant and any other migrant members of the household. Interviews were conducted with the applicants themselves if they were present, or with a knowledgeable household member if the applicant was not present. The survey also had modules on household consumption, enterprises, housing and assets, debt position, and female decision-making of the household in Bangladesh. We also collected data on applicant and household characteristics that are unlikely to vary over time, as well as retrospective data on some pre-lottery outcomes.

4.1 Data collection

Phase 1 winners (group T1) were thinly spread across Bangladesh. BMET limited the number of Phase 1 winners in each village to at most one applicant. Unions, which typically have about 6,000 households from a few villages, had an average of two Phase 1 winners. To manage the geographic scope of data collection efforts within our budget, we limited

Figure 2: Stages of lottery and study design



Note: The Figure shows the various stages of the lottery program and the study design.

the survey to Dhaka, Mymensingh, and Chittagong Divisions.[3] These divisions housed 53 percent of Bangladesh's population in 2011, including 48 percent of the rural population (BBS, 2015). 38 percent of all lottery applicants and 50 percent of lottery winners come from these divisions. They include the most densely populated and prosperous divisions of Bangladesh. We randomly selected 49 of 223 upazilas from these divisions.[4] The survey was conducted in all 522 unions within the selected 49 upazilas.

Sampling strategy and field protocols

The relative scarcity of T1 households and the nature of available administrative data guided our sampling and field protocols. We received administrative data from BMET in two separate extracts. The first extract was for the lottery losers (group C) which included information on the applicants' names, their parents' names, phone numbers, and the name of the union they live in. The second extract was the published data on lottery winners

[3]The Mymensingh Division was formed in 2015, after the G2G lottery program, by splitting off the northern districts of the Dhaka Division.

[4]The data extract we received from BMET had data from applicants in 223 of 258 upazilas. The discrepancy could be a result of the lottery not collecting data from upazilas with very high urban penetration.

(groups T1 and T2) which contained the same information, but did not include a phone number for everyone. We were able to get matched phone numbers for groups T1 and T2 from BMET only for 76 percent of group T1 and 16 percent of group T2.

To deal with this asymmetry in information, we opted for a combination of phone and field-based tracking of respondents. In each of the sampled unions, enumerators were instructed to find all the T1 individuals. Applicants in the T2 and control groups were randomly ordered, and enumerators were instructed to follow that order in their search for respondents. Enumerators would keep going down the randomized order until the number of successful interviews in that group (T2 or control) matched the number of successful interviews in the T1 group. This way, the final survey would have similar sample sizes across treatment groups within each union.

To find the respondents in a sampled union, enumerators first tried calling the applicants for whom we had phone numbers. Each applicant would be called up to five times over the course of several days. If somebody picked up the phone, we also asked if they knew the phone numbers of anyone else who won the lottery. We searched for lottery applicants not reachable by phone through physical visits to their union and village. Enumerators used all available information to locate respondents, including consulting with union officials and asking local residents.

Survey finding rates

With this protocol, we were able to interview 3,512 lottery applicants, of which 1,127 in group T1, 1,138 in group T2, and 1,247 lottery losers in our control group. We conducted interviews with the applicants themselves if they were present, or with knowledgeable family members if they were absent. However, the finding rate for respondents varied by treatment status. We found 94 percent of the T1 applicants we searched for, 69 percent of T2 applicants, and 68 percent of the control group.

Given the scant information we had to locate lottery participants, the finding rate of the control group (68 percent) is quite high. For reference, Clemens and Tiongson (2017) was able to locate and interview only 44 percent of applicants in their Philippines-Korea migration study. The extensive field engagement of the enumerators and, perhaps, the rural setting of Bangladesh, where villagers tend to know about each other, led to the high finding rate in our study.

A few factors explain the almost universal finding rate of T1 households. First, phase 1 lottery winners were required to interact with local officials to prepare for government intermediation, so local officials were likely to know of them or have updated contact information. Second, winning the lottery made them well-known in the communities. Third, given the status conferred by international migration in rural Bangladesh, other villagers are more likely to know the whereabouts of migrant families.

This, unfortunately, creates a differential finding rate of 26 percentage points between treatment and control, which can complicate inference. The differential rate mostly reflects the details of program administration rather than any differences in some underlying economic characteristics. We try to be careful and use insights from the literature on differential attrition (eg. Lee, 2009; Behaghel et al., 2015) in Appendix B and section 8 to investigate how the differential finding rates can affect interpretation. We limit the main empirical inferences and statements we make to ones that are robust under a broad set of reasonable assumptions.

Comparison of the sample with the population

While our sample strategy yields a representative sample of the lottery applicants, the applicants themselves are non-randomly selected from the population. Those households must have a member who satisfies the eligibility criteria, and is interested and able to finance the trip to Malaysia. This would exclude households facing borrowing constraints.

Appendix Table C.1 compares our study sample to a nationally representative sample of households drawn from the 2016/17 Household Income and Expenditure Survey (HIES)

(BBS, 2017). To understand what distinguishes lottery participants from others, we successively restrict the HIES sample to rural areas, rural areas in the three divisions where we conducted surveys, and further to households with a male aged 20-45 who would have been eligible for the lottery.

Not surprisingly, households that participated in the lottery are more likely to have a migrant and receive remittance income. A quarter of our sample (both treatment and control) have had a migrant in the past 5 years, compared to 15 percent in the rural areas of divisions we surveyed, and 9 percent nationwide. Our study sample has higher expenditures and incomes and significantly lower poverty rates than national averages, probably partly due to the large difference in remittance income and partly due to the selection of who can bear international migration expenses. Our study sample is slightly younger and more educated than other comparable national samples, and more likely to be entrepreneurial. While households interested in migration are different from the population at large, our study sample is the most policy-relevant sub-population for estimating the returns to migration: those who are eager to migrate, and can finance the trip.

Balance

Time-invariant characteristics appear well balanced across treatment groups. We do not have a true baseline collected before the visa lottery, but we collected data on characteristics that are unlikely to change over time, and some retrospective pre-lottery outcomes. As Appendix Table C.2 shows, a joint test across the 13 outcomes we measure fails to reject the null that the characteristics are balanced across the lottery outcomes.

The table also shows that lottery participants were 29 years old on average at the time of application, with 6.8 years of schooling. 60% were married at the time of the lottery and lived in household with four others. Applicants were working virtually all year in 2012 (just before the lottery), and earned about 8,800 Taka ($110) per-month.

4.2 Empirical strategy

The lottery program was randomized, so we use a very simple specification to report intent-to-treat (ITT) estimates:

$$y_i = \beta_1 T1_i + \beta_2 T2_i + \gamma X_i + \varepsilon_i \tag{1}$$

where y_i is the outcome for applicant i, $T1_i$ and $T2_i$ indicate whether the applicant won the Phase 1 lottery or the Phase 2 and Phase 3 lottery, X_i controls for baseline characteristics, including upazila fixed effects, and ε_i represents the error terms assumed to be clustered at the union level. We weight each observation so that the number of observations within each treatment group is the same within each union.

We test multiple hypotheses simultaneously, so we present several adjustments to account for multiple inference (à la Anderson, 2008). First, when reporting results for specific outcomes within a group, we control the False Discovery Rate (FDR) and present corrected q-values for the reduced form. Second, for each group of outcomes, we construct an inverse-covariance weighted summary index of all outcomes within the family. The summary index is less prone to incorrect inference due to multiple hypotheses testing than the individual outcomes. Third, we control for Family Wise Error Rate (FWER) when we summarize a set of outcomes across the groups.

We sometimes report local average treatment effect (LATE) estimates of the effects of migration, where we instrument the decision to migrate with random assignment to T1, which are the phase 1 lottery winners who received immediate intermediation. We estimate:

$$\begin{aligned} y_i &= \delta M_i + \eta X_i + \varepsilon_i \\ M_i &= \alpha T1_i + \xi X_i + \nu_i \end{aligned} \tag{2}$$

where M_i indicates whether the applicant migrated abroad at any point after the initial lottery, and ε_i and ν_i are error terms uncorrelated with each other. We exclude data on T2 due to potential violation of the exclusion restriction. The T2 group was initially offered a delayed government intermediation which did not materialize as planned. It is possible that this group may have taken some steps in expectation of migration in the future, and this could have affected their outcomes directly. Furthermore, only a small share of the T2 group received actual intermediation, making it a weak instrument for migration. However, including T2 as an additional instrument does not substantively change the results.

5 Results

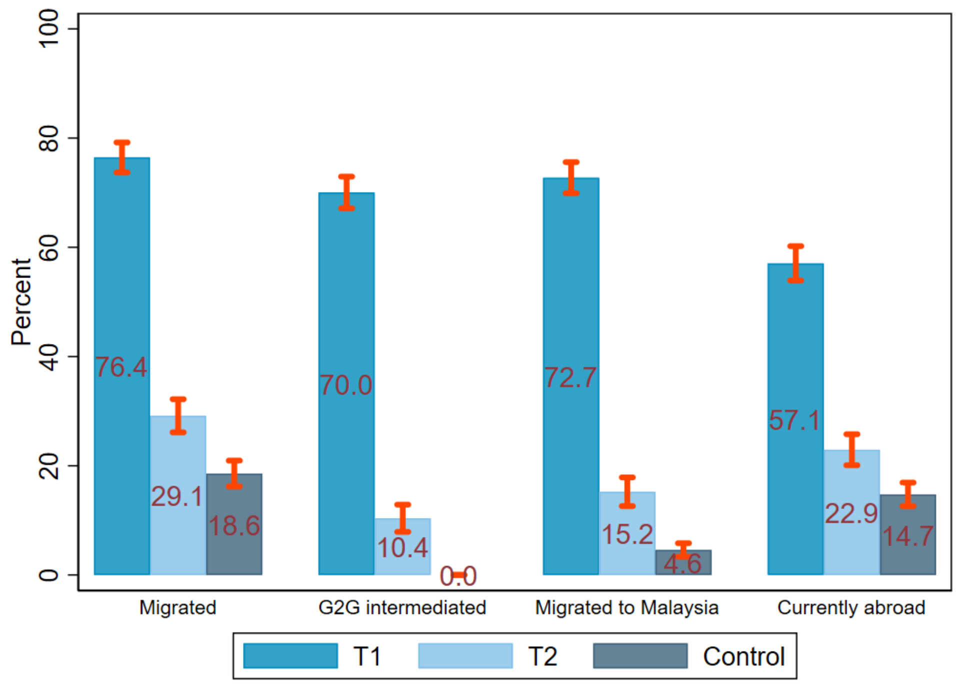
5.1 Effects of the Lottery on Migration

By the time we conducted our survey in 2018, over five years after the lottery, 76 percent of the Phase 1 lottery winners (group T1) had migrated abroad, while 19 percent of the lottery losers did (Figure 3). Around 70 percent of the T1 group's travel was intermediated through the government channels, and the vast majority who migrated from this group traveled to Malaysia, which suggests that the lottery outcome had a very direct effect on the lottery winners who received quick intermediation. However, only a small fraction of Phase 2 and Phase 3 winners (group T2) - who were promised intermediation later - ultimately benefited from it. Only 10% of T2 migrants were G2G-intermediated, and the T2 migration rate was exactly 10 percentage points higher than that of the control group.

Reassuringly, migration rates captured in our survey closely match the migration numbers in BMET's administrative records. Extrapolating migration rates in our survey sample to the full population of lottery participants across Bangladesh, our estimates would imply that about 10,700 would have migrated. The official count provided by BMET officials in March 2018 was 9,800.

The G2G program affect migration modalities in a couple of dimensions. Almost all T1 migrants traveled to Malaysia, while two-thirds of control group migrants traveled to Gulf countries. Malaysia was the destination of choice for a quarter of the control group migrants, but clearly some of the lottery winners would have otherwise ended up in Saudi Arabia, Oman or Qatar. Malaysia was also the most popular destination for the T2 (delayed

Figure 3: Impact of winning the lottery on migration



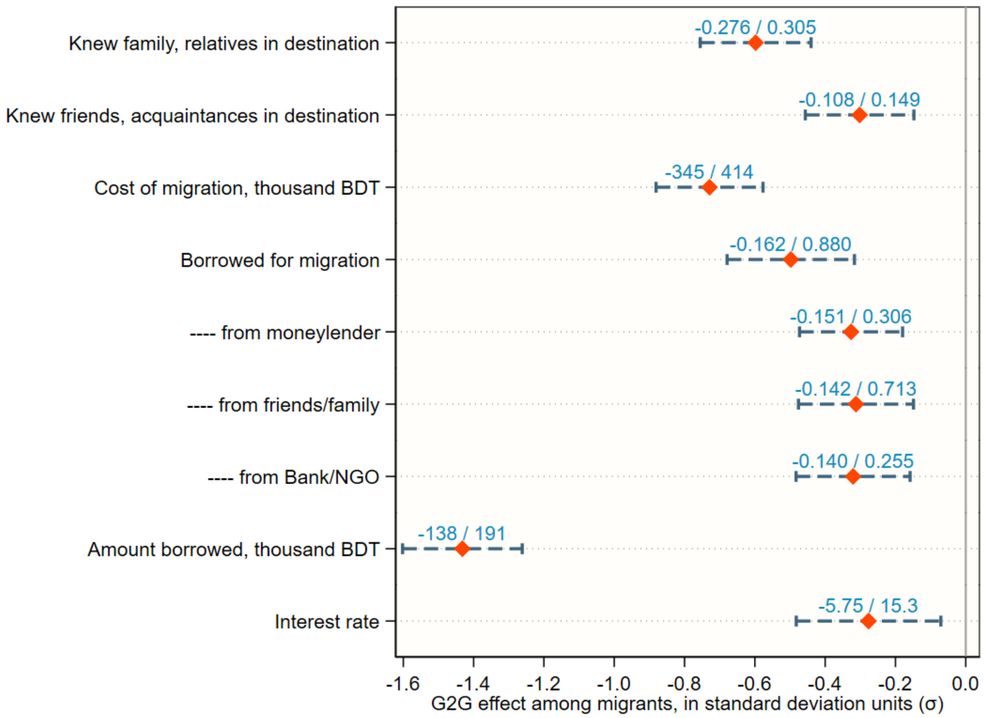
Source: Authors' estimates from the survey data collected for this study.
Note: The Figure shows the impact of winning the lottery on migration. The bar shows the migration rates and the vertical lines denote 95 percent confidence interval.

intermediation) group. Second, winning the lottery allowed T1 migrants to travel abroad earlier than migrants from the control group. The average T1 migrant left 15 months after the lottery, while T2 and control group migrants traveled 33 months after the lottery. Government intermediation clearly sped up the process: Of those who used the G2G mechanism, Phase 1 winners (T1) migrated 14 months after the lottery, and Phase 2 and 3 winners (T2) 26 months after the lottery.

A large share of applicants who migrated were still abroad at the time of survey. This is true for 75 percent of T1 migrants, and 78 percent of T2 and control group migrants. Since our survey was conducted almost four years after the initial migration of T1 applicants, they were evidently able to either extend their initial labor contract or find another job abroad.

Figure 4 shows that the G2G program changes the selection of *who gets to migrate*, by (non-experimentally) comparing of the characteristics of treatment and 'regular' (control

Figure 4: Differences between the G2G and non-G2G migrants



Source: Author's calculations from the data collected for the survey.
Note: The Figure shows the difference between G2G and non-G2G migrants in terms of their networks abroad and means of financing migration. The impacts are estimated using $y_i = \alpha + \beta \mathrm{G2G}_i + \varepsilon_i$ where $\mathrm{G2G}_i$ is instrumented by T1. The estimation is restricted to the sample of migrants from T1 and C. Outcomes are standardized to the relative to the control group mean and standard deviation for the plot. The effect on the non-standardized outcomes and the control group mean appear as labels separated by '/'. The error bars represent 95% confidence intervals. Standard errors are clustered at the union level.

group) migrants. First, regular migrants often find opportunities through social connections (Munshi, 2003), while the G2G migrants found employment without any family or friends at the destination. 30% of control group migrants had a relative in the destination country, only 3% of the G2G migrants did. Second, the program drastically lowered the cost of migration from 414,000 BDT (USD 5,300) to a sixth of the amount. As a result, G2G lottery winners were 16 percentage point less likely to have to borrow to finance the trip, they borrowed much less when they did, and at lower interest rates. In summary, the program extended migration opportunities to those less connected internationally, and less well off.

Even then, G2G intermediation was unaffordable for some applicants. 54% of lottery winners who chose not to migrate cite the cost of intermediation as the key barrier. 22% cite a change in family, personal, or local employment circumstances, and 11% failed the medical and fitness screening conducted by BMET in Bangladesh. Very few respondents (2.6%) had communication difficulties, and none mentioned rejection from Malaysia. In contrast, 79% of non-migrants in the control group cite cost as the barrier. In summary, the program appears to have been implemented well - exactly as designed, which made it a lucrative opportunity for many, but still unaffordable for some.

5.2 Effects of Migration on Income and Labor Supply

In Table 1, we first examine the effect of winning the lottery on household income as well as the various components of income earned at the origin and at the migration destination. In the intent-to-treat (ITT) estimates from Equation (1) presented in column 1, we compare the phase-1 lottery winners (T1) to the control groups of lottery losers. The instrumental variables (IV) estimates of the effects of migration in column 2 instruments the migration decision with random assignment to column 1. We apply the inverse hyperbolic sine transformation to all outcomes, so that coefficient estimates can be read an percent changes relative to the control group. To judge statistical precision, we report both p-values and - because we are studying many outcomes - q-values that adjust for the false discovery rate, to address concerns about multiple hypothesis testing.

Households of visa lottery winners enjoy 61% greater income than households that lost the lottery. The IV estimate indicates that those who migrated and received G2G intermediation more than doubled their household income relative to those who lost the lottery. Decomposing the components of income, we see that this is entirely due to very large increases in labor income earned away at migration destinations among lottery winners (four times larger), and the remittance that lottery-winning households receive (436% larger) compared to the control group. The migrant's absence does reduce the labor income earned by the household in their village in Bangladesh (-156%), but that loss is not nearly large enough to overcome the tremendous advantage in remittance earnings.

Table 1: Impact of winning the lottery and migration on household income

	(1) ITT	FDR adjusted q-value	(2) IV	(3) Control mean
Total income home and away	0.612		1.085	12.537
	[0.000]	[0.001]	[0.000]	
Labor income, away	4.053		7.192	5.194
	[0.000]	[0.001]	[0.000]	
Remittance income	4.362		7.520	2.379
	[0.000]	[0.001]	[0.000]	
Labor income at home	-1.557		-2.685	5.191
	[0.000]	[0.001]	[0.000]	
Farm income	0.159		0.275	8.371
	[0.466]	[0.154]	[0.459]	
Non-farm business income	-0.887		-1.530	5.131
	[0.000]	[0.001]	[0.000]	
Rental and other income	-0.091		-0.157	5.233
	[0.659]	[0.198]	[0.654]	
Total income at home (incl remittances)	0.300		0.517	12.112
	[0.000]	[0.001]	[0.000]	

Source: Authors' calculations from the survey data collected for this study.

Note: This table shows the intent-to-treat and IV estimates on household income measures indicated by the row headers estimated using Equations (1) and (2). An inverse hyperbolic sine transformation is applied to all income measures. Income measures with missing values, mostly for incomes abroad, are replaced by the tenth percentile of incomes for applicants in the same destination and with same age and education. Estimates are restricted to the sample of early treatment (T1) and the control group (C). Column (1) shows the ITT estimates with associated p-values in brackets; the subsequent column shows the q-values adjusted for False Discovery Rate to account for multiple hypotheses testing. Column (2) shows the IV estimates and associated p-values in brackets. Column (3) presents the mean of the outcome for the control group. Both ITT and IV estimates control for applicant height, age, religion, parental education, and indicators for survey Upazilas. Standard errors are clustered at the union levels.

The IV coefficients are useful for tracking magnitudes of the impact of government-intermediated migration. Migration increases remittance income by more than BDT 82,000 per year, whereas wage income earned at home falls by about BDT 33,000.

Other sources of household income show small, statistically insignificant changes. The migrant's absence did not fully displace agricultural (or other sources of) earnings in the village in Bangladesh, and the household came out ahead on net by winning the visa lottery. The reported q-values indicate that these large income effects are robust to concerns about multiple-inference.

Effects on Labor Supply and Earnings of the Migrant

Since the household income increase is largely driven by increases in labor income earned abroad, we delve into the details of the lottery applicant's hours worked and earnings abroad in panel A of Table 2. We ask about income in various ways in our surveys. Across all measures, we see substantial gains for lottery winners.

Table 2: Impact of winning the lottery and migration on labor and incomes

	(1) ITT	FDR adjusted q-value	(2) IV	(3) Control mean
A. Impact on the applicant labor and income				
Monthly income in 2015	0.596		1.022	9.659
	[0.000]	[0.001]	[0.000]	
Income last month, (reported)	0.437		0.758	9.205
	[0.001]	[0.001]	[0.001]	
Average monthly income (computed)	0.657		1.133	11.879
	[0.000]	[0.001]	[0.000]	
Total hours worked	-0.063		-0.109	8.350
	[0.214]	[0.057]	[0.208]	
B. Impact on labor and income of non-applicant family members				
Monthly income in 2015	-0.083		-0.142	7.414
	[0.362]	[1.000]	[0.355]	
Income last month (reported)	0.051		0.088	5.028
	[0.756]	[1.000]	[0.753]	
Average monthly income (computed)	0.118		0.202	6.969
	[0.436]	[1.000]	[0.433]	
Total hours worked	0.096		0.165	5.008
	[0.359]	[1.000]	[0.356]	

Source: Authors' calculations from the survey data collected for this study.

Note: This table shows the intent-to-treat and IV estimates on labor and income measures indicated by the row headers estimated using Equations (1) and (2). Panel A shows the outcomes for the applicant whereas Panel B shows the outcomes for non-applicant adult family member. An inverse hyperbolic sine transformation is applied to all measures of labor and income. Income measures with missing values, mostly for incomes abroad, are replaced by the tenth percentile of incomes for applicants in the same destination and with same age and education. The sample restrictions and the table structure is identical to that of Table 1. Both ITT and IV estimates control for applicant height, age, religion, parental education, and indicators for survey Upazilas. Standard errors are clustered at the union levels.

We first use a retrospective measure of the lottery applicant's monthly income in 2015, about one year after lottery winners in group T1 migrated to Malaysia.[5] The second measure asks about income in the month immediately preceding the survey. This addresses concerns about biases with retrospective data, but introduces a new concern because incomes in rural areas tend to be seasonal, and asking about any specific month can be prone to large measurement error. We therefore add a third measure that computes the lottery applicant's income by adding up their wage income, profits from farms and family business, where profits are allocated across involved household members in proportion to the hours they put in the farm or family business.[6]

Lottery winners enjoy a large premium over lottery losers regardless of the income measure used. Across the three measures, we see that lottery winners earn 40-65% more than lottery losers in the ITT specification, while migrants earn a premium of 75-113% in the IV specification.

The increase in income is mostly driven by increase in hourly wage rates. Migration does not change the total labor supply of the lottery applicants. Lottery losers work 49 hours per week, which is statistically comparable to lottery winners and to migrants. However, unlike non-migrants, who often combine wage work with self-employment and farm work, migrants work almost exclusively in wage-work, in accordance with the G2G labor contracts. We compute hourly wage rates, and find that the hourly productivity of migrants increase by 0.73 log points (107 percent).

The remittance amounts we document in the previous table is small relative to the size of

[5]Note that for migrants who are away, the income measures are reported by their household members. Family members often underestimate migrants' income abroad (Seshan and Zubrickas, 2017). That would create an underestimate the income gains from migration. However, we also asked their monthly income during their migration episode. The reports made by the applicants themselves (if they had returned at the time of the survey) were statistically identical to the reports made by their family members (if applicants were still abroad). This suggests that such misreporting might not be too large in this context.

[6]This last measure is not reported for about a quarter of the applicants that were still abroad at the time of our survey, which is disproportionately the case for lottery winners. We impute the missing income by assuming that those migrants earn income equivalent to the 10th percentile of earnings of other migrants in the same destination and with similar age, gender, and education profile. Even with the most extreme assumption – that those with missing income data earn zero – we still estimate large, positive coefficients for lottery winners and for migrants.

this income increase. The IV estimate suggests that migration through G2G intermediation increases household income in Bangladesh by BDT 130,000 per year. This is only a fraction of the estimated income gains of the migrant, which is BDT 269,000. This suggests that migrants do not remit all of their income back home. They may be consuming or saving while abroad, or paying back debts they incurred to finance the trip.

Spillover Effects on the Labor Supply of other Household Members

The migration of a household member could affect labor supply and incomes of other members of the family through multiple channels. Remittances could produce an income effect, leading other household members to cut back their labor supply and consume more leisure. Imperfections in the labor market that leads to reliance on family labor in rural areas of developing countries (eg. Binzel and Assaad, 2011; Mu and Van de Walle, 2011; Shrestha, 2017*a*) could force other household members to increase their labor supply in the migrant's absence. Migration could also change the reservation wage for other household members.

In panel B of Table 2, we see very little spillover effect of winning the lottery on the labor supply and earnings of household members other than the lottery applicant. Not only are the effects statistically indistinguishable from zero, the point estimates are also small.

5.3 Effects on Consumption and Investments

We implemented detailed modules on food and non-food expenditures in our survey, modeled after the Bangladesh Bureau of Statistics consumption modules that were also used in other trials conducted in Bangladesh (e.g. Bryan et al. 2014). Table 3 investigates whether the large increase in income for lottery winners translates into greater consumption, and exactly what those households spend the money on.

Lottery winners have 11.6% greater consumption than lottery losers. There is no big change in food consumption, and the increase in expenditures is concentrated in the non-food category. This is likely because – as noted above – those who could afford intermediation were relatively well-off by rural Bangladesh standards, and food deprivation is not a big concern in this particular sample. The non-food aggregate includes expenditures on clothing, fuel, travel, utilities, and household essentials.

We can use the IV estimates to compute the income elasticity of consumption. Per-capita consumption in the control group was BDT 58,000 per year, which increases by 22 percent due to migration. Our estimates imply an income elasticity of consumption of 0.379 ($p = 0.002$). That is, for each $1 increase in household income (due to migration), consumption per-capita increases by 29 cents.

Land and dwellings are the most important components of wealth in rural Bangladesh (and an important form of savings for the middle class), so we examine the effects of the lottery on those outcomes. Lottery winning households become significantly more likely to make big-ticket expenditures on land and housing.[7] They are more likely buy real estate, less likely to sell, and the value of the land they own increases by 30% relative to lottery-losing households. Lottery winners are 5 percentage points more likely to own "pakka dwellings", which are homes constructed using durable building materials like brick and cement. The value of the dwelling is about 14% higher. Winners are 6.5 percentage points more likely to invest in a private latrine in their home. Such large expenses on durables could explain the gap between the (much larger) increase in migration income and (smaller) increase in income measured at home. Migrants could be saving up some of their income in Malaysia until they accumulate enough for large expenses on land and housing in Bangladesh.

Investments in children

When migrants are asked why they travel, earning money to educate children is frequently cited as a key motive. Migration could also change perceptions about the returns to education when migrants are exposed to new opportunities in a foreign labor market. We find a very large 25% increase in educational expenditures among lottery winning families. The increase

[7] We asked about less common but consequential expenses such as purchase and sale of land and residences over a 36-month recall window, to capture infrequent transactions.

Table 3: Impact of winning the lottery and migration on consumption and investments

	(1) ITT	FDR adjusted q-value	(2) IV	(3) Control mean
A. Impact on consumption				
Consumption per capita	0.116		0.200	10.826
	[0.000]	[0.001]	[0.000]	
Food per capita	0.039		0.066	10.256
	[0.088]	[0.031]	[0.083]	
Non-food exp. per capita	0.136		0.235	9.681
	[0.000]	[0.001]	[0.000]	
Health exp. per capita	0.378		0.653	7.118
	[0.000]	[0.001]	[0.000]	
Large exp. per capita	0.580		1.001	2.024
	[0.035]	[0.014]	[0.031]	
Value of land	0.298		0.514	13.464
	[0.026]	[0.012]	[0.023]	
Pakka or semi-pakka dwelling	0.048		0.082	0.216
	[0.007]	[0.005]	[0.006]	
Value of dwelling(s)	0.144		0.248	11.652
	[0.002]	[0.003]	[0.002]	
Has private latrine	0.065		0.112	0.727
	[0.001]	[0.001]	[0.001]	
B. Impact on investments				
Education exp. per-capita	0.249		0.431	4.153
	[0.046]	[0.062]	[0.042]	
Education exp. per boy	0.083		0.143	9.411
	[0.290]	[0.170]	[0.273]	
Educational exp. per girl	0.143		0.245	9.367
	[0.032]	[0.059]	[0.027]	
Child attends school	-0.002		-0.003	0.901
	[0.901]	[0.347]	[0.898]	
Child works for wage-work	-0.012		-0.021	0.015
	[0.016]	[0.059]	[0.012]	
Protein per-capita	0.089		0.153	9.076
	[0.008]	[0.059]	[0.007]	
Tobacco per-capita	0.109		0.188	-1.076
	[0.178]	[0.120]	[0.170]	

Source: Authors' calculations from the survey data collected for this study.

Note: This table shows the intent-to-treat and IV estimates on household consumption and investments as indicated by the row headers estimated using Equations (1) and (2). An inverse hyperbolic sine transformation is applied to all measures of consumption. The sample restrictions and table structure is identical to that of Table 1. Both ITT and IV estimates control for applicant height, age, religion, parental education, and indicators for survey Upazilas. Standard errors are clustered at the union levels.

is on the intensive margin: there are no significant changes to children's propensity to attend school. Over 90% of all children in our sample attend school (which is compulsory for children in Bangladesh), so this is not the margin that is most relevant in this context.

We break educational expenditures down by the gender of the child, and see that daughters benefit more than sons. Girls in lottery-winning households experience an increase of 14 percent in educational expenditures, whereas boys only see a more modest, and statistically insignificant, improvement of 8 percent. This asymmetric response reduces the gender gap, because educational expenditures were 14% lower for girls than for boys in the control group.

For children aged 10 to 14, migration reduces the probability that a child works for wages; 1.5 percent of children in control group households worked for wages, and this essentially disappears for all children – boys *and* girls – in households that won the visa lottery.

Another important type of investment in this context is protein consumption, which aids physical and cognitive development of young children. Households that lost the lottery spent BDT 12,000 per capita annually on animal proteins (eggs, fish, and meat).[8] Winning the lottery raises per-capita expenditures on animal proteins by 9 percent. Households that win the lottery therefore increase the quality and nutrition value of the food they consume, although they do not consume more food in the aggregate.

A concern typically expressed about opportunities that suddenly raise remittance income is that households may spend the money on undesirable, temptation goods. Alcohol consumption in Bangladesh is extremely low due to legal and religious restrictions, so we focus on expenditures on cigarettes and other tobacco products. We do not detect any significant impact, partly because only 6 percent of all lottery applicants report any expense on tobacco.

5.4 Effects on Poverty and Indebtedness

We measure the effect on the migration lottery on households escaping poverty measured at three different internationally-accepted poverty lines: USD 1.90 per day, USD 3.20 per day,

[8] Our consumption measure includes the value of home-produced goods, since some households raise livestock and poultry.

and USD 5.50 per day. This program is not effective at reducing extreme poverty (defined at PPP$ 1.90 per day). Only 2.7 percent of control group households were poor by this measure. The extreme poverty rate is almost three times as high in rural areas of Bangladeshi divisions where we conducted our surveys, but the majority of those households did not participate in this lottery. Migration costs – even with subsidized government intermediation – is BDT 45,000 per applicant, which is equivalent to more than two years of consumption for households living in extreme poverty. Since households in extreme poverty self-selected out of this program, we do not see any effect on food insecurity either, because this is a rare problem in the sample of lottery applicants.

Winning the Malaysia visa lottery lowers poverty rate at the higher thresholds. 27 percent of control group households were living under the PPP$ 3.20 per-day poverty line, and winning the lottery reduces this by 3 percentage points. 70 percent were living under the PPP$ 5.50 per-day poverty line, and winning the lottery reduces this by 10 percentage points. In the IV specification, G2G-intermediated migration reduces this poverty rate by 18 percentage points.

A major policy concern with international migration as a development strategy is that most migrants are forced to borrow at high interest rates to finance the trip, given exorbitant fees charged by middlemen. Wages are withheld to repay such loans at high implicit interest rates. Subsidized G2G-intermediation should help along this margin, which we investigate.

Winning the lottery makes households 5.5 percentage points less likely to take on a loan. When we ask about sources of loans, we see the sharpest drop in loans from high-interest moneylenders (who charge 58 percent annual interest on average), from 17 percent in the control group to 11 percent among lottery winners. Consequently, the average annual interest rate paid on loans drops significantly for lottery winners (from 21% to 18%), and household net debt position improves by 20%.

Table 4: Impact of winning the lottery and migration on poverty and insecurity

	(1) ITT	FDR adjusted q-value	(2) IV	(3) Control mean
Poverty rate ($1.90 per day)	-0.007		-0.013	0.027
	[0.279]	[0.141]	[0.271]	
Poverty rate ($3.20 per day)	-0.031		-0.054	0.267
	[0.088]	[0.076]	[0.084]	
Poverty rate ($5.50 per day)	-0.103		-0.178	0.701
	[0.000]	[0.001]	[0.000]	
Not enough food	-0.002		-0.004	0.023
	[0.720]	[0.259]	[0.715]	
Any loan	-0.055		-0.095	0.734
	[0.007]	[0.012]	[0.006]	
Loans from Moneylender	-0.064		-0.111	0.174
	[0.000]	[0.001]	[0.000]	
Average annual interest rate	-3.638		-6.632	21.370
	[0.083]	[0.076]	[0.076]	

Source: Authors' calculations from the survey data collected for this study.

Note: This table shows the intent-to-treat and IV estimates on household poverty rate, food insecurity, and financial security measures as indicated by the row headers estimated using Equations (1) and (2). The sample restrictions and table structure is identical to that of Table 1. Both ITT and IV estimates control for applicant height, age, religion, parental education, and indicators for survey Upazilas. Standard errors are clustered at the union levels.

5.5 Effects on Entrepreneurship and Economic Activities at Home

Migration of a family member to Malaysia could affect the household's economic or entrepreneurial activities in Bangladesh through multiple mechanisms. The remittance income could increase resources available for business or agricultural investments, the family member abroad could generate new ideas through this exposure abroad, but the migrant's departure could also remove the most entrepreneurial family member from Bangladesh.

We find in Table 5 that winning the lottery does not change the household's propensity to engage in either agriculture or livestock-rearing. However, lottery winning households are 7 percentage points less likely to operate a non-farm business than the 44% of lottery-losing households that do. Conditional on operating an enterprise, winning the visa lottery further

Table 5: Impact of winning the lottery and migration on household entrepreneurship

	(1) ITT	FDR adjusted q-value	(2) IV	(3) Control mean
Has crop income	-0.012		-0.021	0.737
	[0.499]	[0.599]	[0.492]	
Has Livestock	-0.005		-0.009	0.788
	[0.763]	[0.632]	[0.759]	
Has non-farm business	-0.069		-0.119	0.436
	[0.001]	[0.004]	[0.000]	
Value of business	0.042		0.080	11.382
	[0.774]	[0.632]	[0.764]	
Has capital expenditure for business	-0.055		-0.102	0.792
	[0.069]	[0.103]	[0.059]	
Hired workers for business	-0.064		-0.119	0.197
	[0.021]	[0.055]	[0.016]	

Source:Authors' calculations from the survey data collected for this study.

Note: This table shows the intent-to-treat and IV estimates on household entrepreneurial outcomes as indicated by the row headers estimated using Equations (1) and (2). Inverse hyperbolic sine transformation is applied to value of business. The sample restrictions and table structure is identical to that of Table 1. Both ITT and IV estimates control for applicant height, age, religion, parental education, and indicators for survey Upazilas. Standard errors are clustered at the union levels.

lowers the likelihood of hiring an external worker for the business or having capital expenditures by about 6 percentage points. The effect on capital expenditures is not statistically significant once we apply false-discovery-rate adjusted q-values to infer statistical precision under multiple hypothesis testing.

The reduction in non-farm business activity is most likely caused by the departure of the family member who would otherwise engage in entrepreneurship at home. If that is the case, then we might expect can expect a boomerang effect on entrepreneurship once the migrant returns with his overseas exposure and accumulated savings. Indeed, there is some (non-experimental) support for this theory in the data. Households with lottery winners who migrated and returned by the time of our survey were 11 percentage points *more* likely to operate a non-farm family business than households without a migrant.

5.6 Effects on Household Demography

Migration mechanically changes the composition of the household, but it does not otherwise change the household size. For example, winning the lottery does not affect the probability that *other* (non-applicant) household members migrate.

However, migration reduces the likelihood of new household formation. While the lottery winner is away in Malaysia, his nuclear family is less likely to split away from the broader households they belonged to at the time of the lottery. That is, migration delays the process of new household formation as applicants (or their spouses) are more likely to continue to co-habitate with parents or siblings instead of forming their own households.

Table 6: Impact of winning the lottery and migration on household composition

	(1) ITT	FDR adjusted q-value	(2) IV	(3) Control mean
HH size, incl migrants	0.098		0.170	5.692
	[0.261]	[0.094]	[0.253]	
HH split since 2013	-0.032		-0.055	0.132
	[0.015]	[0.019]	[0.013]	
Has non-applicant migrant	0.009		0.016	0.295
	[0.637]	[0.190]	[0.631]	
Married since 2013	-0.033		-0.057	0.189
	[0.048]	[0.040]	[0.043]	
Has new HH member since 2013	-0.074		-0.128	0.460
	[0.000]	[0.001]	[0.000]	
Applicant is the HH head	-0.222		-0.383	0.507
	[0.000]	[0.001]	[0.000]	
Applicant's wife is the HH head	0.139		0.240	0.094
	[0.000]	[0.001]	[0.000]	
Applicant's parent is the HH head	0.038		0.065	0.359
	[0.064]	[0.045]	[0.059]	

Source:Authors' calculations from the survey data collected for this study.

Note: This table shows the intent-to-treat and IV estimates on household composition measures as indicated by the row headers estimated using Equations (1) and (2). The sample restrictions and table structure is identical to that of Table 1. Both ITT and IV estimates control for applicant height, age, religion, parental education, and indicators for survey Upazilas. Standard errors are clustered at the union levels.

Similarly, migration reduces the likelihood of inviting new members into the existing households. This is because migration delays marriage among applicants. Four years after winning the lottery, successful applicants were 3.3 percentage points less likely to be married than the control group (p-val 0.048, FDR-adjusted q-val 0.106). The delay in marriage (and therefore, childbirth) means that lottery-winning households are 7 percentage points less likely to have a new household member compared to losers.

These demographic changes affect the composition of household headship. The absence of the young male migrant means that household headship is likely to be skewed towards his parent or his spouse. The wife of the lottery applicant becomes 14 percentage points more likely to be classified as the household head.

Effects on Women's Involvement in Decision-making

Only young males were eligible to participate in the Malaysian G2G lottery. Table 7 indicates that the male migrant's departure causes women to become more involved with decision-making and managing household operations in Bangladesh. Our survey asked about female involvement in making decisions across various dimensions involving children (schooling, childcare), household expenses (expenses in health care, food, clothing, necessities, and managing daily finances), and other large decisions related to household business or entrepreneurial activities (selling household assets, decisions related to farming such as crop/seed choice and fertilizers, decisions related to household debt, and large purchases such as of a house, land, or large appliances).

Female involvement in decision-making improved across all dimensions. Though females were partly involved in making these decisions for about 60 percent of the households in the control group, decisions were made exclusively by female members in only 10 percent of households. Winning the lottery increased the likelihood that females are involved in any decision-making by 3.5 percentage points, that they exclusively make decisions about all matters by 8 percentage points (an increase of 75%), that they exclusively decide about

Table 7: Impact of winning the lottery and migration on female decision-making

	(1) ITT	FDR adjusted q-value	(2) IV	(3) Control mean
Female: all matters	0.035		0.061	0.597
	[0.021]	[0.005]	[0.017]	
Only female: all matters	0.078		0.134	0.106
	[0.000]	[0.001]	[0.000]	
Only female: big decisions	0.062		0.106	0.050
	[0.000]	[0.001]	[0.000]	
Only female: HH expense related	0.092		0.159	0.082
	[0.000]	[0.001]	[0.000]	
Only female: child matters	0.072		0.125	0.293
	[0.000]	[0.001]	[0.000]	

Source: Authors' calculations from the survey data collected for this study.

Note: This table shows the intent-to-treat and IV estimates on outcomes measuring female involvement in decisionmaking as indicated by the row headers estimated using Equations (1) and (2). Outcomes with a prefix "female" indicate that a female member is involved in decisionmaking process; outcomes with prefix "only female" indicate that only female members are involved. 'Child matters' involve decisions regarding child health and education; 'HH expense' involve decisions regarding expenditures in healthcare, food, clothing, necessities, and managing daily finances; 'big decisions' involve decisions regarding household business or entrepreneurial activities such as selling assets, household debt, and choice of crop/seeds and fertilizers. The sample restrictions and table structure is identical to that of Table 1. Both ITT and IV estimates control for applicant height, age, religion, parental education, and indicators for survey Upazilas. Standard errors are clustered at the union levels.

financial expenses by 6 percentage points, and about children's matters by 7 percentage points. These are all large, drastic change in the locus of intra-household decision-making in rural Bangladesh, and the gains are especially large in areas where women were traditionally not involved. Even for infrequent, large decisions where remote participation of the lottery applicant may be possible, we see that women start playing a much larger role.

In Table 8 we study the heterogeneity of this improvement in female decision-making power across different types of families, to further probe the conditions under which women are most likely to gain influence. We find that the effects are more muted when the migrant's father is present: when he is alive, when he resides in the household, and when he (and not the migrant) is characterized as the household head. Further, there is absolutely no increase in female influence within the household when the applicant is not married at the time of the lottery. This implies that the decision-making power sometimes shift to the wife when the migrant departs, but never to his mother or sisters or other female family members.

Table 8: Heterogeneous impact of migration on female decisionmaking

Depvar: **Only female - all matters**	(1) Main	(2) Applicant not married	(3) Applicant's father is alive	(4) Applicant's father resides in the HH	(5) Applicant's father is the HH head
Migrated	0.134	0.193	0.204	0.205	0.199
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Migrated x HET		-0.155	-0.124	-0.175	-0.186
		[0.000]	[0.000]	[0.000]	[0.000]
HET		0.006	-0.029	-0.036	-0.045
		[0.691]	[0.047]	[0.008]	[0.001]
Migrated + interaction		0.037	0.080	0.030	0.013
		[0.143]	[0.000]	[0.111]	[0.384]

Source: Authors' calculations from the survey data collected for this study.

Note: This table shows the heterogeneous impact of migration on female decisionmaking by various measures of household composition at the time of the lottery. The heterogeneity measure (HET) is indicated by the column heading. Each column represents a single regression estimated on the sample of early treatment (T1) and the control group (C) with the exclusive female involvement in decisionmaking as the dependent variable. Column (1) shows the IV estimate of Equation (2) for reference. Columns (2) - (5) include interaction of migration with the heterogeneity measure with the treatment status and its interaction with the heterogeneity measure used as instruments. All estimates control for applicant height, age, religion, parental education, and indicators for survey Upazilas. Standard errors are clustered at the union levels. The p-values are shown in brackets. The last row shows the estimates and p-value for the total effect of migration on the sub-sample of heterogeneity indicator (HET).

6 Effects of Lottery on Pre-departure Investments in Skill

We investigate whether the lottery winners took any initiative to better prepare themselves for work abroad before they departed. We asked applicants whether they made any investments in language or other skills, or in maintaining their health after the lottery outcome was announced, but before they traveled (if at all). The T2 group - who won the lottery for a phase 2 or phase 3 *delayed* intermediation that was ultimately not fully provided - gives us a unique analytical opportunity to study the effects of such preparatory investments on labor market returns, even if the actual migration does not ultimately take place.

Table 9: Impact of winning the lottery on pre-migration investments

	(1) T1 (early treatment)	(2) T2 (deferred expected treatment)	(3) Control group
Took skills training	0.715	0.160	0.053
	[0.000]	[0.000]	
Invest to learn a foreign language	0.335	0.077	0.022
	[0.000]	[0.000]	
Invest to learn Malay	0.377	0.082	0.009
	[0.000]	[0.000]	
Ate more food	0.176	0.119	0.060
	[0.000]	[0.000]	
Ate more protein	0.211	0.143	0.073
	[0.000]	[0.000]	
Did more exercise	0.113	0.081	0.040
	[0.000]	[0.000]	
Took gym membership	0.007	0.002	0.003
	[0.074]	[0.588]	

Source: Authors' calculations from the survey data collected for this study.

Note: This table shows the intent-to-treat estimates of various treatments on skills investment measures estimated using Equation (1). Outcomes are represented by the row headers. The first two columns show the impact of early treatment (T1) and deferred expected treatment (T2) with p-values in brackets. The third column presents the mean of the control group. Each row represents a separate regression. The estimations control for applicant height, age, religion, parental education, and indicators for survey Upazilas. Standard errors are clustered at the union levels.

Table 9 shows that winning the lottery has a large impact on investments to learn a foreign language, particularly Malay, and in participating in skills training. About 35 percent of group T1 and 9 percent of group T2 invested in foreign language training compared to only 2 percent of the control group. 76 percent of group T1 participated in some formal skills training compared to 20 percent of group T2 and only 5 percent of the control group. These effects are likely driven by the G2G program requirements (see Appendix A). Lottery winners participated in a 10-day training required by the Malaysian government that covered topics related to palm-oil, agriculture, gardening, at the closest BMET Technical Training Centers

(TTCs). The skills training rate in groups T1 and T2 are comparable to the migration rates in those groups (76 percent and 30 percent respectively). In contrast, only 2-5% of migrants in the control group invested in these skills, even though 20 percent eventually migrated.

We also find evidence of other investments not strictly required by the G2G program. Lottery winners make investments to improve their physical strength, prior to traveling abroad to conduct physically strenuous work at Malaysian plantations. Their intake of food and protein increase, they were more likely to exercise, and even take out gym memberships. The ratio of these investments to the migration rates were similar for group T1 and the control group, which is not surprising because Bangladeshi men do strenuous work at outdoor sites in the Gulf as well, where G2G lottery losers would often travel. Interestingly, the ratio of those undertaking such investments in T2 relative to the eventual migration rate in that group was significantly higher. It appears that group T2 – who were promised G2G intermediation but the governments failed to follow through – overestimated their migration probability. That gives us an opportunity to investigate whether such investments generate returns in the domestic labor market.

We study this in two ways. First, we regress earnings on the specific skills that lottery applicants (may have) invested in to compute a metric for 'returns to skill', and estimate these returns separately for migrants and non-migrants. Results are shown in Table 10. The migration decision is instrumented by the lottery outcome. The language learning and taking formal skills training were both program requirements, so these decisions can reasonably be treated as exogenous. We see that the formal skills training does not generate higher earnings for migrants, but investing in learning a foreign language does. The added earnings effects of language training is positive and large, but highly imprecisely estimated. Importantly, neither formal skills training nor language training generates any monetary returns to non-migrants who remain in the Bangladeshi labor market. The coefficient estimates are both statistically insignificant, and very small.

Second, we focus only on the sample of T2 lottery winners who were promised deferred

Table 10: Impact of skill acquisition on labor and income for migrants and non-migrants

Depvar: **Average monthly income (computed)**	(1) Took skills training	(2) Invested in a Language
A. Returns to skills investments among migrants (T1 vs. C)		
Migrated	1.136	1.106
	[0.001]	[0.000]
Migrated x SKILL	-0.914	-0.245
	[0.275]	[0.799]
SKILL	0.721	1.061
	[0.409]	[0.308]
Mean of SKILL among migrants	0.677	0.347
B. Returns to skills investment among non-migrants (T2 vs. C)		
SKILL	-0.556	42.005
	[0.592]	[0.440]
Mean of SKILL	0.081	0.029

Source: Authors' calculations from the survey data collected for this study.

Note: This table tests the impact of skill acquisition on labor and income for migrants and non-migrants. The measure of skill acquisition (SKILL) is indicated by the column heading. The dependent variable is the inverse hyperbolic sine transformation of the average monthly income (as defined in Table 2). Panel A shows the IV estimation on the sample of early treatment (T1) and the control group with the lottery status and its interaction with the skills acquisition measure serving as instruments. Panel B shows the IV estimation on the sample of non-migrants from deferred expected treatment (T2) group and the control group with the lottery status serving as the instrument for skill acquisition. Each column in each panel shows a separate regression which controls for applicant height, age, religion, parental education, and indicators for survey Upazilas. Standard errors are clustered at the union levels. The p-values are shown in brackets. The SKILL measure in column (1) indicates that the applicant took skills training; in column (2) it indicates that they took a language training on Malay, English, or Arabic.

intermediation, but where the government failed to follow through. As we documented earlier, these applicants appeared to be taken by surprise in that many of them invested in program requirements (took skills and language training), but the migration opportunity never materialized. In panel B we estimate the returns to skill, by comparing non-migrants from T2 and from the control group. The identification strategy exploits the fact that non-migrants in T2 had 'mistakenly' invested in skills, based on the (unrealized) promise of deferred intermediation. The comparison again shows that the skills and language training generate zero returns in the domestic labor market.[9]

[9]We find that investing in other skills that were not strictly program requirements also generate zero

7 Effects of G2G Program on the Migration Experience

Given concerns about 'failed migration', abuse and fraud in private sector intermediation, we also investigate how G2G intermediation affects aspects of the migration experience. Figure 5 compares (non-experimentally) the experiences of G2G migrants in our treatment group to that of 'regular' migrants in the control group.

Government intermediation ensures better pre-departure preparedness. G2G migrants are 17 percentage points more likely to have a contract in place prior to migration, 18 percentage points more likely to have the required employment permits from BMET, and 12 percentage points more likely to have taken out an insurance policy against injuries, accidents, and death. Government intermediation appears to be more reliable: a third of migrants in the control group have to wait over 2 weeks to start work, and that is virtually eliminated under G2G. G2G migrants work fewer hours per week (55 rather than 60) without any significant loss in income, more likely to be allowed rest days and collect overtime pay.

On the other hand, palm oil plantation work in Malaysia appears to be more dangerous than the types of jobs that regular migrants sort into. They are significantly more likely to be injured, 10 percentage points more likely to witness workplace injuries, and 7 percentage points more like to have witnessed workplace deaths, compared to control group migrants.

Given these negative results on the risk of workplace injury, it is important to engage with the question of whether migration produces a net positive return for the lottery winners and their families. Beyond various risks incurred at the destination[10], the migrant's absence and separation from their family are also relevant for computing the household's overall welfare. Aggregate welfare is always difficult to assess, but migrant's decision-making after the initial contract expires is informative. 85% of the G2G migrants stay on in Malaysia

additional returns in the domestic labor market, but don't emphasize these results because the decision to invest in such skills is endogenous.

[10]Quantification of risks is hard in these contexts. Shrestha (2019) finds that mortality rates for Nepali migrants in the Gulf countries and Malaysia are lower than the mortality rate for the same demographics within Nepal, yet the perceptions and actions of potential migrants are hugely influenced by what they observe.

Figure 5: Comparison of migration experience between G2G and non-G2G migrants

Source: Author's calculations from the data collected for the survey.
Note: The Figure shows the difference between G2G and non-G2G migrants in their experiences prior to departure and at destination. The impacts are estimated using $y_i = \alpha + \beta \text{G2G}_i + \varepsilon_i$ where G2G_i is instrumented by **T1**. The estimation is restricted to the sample of migrants from T1 and C. Outcomes are standardized to the relative to the control group mean and standard deviation for the plot. The effect on the non-standardized outcomes and the control group mean appear as labels separated by '/'. The error bars represent 95% confidence intervals. Standard errors are clustered at the union level.

after the initial contract duration of 2 years, and this represents a 30 percentage point increase relative to control group migrants. The revealed preference embodied in migrants overwhelmingly choosing to extend their contracts strongly suggest that the large economic returns we document outweigh the discomfort associated with separation, working conditions or risk of injury.

8 Summary of Effects and Robustness of Results

Summary and robustness to multiple inference

As we are testing multiple outcomes, it is important to be vigilant about incorrect inferences due to multiple hypothesis testing. One way to address this, beyond the FDR-corrected q-values we report, is to construct a single index for each 'domain' by combining multiple outcomes, instead of testing each one individually. For each group of outcomes presented in Tables 1 - 7, we create a summary index which is the inverse-covariance weighted average of standardized outcomes within each family. By construction, the index value in the control group is normalized to have zero mean and a standard deviation of 1. Figure 6 shows the impact of winning the lottery on these indexes, which also serves as a summary of what we have learned about the effects of Malaysian visa lottery for Bangladeshi workers. As there are multiple indexes, we adjust the p-values to control for family-wise error rate (FWER) - the probability of rejecting at least one true null hypothesis of no effects.[11] FWER corrected p-values appear in brackets with conventional confidence intervals drawn in the figure.[12]

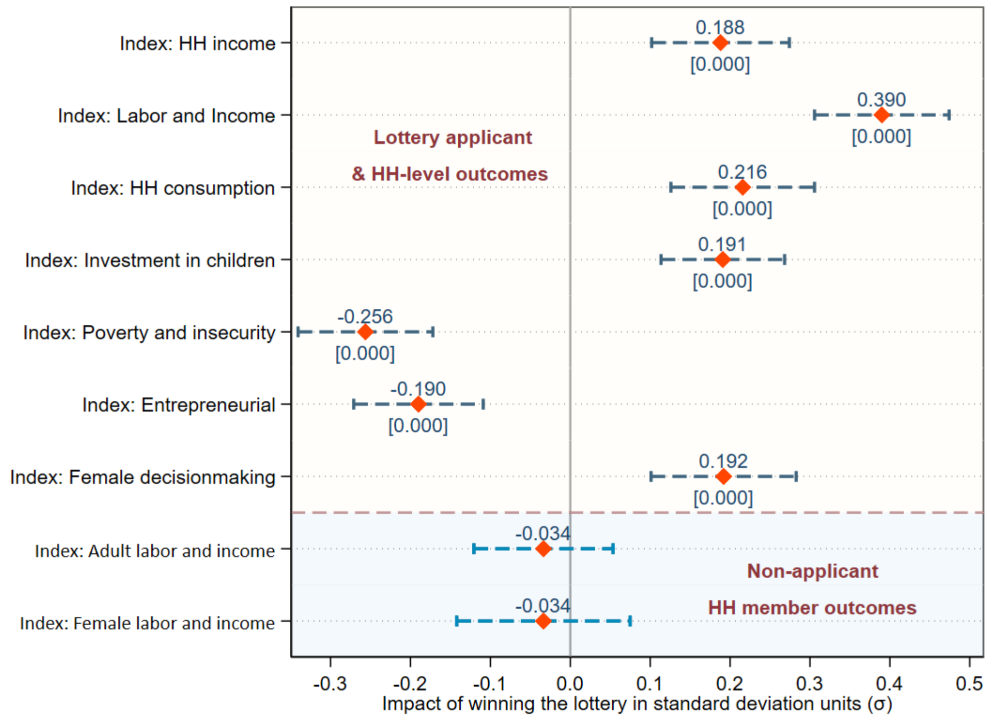
Consistent with the results above, winning the lottery increases household incomes by 0.19 standard deviations (σ), applicant labor supply and income by over 0.39σ. Consequently, household consumption improves by 0.22σ, child investments increases by 0.19σ, and poverty and insecurity fall by 0.25σ. The departure of the lottery winners has other economic and demographic consequences: entrepreneurship back home falls by 0.19σ and female involvement in household decision improves by 0.19σ. The FWER adjusted p-values are less than 0.001 for each of these outcomes which suggests that the inferences we draw in this study are robust to multiple inference concerns.

Figure 6 also shows spillover effects on other (non-lottery-applicant) family members. Labor and incomes of other adults and females are not affected by the lottery. Appendix

[11] We implement the Westfall and Young (1993) free step-down resampling procedure with 10,000 simulations.

[12] Papers employing these techniques to address multiple inference concerns include Anderson (2008) and Casey et al. (2012) among many others.

Figure 6: Summary of effects of winning the lottery



Source: Author's calculations from the data collected for the survey.
Note: The Figure shows the impact of winning the lottery on indexes of outcomes in various domains. Each index in the top panel of the figure is the inverse covariance weighted index of outcomes presented in Tables 1 - 7. The unit of impact is in standard deviation units (σ). FWER corrected p-values are presented in brackets below the point estimates. Each index in the bottom panel of the figure is the inverse covariance weighted index of outcomes presented in panel B of Table 2 and the same outcomes for adult female members.

D shows detailed results, including for outcomes not explicitly discussed in the main text. Adjusting the summary indexes to include this broader set of outcomes also does not affect the inferences drawn in this paper.

Robustness to differential finding rates

While our survey finding rates are high across the board, the differential success in finding T1 (lottery winner) households could lead to concerns about differential selection along unobservable dimensions. We devote Appendix B to addressing these concerns in depth. Here, we present a brief summary.

Common non-parametric bounds (e.g. Lee 2009) are often wide and uninformative, as they trim the data from the extremes of the outcome distribution. The results we report on the effects of the lottery on migration, on household income, on remittances, on individual incomes, and on pre-migration investments all pass even this stringent bounding criteria. This is due to the very large impact of winning the migration lottery, coupled with our relatively large sample size. However, those bounds are still too wide for a few other outcomes.

We next use insights from Behaghel et al. (2015) (BCGL) to tighten the bounds. Their intuition is that, with increased enumerator effort, finding rates would equalize across treatment groups. To implement this intuition, BCGL first artificially reduce exerted effort in the group with higher finding rate so that the finding rates approximately equalize between the groups. They then proceed with an approach similar to Lee (2009) in this restricted sample to construct non-parametric bounds.

We adapt those insights in our context by retaining data on the specifics of the survey effort we made in the field. We first use the number of phone calls made to track respondents as a proxy for effort. Second, we utilize the fact that survey finding rates are lower in larger villages, and add population decile the village belongs to as another measure of effort. The bounds for most of our outcomes are quite tight with the BCGL approach.

The 'excess' close-to-universal finding rate of T1 households was because of the way that the lottery program was administered. The lottery winners had to register with local leadership, who our surveyors could easily locate. So another pragmatic approach we take to test robustness is to randomly trim the excess sample from T1, and re-estimate treatment effects. We repeat this process one million times for each outcome, and count the number of simulation where we fail to reject the null at 95% significance level. For most of our key outcomes we reject the null in every single simulation. The only exceptions are: (a) the female decision-making index, where we fail to reject in only 17 simulations, and (b) for the variable "household has an outstanding loan" where we fail to reject 1.9 percent of the time.

Lastly, we estimate the treatment effects only on villages that have equal (or similar) finding rates. This restricted sample is typically restricted to the smaller villages within our sample. We find mostly similar effects in these sub-samples. The positive effects on consumption and poverty reduction get a little larger, and the negative effect on household entrepreneurship gets smaller. These make sense as these villages are likely to be poorer at baseline, with fewer entrepreneurship opportunities outside farming.

9 Conclusion

Migration is a large part of the global economy, and low-skilled South Asian migrants working temporarily in richer Asian nations under time-delimited labor contracts is the most common type of global migration flow. Stories of worker abuse (Pattisson, 2013), fraud (Karim, 2019), and human rights violations (Stephenson, 2015) often dominate informal evaluations of such low-skill work migration programs. Media coverage also skews towards sensational (Siddiqui, 2019), but possibly rare and unrepresentative incidents that capture the world's attention in the absence of large-sample data. We provide an experimental evaluation using large-sample, representative data and a rigorous research design, and track a broad range of socio-economic and demographic effects. We learn that an international migration opportunity triples the migrant's earnings, and the remittances he sends doubles the incomes of his family in Bangladesh. These effects are much larger than the returns to rural-urban migration within Bangladesh, and in other developing countries (Lagakos et al., 2020).

These numbers imply that providing visas to low-skilled Bangladeshi workers to fill positions that richer countries like Malaysia cannot otherwise easily fill with domestic labor would rank among the most successful anti-poverty and development interventions for rural Bangladesh. To our knowledge, this is the only experimental evaluation to track the effects of migration along such a large and important international corridor. Furthermore, we use a sampling frame and sample size that is an order of magnitude larger than any other experimental evaluation of migration opportunities, allowing us to report statistically precise estimates that would remain unbiased under a broad array of reasonable assumptions on sample selection, variable selection, or attrition.

We study migration under an innovative government-to-government agreement, and our results highlight the positive role governments can play to improve access to migration opportunities among the poor, while limiting the risk of abuse they normally face due to market failures in private sector intermediation. Migration costs were reduced by a factor of seven under the G2G program. This allowed poorer households in Bangladesh to apply, which partly explains the large welfare gains we document. The lottery mechanism also opened up opportunities to those without pre-existing social contacts abroad. Yet, even in this context, cost was a barrier for the very poorest Bangladeshi households. Those living under the US$1.90 a day poverty line were vastly under-represented in our applicant pool. Even the sharply reduced G2G intermediation costs were a deterrent for households with stringent borrowing constraints. Expanding government intermediation services with financing could channel such lucrative opportunities towards the poorest of the poor.

Some of our findings deserve a longer-run follow-up. The gains in female decision-making power we observe could simply be the short-run effect of the migrant being temporarily absent from the household. It would be important to track whether there are any persistent changes in the balance of intra-household decision-making authority after male migrants return home. Such gains for women proved to be short-lived in the case of seasonal domestic migration within Bangladesh (Mobarak and Reimão, 2020). However, those trips are very short-term, with the migrant leaving for only a few weeks at a time. The longer period of absence in the G2G program, and exposure to a new culture could produce more persistent effects. Second, household entrepreneurial activities in Bangladesh fall when an enterprising member wins the lottery and departs. It would be important to track the longer-run effects on entrepreneurship when the migrant returns with international work experience and the liquidity to start new businesses.

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Appendices: For Online Publication Only

Appendix A The G2G intermediation process

The following steps provide an outline of the G2G intermediation process.

1. Interested and eligible men apply for the G2G lottery program through their Union Information and Service Centers (UISCs). The application costs between BDT 50 and BDT 100.

2. Lottery winners are notified via text messages. Winners go to the BMET website to print their confirmation cards with detailed instructions.

3. Winners are asked to undergo a 10-day training at the closest Technical Training Centers (TTCs). Training is prepared following Malaysian government requirements.

4. Winners (mostly Phase-I) undergo a medical test in one of the nine medical colleges across Bangladesh.

5. TTCs prepare files for each applicant, which include copies of passport, full-size pictures, and biometrics, along with evidence of clearing the medical test and completing training and other required documents.

6. Individuals' files (scanned into DVDs) are sent to Malaysia. Malaysian firms decide which workers they want in their firms.

7. Malaysian government sends 'Visas With Referral' to the selected workers through BMET.[1]

8. BMET notifies the selected workers through SMS, asking them to come to the BMET office in Dhaka for final processing.

9. Workers submit their passports and necessary documents to BMET for visa processing. They also deposit recruitment fees at the Expatriates' Welfare Bank.

10. BMET conducts further processing to obtain visas as well as other documents, permits, and clearance.

11. Workers sign employment contracts. The contracts are typically for a two-year period with the possibility of renewal. Lodging is typically provided by the employers, whereas food may not always be provided. The contracts ensure a basic salary of MYR 900 and allow the possibility of overtime work.

12. BMET issues plane tickets for the workers.

13. BMET conducts pre-departure training the day before departure. Workers spend the night at the training camp and leave for Kuala-Lumpur the next day.

14. Migrant workers arrive in Kuala-Lumpur and are received by the employers in the presence of a representative from the Bangladesh High Mission in Kuala-Lumpur.

Appendix B Bounding exercise to address differential finding rates in the survey

B.1 Survey finding rates

With the field protocol described in Section 4, we were able to find and interview a higher share of T1 group compared to T2 and the control group. As Appendix Figure C.1 shows, the overall interview rates were 94 percent for T1, 69 percent for T2, and 68 percent for the control group. The large follow-up rate for T1 is seen in both the phone-based tracking as well as field-based tracking. While 47 percent of the control group were found through phone calls, conditional on having a phone, or getting phone numbers from fellow applicants, 55 percent of T1 were found and 89 percent of T2 were found. The reason for this discrepancy is that the phone records we got from BMET, albeit incomplete, were more up-to-date, as they kept interacting with the winners for further recruitment processes. Among respondents who we tracked on-field (all those not found by phone), the finding rate for the control group was about 40 percent whereas the finding rates for the treated groups were significantly higher at 89 percent and 64 percent for T1 and T2 respectively. Enumerators found it much easier to track the treated individuals in the villages because their information was more up to date with the local authorities. The winners had to interact with local authorities to submit the necessary information for their recruitment processing. Additionally, the treated applicants also became more well known in the local community as a result of winning the lottery.

B.2 Impact of differential finding rates

Common non-parametric bounding approaches, such as the Lee (2009) bounds are uninformative for many of our outcomes due to our particularly high finding rate in the treatment group (94 percent) relative to the control group (68 percent). This means that the Lee bounds approach drops the highest and lowest 27 percent of the outcome variables in the treatment group to construct the bounds. This extreme assumption naturally leads to wide and uninformative bounds. However, even under the extreme assumption of Lee bounds, migration and monthly income measure have bounds that are significantly different from zero (columns 2 and 3, Appendix Table C.3).

However, for other measures where the impact of the lottery is not very high, traditional Lee bounds estimate wide confidence intervals. This is partly because most of the outcomes are intermediated through migration. For instance, if migration leads to higher household expenditure, the Lee (lower) bound estimates of the ITT removes 27 percent of the migrants from the treated group with highest expenditures. That is, the share of migrants in the treated group falls from 76 percent to 49 percent, drastically reducing the power to detect reasonable impacts. Columns 2 and 3 of Appendix Table C.3 show this.

We next estimate the bounds assuming that we had not searched for any of the applicants in the field and completely relied on phone-based tracking. This is motivated by the high finding rate of 89 percent for group T1 compared to 40 percent for the control group (Appendix Figure C.1). However, even if we had just relied completely on phone-based tracking, there would still be a differential finding rate, as we would have found 55 percent of T1 and 44 percent of the control group. The Lee procedure will now remove 15 percent of the T1 sample to estimate the bounds, slightly better than in the full sample. Unfortunately, as columns 4 and 5 of Appendix Table C.3 show, the bounds are still too wide for outcomes other than income and migration measures.

Another approach we use to tighten the bounds derives from Behaghel et al. (2015) (henceforth BCGL). This approach instruments the difficulty in finding respondents with some measure of effort exerted to find the respondents. The assumption of this approach is that, with enough effort, the finding rate would equate across treatment groups. This approach first selects different levels of effort in each treatment group in order to approximately balance the sample sizes and then runs a non-parametric procedure similar to the Lee procedure in the truncated data. BCGL apply this method in a setting where they use the number of phone call attempts made to locate the respondent as a truncating instrument. This approach often leads to much tighter bounds, as it incorporates additional information in constructing the bounds.

We follow the BCGL approach to construct bounds in our context as well. Columns 2 and 3 of Appendix Table C.4 show the BCGL bounds in our sub-sample of phone-found applicants. In this estimation, we treat as non-missing only the cases where respondents were found by phone (field found applicants are coded as missing). This procedure first truncates the treatment group that was found with more than two attempts (about 8 percent of the treatment group). The bounds are much tighter with this approach. Most of the key outcomes and indexes have bounds that are significantly different from zero.

However, the sample for whom we had phone numbers is a non-random subset of the treatment group. Among those we found, those for whom we had a phone number are more likely to be a migrant. In addition, the assumption that we only did phone-based tracking throws away 55 percent of the data. To incorporate the sample that was found in the field, we apply the BCGL intuition to construct another truncating instrument. Finding applicants is more difficult in highly populated unions. In our data, finding an increase in union population by 1 percent is associated with a fall in finding rate of 6 percentage points. Hence, we construct a truncating instrument which is defined as the number of phone call attempts for those for whom we had a phone numbers and the population decile of the union for those for whom we searched in the field. We qualitatively rank the phone attempts higher (low-effort) than population decile to reflect higher effort of finding someone in the field.

The BCGL bounds with this truncating instrument are presented in columns 4 and 5 of Appendix Table C.4. With this approach, the treated group is truncated at the top decile of population if they were not found through phone-based tracking. This results in tighter bounds for most of our estimates with bounds significantly different from zero for our key results. However, the BCGL bounds have some limitations in our context. Migration status, and treatment effect, differ by whether the respondent had a phone number. The BCGL, for example, constructs the bounds by comparing the control group with the treatment group that lives in lesser populated unions. This may introduce some bias or, at the least, change the interpretation of the impact.

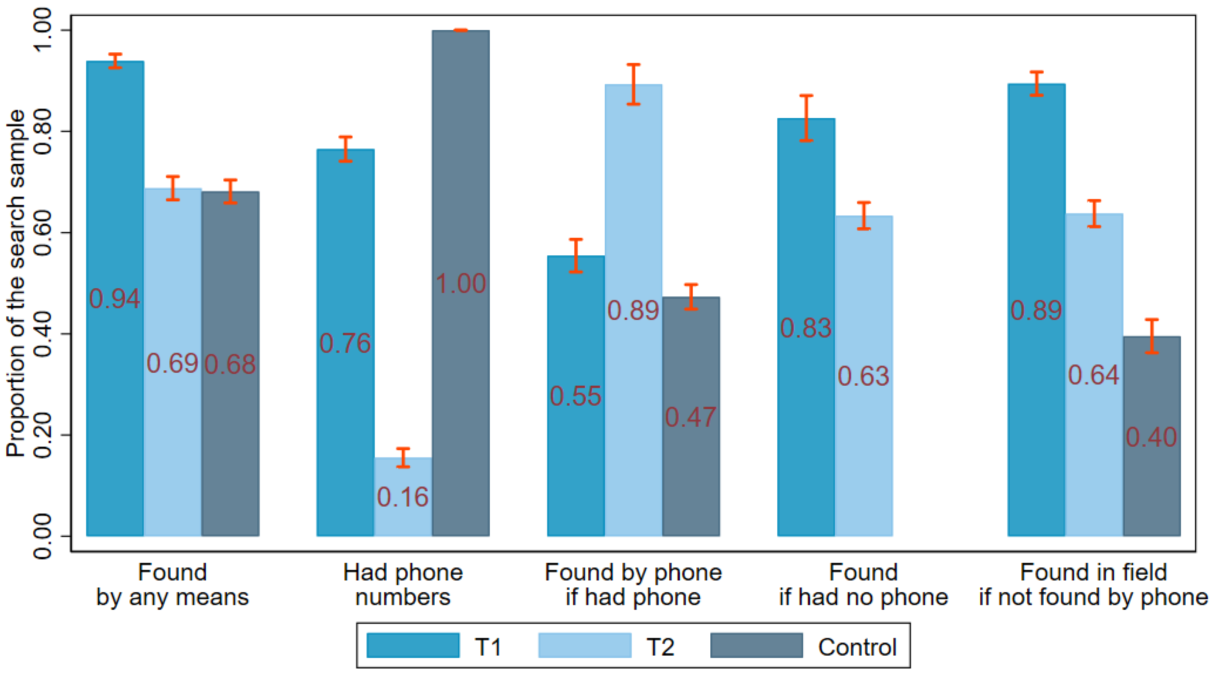
Lastly, we resort to a pragmatic approach to characterize the likelihood of large bias due to differential finding rates. We assume that the higher finding rate of the treatment group is due to the artifact of winning the lottery and not some underlying characteristics that could directly affect the outcomes. With this assumption, we conduct 1 million monte-carlo simulations where we remove a random subset of the treatment group in order to match the finding rate and estimate the ITT on each of the samples. Column 6 of Appendix Table C.4 reports the proportion of the simulations in which we fail to reject the null of no effect. For most of our key outcomes, we do not fail to reject the null of no impact in a single simulation. We fail to reject null impacts on female decisionmaking index 17 times (0.0017%). Hence, any biases due to differential finding rates are extremely unlikely for our key outcomes. Only for one outcome (household with a loan), we fail to reject at a higher rate of 1.9%.

Finally, in Appendix Table C.5, we present the ITT and IV estimates on sub-samples restricted to unions where differential finding rates are low. We restrict to samples where the finding rates are same for both treatment and control group (in columns 2 and 4) as well as to unions where the finding rates are within 25 percentage points of each other (in columns 3 and 6). The differential finding rates in these subsamples are, by construction, either the same (96 percent) or very similar (94 percent for treatment and 92 percent for control). As discussed earlier, unions where the finding rates were high are likely to have lower population. These smaller unions are likely to also have different characteristics (such as not being the main town or economic center). However, the table shows the ITT and IV estimates in these sub-samples are similar to the full sample. The differences are, in most cases, numerically small and statistically insignificant. The only meaningful differences are for the index of entrepreneurial activities where we see muted impact and for household consumption where we see increased impact in the sub-samples. These results are driven by lack of some entrepreneurial opportunities and lower levels of consumption among these households.

Appendix C Additional Figures and Tables

Appendix Figures

Figure C.1: Finding rates by treatment status and mode of search



Source: Authors' estimates from the survey data collected for this study.
Note: Figure shows the finding rates for the treated and control groups. The error bars show 95 percent confidence intervals.

Appendix Tables

Table C.1: Comparison of study sample with the population

	Study sample (1)	HIES 2016 All (2)	Rural (3)	... in survey divisions (4)	... with adult male (5)
Any migrant, last 5 years	0.249	0.087	0.101	0.149	0.074
		[0.000]	[0.000]	[0.000]	[0.000]
Any remittance income last year	0.250	0.029	0.033	0.050	0.020
		[0.000]	[0.000]	[0.000]	[0.000]
Per-capita consumption	58,584	55,204	48,722	54,578	50,811
		[0.007]	[0.000]	[0.002]	[0.000]
Log(per-capita consumption)	11.519	11.430	11.328	11.453	11.398
		[0.000]	[0.000]	[0.000]	[0.000]
Poverty rate (PPP$1.90 per day)	0.027	0.095	0.117	0.066	0.077
		[0.000]	[0.000]	[0.000]	[0.000]
Poverty rate (PPP$3.20 per day)	0.267	0.430	0.503	0.394	0.434
		[0.000]	[0.000]	[0.000]	[0.000]
Per-capita income	54,944	57,120	47,411	50,851	49,639
		[0.346]	[0.000]	[0.073]	[0.015]
Log(per-capita income)	10.967	11.151	11.023	11.087	11.097
		[0.012]	[0.441]	[0.108]	[0.085]
Average age of HH members	26.05	29.10	29.56	28.71	25.09
		[0.000]	[0.000]	[0.000]	[0.005]
Average education among adults	5.90	4.50	3.95	4.10	4.48
		[0.000]	[0.000]	[0.000]	[0.000]
Household size	4.93	4.07	4.12	4.23	4.63
		[0.000]	[0.000]	[0.000]	[0.000]
Operates Non-farm business	0.436	0.179	0.164	0.156	0.191
		[0.000]	[0.000]	[0.000]	[0.000]
Farming Household	0.858	0.558	0.689	0.599	0.604
		[0.000]	[0.000]	[0.000]	[0.000]
Took loan in past year	0.734	0.302	0.332	0.280	0.317
		[0.000]	[0.000]	[0.000]	[0.000]

Source:Authors' calculations from the survey data collected for this study and HIES 2016.

Note: This table shows the comparison of the study sample with the Bangladeshi population along outcome measures indicated by the row headers. The first column presents the mean for the control group in the study sample. The remaining columns presents the statistics for various subsamples of the nationally representative Household Income and Expenditure Survey of 2016/2017. Column 2 presents the national sample; column 3 restricts this sample to rural areas; column 4 further restricts the sample to rural household in the survey provinces of Dhaka, Mymensingh, and Chittagong; column 5 further restricts the sample to households with a male member between the ages of 20 and 45. For each subsample and outcome, the p-value from the test of equality of outcomes with the study sample is presented in brackets.

Table C.2: Balance of characteristics across treatment groups

	(1) Control mean	(2) Early treatment (T1) - Control (C)	(3) Deferred expected treatment (T2)-C	(4) T1-T2
Age	34.01	-0.220	-0.383	0.164
		[0.460]	[0.212]	[0.608]
Height, inches	64.98	0.220	0.157	0.064
		[0.003]	[0.034]	[0.436]
Muslim	0.928	0.015	-0.025	0.040
		[0.124]	[0.024]	[0.000]
Can read and write	0.808	0.003	-0.007	0.010
		[0.854]	[0.666]	[0.511]
Completed years of education	6.83	-0.175	-0.020	-0.155
		[0.307]	[0.910]	[0.313]
Father is alive	0.588	-0.009	-0.004	-0.005
		[0.680]	[0.858]	[0.815]
Father's years of education	3.16	-0.255	0.157	-0.411
		[0.115]	[0.354]	[0.020]
Mother is alive	0.835	-0.009	0.004	-0.013
		[0.573]	[0.818]	[0.412]
Mother's years of education	1.67	-0.075	0.176	-0.251
		[0.505]	[0.167]	[0.051]
Married before lottery	0.615	-0.016	-0.024	0.008
		[0.383]	[0.247]	[0.710]
HH size before lottery	4.98	-0.185	-0.170	-0.015
		[0.107]	[0.147]	[0.889]
Months worked in 2012	11.37	-0.051	0.049	-0.100
		[0.497]	[0.487]	[0.145]
Average monthly income in 2012	8810	565.4	86.7	478.7
		[0.236]	[0.871]	[0.385]
Joint p-value across all outcomes		[0.225]	[0.339]	[0.319]

Source:Authors' calculations from the survey data collected for this study.

Note: The table shows the relationship between individual characteristics and the treatment status. The first column shows the mean of the characteristic in the control group. The rest of the columns show the differences between various treatment groups as indicated in the column headers with p-values in brackets. Each row is estimated from a regression of the characteristic on the treatment indicators controlling for upazila fixed effects and standard errors clustered at the union level. The last row shows the p-value of a joint-test that all coefficients in each column are jointly zero.

Table C.3: Lee bounds on ITT estimates accounting for differential finding rates

	(1) Full sample	(2) Lee bounds (full sample)	(3)	(4) Lee bounds (phone sample)	(5)
	ITT	Lower bound	Upper bound	Lower bound	Upper bound
Migrated abroad	0.571	0.483	0.806	0.611	0.783
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
ihs(Total income, home and away)	0.570	0.225	0.998	0.468	0.965
	[0.000]	[0.022]	[0.000]	[0.000]	[0.000]
ihs(Remittance income)	4.555	2.303	7.725	3.290	6.368
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
ihs(monthly income, computed)	0.721	0.288	1.381	0.466	1.302
	[0.000]	[0.004]	[0.000]	[0.002]	[0.000]
Index: Labor and Income	0.406	0.158	0.808	0.252	0.711
	[0.000]	[0.001]	[0.000]	[0.000]	[0.000]
Log(Consumption per capita)	0.120	-0.149	0.359	-0.065	0.236
	[0.000]	[0.000]	[0.000]	[0.121]	[0.000]
Index: HH consumption	0.199	-0.247	0.657	-0.022	0.505
	[0.000]	[0.000]	[0.000]	[0.760]	[0.000]
Index: Investment in children	0.192	-0.153	0.594	-0.065	0.411
	[0.000]	[0.001]	[0.000]	[0.338]	[0.000]
Any loan	-0.052	-0.171	0.208	-0.110	0.062
	[0.007]	[0.000]	[0.000]	[0.001]	[0.145]
Index: Poverty and insecurity	-0.241	-0.685	0.132	-0.536	-0.056
	[0.000]	[0.000]	[0.005]	[0.000]	[0.448]
Index: Entrepreneurial	-0.198	-1.071	0.192	-0.527	0.004
	[0.000]	[0.000]	[0.000]	[0.000]	[0.957]
Index: Female decisionmaking	0.184	-0.414	0.639	-0.260	0.349
	[0.000]	[0.000]	[0.000]	[0.001]	[0.000]
Index: Pre-migration investments	2.599	1.401	4.145	1.943	3.054
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]

Source:Authors' calculations from the survey data collected for this study.

Note: This table shows non-parametric Lee bounds to address the differential finding rates on select outcomes indicated in the row headers. Column 1 shows the ITT estimate (unweighted) for reference estimated using Equation (1) on the sample including T1 and control group. Columns 2 and 3 shows the Lee (2009) bounds on the full sample. Columns 4 and 5 show the Lee bounds assuming that we had conducted surveys only among applicants who were found by phone. p-values of the estimates in brackets.

Table C.4: Behaghel et al. bounds on ITT estimates and simulations results

	(1) Full Sample	(2) BCGL	(3) bounds	(4) BCGL	(5) bounds	(6) Simulations
		(phone sample)		(full sample)		
	ITT	Lower bound	Upper bound	Lower bound	Upper bound	Failure rate
Migrated abroad	0.571	0.633	0.664	0.571	0.586	0.000000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	
ihs(Total income, home and away)	0.570	0.622	0.723	0.555	0.596	0.000000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	
ihs(Remittance income)	4.555	4.135	4.955	4.512	4.670	0.000000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	
ihs(monthly income, computed)	0.721	0.668	0.825	0.708	0.754	0.000000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	
Index: Labor and Income	0.406	0.337	0.433	0.387	0.418	0.000000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	
Log(Consumption per capita)	0.120	0.079	0.158	0.100	0.121	0.000000
	[0.000]	[0.069]	[0.000]	[0.001]	[0.000]	
Index: HH consumption	0.199	0.106	0.272	0.179	0.228	0.000000
	[0.000]	[0.180]	[0.000]	[0.003]	[0.000]	
Index: Investment in children	0.192	0.094	0.215	0.165	0.200	0.000000
	[0.000]	[0.195]	[0.000]	[0.000]	[0.000]	
Any loan	-0.052	-0.076	0.010	-0.056	-0.041	0.018765
	[0.007]	[0.056]	[0.736]	[0.012]	[0.228]	
Index: Poverty and insecurity	-0.241	-0.307	-0.152	-0.246	-0.197	0.000000
	[0.000]	[0.000]	[0.046]	[0.000]	[0.001]	
Index: Entrepreneurial	-0.198	-0.265	-0.113	-0.205	-0.168	0.000000
	[0.000]	[0.000]	[0.250]	[0.000]	[0.001]	
Index: Female decisionmaking	0.184	0.028	0.226	0.163	0.210	0.000017
	[0.000]	[0.730]	[0.028]	[0.011]	[0.001]	
Index: Pre-migration investments	2.599	2.405	2.792	2.562	2.676	0.000000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	

Source:Authors' calculations from the survey data collected for this study.

Note: This table shows non-parametric bounds to address the differential finding rate on select outcomes indicated in the row headers. Column 1 shows the ITT estimate (unweighted) for reference estimated using Equation (1) on the sample including T1 and control group. Columns 2 and 3 shows the Behaghel et al. (2015) (BCGL) bounds on the sample using phone call attempts as the truncating instrument. These bounds are estimated in that sample that were found through phone calls. Columns 4 and 5 shows the BCGL bounds on the full sample using a mix of phone call attempts and a measure of union population as the truncating instrument. The p-values for the estimates and bounds are presented in brackets. Column 6 shows the proportion of monte-carlo simulations in which we fail to reject the null of no effects of winning the lottery at 95 percent significance level. Each of the 1 million simulation chooses a random subset of the treatment group to match the finding rates between the treated and the control groups.

Table C.5: ITT and IV estimates on trimmed samples to match finding rates

	(1)	(2)	(3)	(4)	(5)	(6)
	ITT estimate			IV estimate		
	All	Equal	within .25	All	Equal	within .25
Sample size	2239	963	1087			
Finding rate (treatment)	0.939	0.960	0.943			
Finding rate (control)	0.681	0.960	0.923			
Migrated abroad	0.580	0.556	0.548			
	[0.000]	[0.000]	[0.000]			
ihs(Total income home and away)	0.612	0.721	0.667	1.085	1.338	1.249
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
ihs(Remittance income)	4.362	3.827	3.646	7.520	6.886	6.649
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
ihs(monthly income, computed)	0.657	0.610	0.577	1.133	1.095	1.051
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Index: Labor and Income	0.390	0.412	0.396	0.672	0.740	0.721
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Log(Consumption per capita)	0.116	0.143	0.136	0.200	0.258	0.248
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Index: HH consumption	0.216	0.259	0.247	0.372	0.467	0.450
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Index: Investment in children	0.191	0.192	0.163	0.329	0.346	0.296
	[0.000]	[0.001]	[0.003]	[0.000]	[0.000]	[0.002]
Any loan	-0.055	-0.054	-0.056	-0.095	-0.097	-0.102
	[0.007]	[0.067]	[0.054]	[0.006]	[0.059]	[0.047]
Index: Poverty and insecurity	-0.256	-0.293	-0.269	-0.442	-0.527	-0.491
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Index: Entrepreneurial	-0.190	-0.079	-0.092	-0.328	-0.143	-0.167
	[0.000]	[0.180]	[0.109]	[0.000]	[0.162]	[0.094]
Index: Female decisionmaking	0.192	0.153	0.157	0.331	0.275	0.287
	[0.000]	[0.030]	[0.020]	[0.000]	[0.021]	[0.013]
Index: Pre-migration investments	2.609	2.536	2.516	4.498	4.563	4.588
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]

Source:Authors' calculations from the survey data collected for this study.

Note: This table shows the ITT (columns 1-3) and IV (columns 4-6) estimates on various subsamples of the data. Columns 1 and 4 present the estimates in the full sample of T1 and control group. Columns 2 and 5 restrict the estimation to unions where the finding rates are identical. Columns 3 and 6 restrict the estimations to unions where the differential finding rate is below 25 percentage points. The first three rows shows the sample size and finding rates across these sub-samples. p-values for the estimates are shown in brackets.