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How do transitory income shocks affect investment in agriculture? Evidence from exchange rate shocks in Bangladesh

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Transitory income shocks affect many poor families in developing countries and can affect household investments, consumption, and labor supply decisions through a variety of channels and with theoretically ambiguous net effects. Using detailed household survey data, this paper exploits a quasi-experiment in Bangladesh in which differential exchange rate shocks across migrant destinations provide an exogenous source of variation in the remittance income, an important supplement to household earnings, received by their origin households. The results show that positive shocks to income cause an increase in household investment and household labor supply, although this effect varies across men and women.

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I. Introduction

GDP growth deriving from the agricultural sector is argued to be more efficacious in alleviating poverty than growth deriving from other sectors (World Bank 2007) and the agricultural sector is said to have served as a major contributor to poverty reduction in Bangladesh (Gautam and Faruquee 2016). Hence, the question of whether transitory income shocks affect investments, and the labor supply of men and women, in agriculture and foster/suppress agricultural productivity growth should be a first-order concern. There is little credible evidence, however, as to the impact of such shocks on agricultural outcomes. From an investment perspective, on the one hand, negative shocks to household income can exacerbate a multitude of market failures which prevail in the developing world; they may intensify poverty not only in the current period but with long-lasting effects (and even intergenerational effects) since there is less money available to invest in human or productive capital. On the other hand, sudden reductions in household income may instead be absorbed by a fall in consumption.

Using data from the Bangladesh Integrated Household Survey (BIHS), a nationally representative survey of Bangladesh, this paper evaluates the impact of transitory income shocks on agricultural investment as well as the household labor supply decisions by men and women in Bangladesh. It makes use of a novel identification strategy to examine the causal impact of shocks to remittance income, as a form of transitory income shock, on Bangladeshi households with members who have migrated internationally. By considering only households with migrants, this mitigates the fundamental challenge in assessing the impact of remittance income; that the decision to migrate is not random. I rely on exogenous exchange rate shocks experienced by migrants across different overseas destinations. In particular, Bangladesh sends many low-skilled workers to Southeast Asia and the Gulf Cooperation

Council region. By exploiting (primarily) the acute plunges in the value of the Malaysian ringgit from the third quarter of 2014 through 2015, this paper uses the exchange rate shocks as a source of quasi-experimental variation in household income. Building on this identification strategy, this paper employs a first-difference approach to analyse how households use transitory income. To my knowledge, this is only the second paper after Yang (2008) to use this identification strategy. It the first to employ this identification strategy to examine the implications of transitory income shocks for agricultural investment and the gendered impacts of migration on source household labor supply decisions.

Bangladesh is particularly useful case study in the context of this question. It is one of the world's largest source countries for international migrants² thus remittance income constitutes a significant portion of (and deviations in) household income. Moreover, agriculture is a particularly important aspect of its economy. Lastly, labor migration originates heavily from rural areas of developing countries and whilst Bangladeshi women are emerging as participants in migration, international migration patterns remain male dominated. In this respect, the effect of income shocks in households in which husbands and/or sons are absent is of particular interest and relates to the growing literature on the feminization of agriculture (see Slavchevska, Kaaria, and Taivalmaa 2019).

The main findings of this paper tend to supplement the evidence of investment responses to transitory income shocks in the form of capital grants in non-agricultural settings (de Mel, McKenzie, and Woodruff 2008) and support the view that transitory income shocks can help households in rural parts of the developing countries to work around credit market failures

² 10.7% of Bangladeshi households have at least one member working abroad in late 2011/early 2012 when the first round of the BIHS was conducted.

that limit their ability to invest in physical capital. In this sense, the impact of income shocks on reducing liquidity constraints should be magnified in the context of underdeveloped capital markets, such as is the case in rural Bangladesh. (Karlan et al. 2014), on the other hand, find that cash grants are not invested in agriculture in the case of Northern Ghana, instead concluding that the binding constraint to agricultural investment in the Ghanaian context is uninsured risk. The absence of husbands in the Bangladeshi households studied in this paper may explain in some part the difference between these findings.

It is also not obvious that higher income should unequivocally lead to higher investment; much of the existing migration literature suggests that remittance income is expended on consumption goods as opposed to investment (including educational investments etc) (Glytsos 1993; Chami, Fullenkamp, and Jahjah 2003). Whilst the differences between the existing literature and the findings of this paper can be explained by differences in the methodologies employed, in the context of the broader literature this paper may highlight the differences in the use of transitory remittance income shocks versus steady streams of remittance income.

It is notable that the findings of this paper also contradict some of the existing literature on the impact of remittance income on household labor supply (Adams 2011; Antman 2013) Contrary to an increase in income being associated with an increase in reservation wage thus disincentivizing paid work, I find that source households decrease hours worked as a result of negative income shocks and increase hours worked as a result of positive income shocks. There is also no suggestion that this effect is stronger for women in the context of transitory shocks (as found by Amuedo-Dorantes and Pozo (2006) in the context of Mexico). I consider a decomposition of household labor supply by gender finding that both men and women the participation of both men and women in food and cash cropping at the extensive margin, and

the number of hours worked without pay by men change in accordance with the direction of the exchange rate shock. That is, appreciations and positive income shocks are associated with increases and depreciations and negative income shocks are associated with decreases. The impact on women's work without pay moves in the opposite direction of the shock.

The remainder of this paper is arranged as follows. Section II describes the data used and provides some descriptive statistics. Section III presents the identification strategy of the empirical analysis. Section IV examines the results and their implications for policy. Section V concludes.

II. The Bangladesh Integrated Household Survey and household exposure to exchange rate shocks

The Bangladesh Integrated Household survey is nationally representative survey of Bangladeshi households. Data on the independent variables was collected during two rounds of the survey: the first round, conducted October 2011–March 2012; and the second round, conducted April–July 2015. It is a rare example of a panel dataset from a developing country which collects detailed data on international migration and remittances thus facilitating the methodology employed in this paper. The unit of observation for remittances is at the individual migrant-level, and the survey also reports labor supply at the level of each individual household member. Some variables, such as productive capital, are observed only at the household-level. During the first round of the survey (2011-12), baseline household characteristics were collected. This round of the survey also reports detailed migrant characteristics such as their length of stay abroad and age, for anyone who was a member of the household in the past five years but has been living away for at least six months. A particular advantage

of the dataset, beyond its capacity to explore the microeconomic impact of transitory income shocks, is that it captures both formal remittances and the large volume of transfers which take place through informal institutions (López-Córdova and Olmedo 2006) such as delivery by family or *hundi*³.

The empirical analysis which follows focuses exclusively on 394 households that received remittances from abroad and/or had at least one individual who had been a member of the household in the past five years and was an international migrant during the first round of the survey, and for which full information about individual-level migrant characteristics is available for all migrants within the household⁴. Households with migrants which are not exposed to exchange rate shocks serve as a natural control group to those which are; by comparing households that have sent migrants to different destinations, this mitigates concerns about the need to sufficiently correct for the intrinsic differences between households with migrants and those without migrant members⁵.

³ 35% of households report receiving transfers from abroad via these channels in first round.

⁴ These characteristics include workers' months overseas at baseline, overseas workers' education level/occupation/ position in the household etc. The sample on which this paper focuses is not representative of the full set of households with migrants (including those 242 for which full information on individual-level migrant characteristics is missing); a number of baseline household-level characteristics are statistically significantly different between the samples. Since a number of the individual-level migrant characteristics are statistically significant in the empirical analysis, I focus on the households for which these characteristics can be controlled for.

⁵ Only households in which the migrants go to one of 40 countries named in the BIHS are included. There is a total of 62 migrants from 60 households who are in destinations defined "others". The non-negligible number of households (42) which were not captured by the second round or had split into multiple households are not included for analysis. Such attrition and the splitting of households during the period between the two rounds is potentially problematic if it is correlated with the exchange rate shocks, as it would create a sample selection problem and lead to biased estimates. Two regressions are executed to verify that the exchange rate shocks are not correlated with attrition or split-household status by the second round (and as such, that these groups are not systematically different to the remaining sample) and these households are subsequently dropped from the sample. The dependent variables in each regression are as follows: an indicator equal to 1 if the household is not captured by the second round and 0 otherwise; and an indicator equal to 1 if the household has split into multiple households by the second round and 0 otherwise. The independent variable is the exchange rate shock. These regressions provide no evidence to suggest that attrition or the splitting of households is correlated with the shocks. The coefficients on the independent variable are not statistically significantly different from 0 (p -values = 0.547 and 0.661 respectively) and are small in size. Since attrition does not appear to be correlated with the exchange rate shocks, the estimates presented in Section IV should not suffer from attrition bias.

Table 1 presents a summary of relevant descriptive statistics at the household-level, from the first round. Table 2 summarises the baseline characteristics of migrants. What is notable from Table 2 is that the majority of migrants have been overseas for more than four years and three quarters of them for at least two years. This implies that the nature of international migration is longer term as opposed to seasonal and that the identification strategy is appropriate in this context.

Table 1
Baseline characteristics of sample households

	Mean	Std. Dev.	10th pctile	Median	90th pctile
Exchange rate shock	0.000	0.0587	-0.082	0.016	0.044
<i>Income and expenditure</i>					
- Annual non-food consumption	87,117	101,780	22,375	51,297	186,231
- Income (annual)	178,079	158,630	50,000	130,600	356,644
- Income per capita	48,640	46,727	12,000	36,000	100,080
- Annual international remittances	118,756	134,013	6,000	90,000	240,000
- International remittances as a share of income	0.66	0.34	0.04	0.75	1
Total number of migrants/remitters	1.14	0.39	1	1	2
Numbers of remitters	1.02	0.49	1	1	2
Number of migrants	1.11	0.35	1	1	1
HH size (excluding overseas members)	4.20	1.93	2	4	7
<i>Household income sources</i>					
- Daily wage/salary share of total	0.06	0.17	0	0	0.22
- Non-zero daily wage/salary income indicator	0.15				

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- Self-employment share of total	0.17	0.25	0	0.02	0.55
- Non-zero self-employment income indicator	0.64				

Household head characteristics:

Age	46.3	15.75	26	45	65
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Education level indicators (5)

- Never attended/did not complete primary	0.49
- Completed primary	0.15
- Some secondary	0.26
- Completed secondary	0.06
- Some higher secondary and above	0.05

Occupation indicators (4)

- Farming & Livestock (poultry) related work	0.43
- Non-earning occupation	0.43
- Self-employment	0.08
- Wage labour/salaried work	0.05

Marital status: single	0.11
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Notes. Number of observations: 394. Data source: Bangladesh Integrated Household Survey, IFPRI: Currency unit: consumption, income and remittances are in Bangladeshi taka (71 per US\$ in October 2010-March 2012). Exchange rate shock definition: change in Bangladeshi taka per currency unit in destination country of overseas worker in first round of the survey. Change is the average of the 12 months prior to the month that that household was surveyed in the first round less the average of the 12 months leading to the month that the household was surveyed in the second round, over the latter (such that a 5% decrease is -0.05). For households with multiple overseas migrants/remitters in the baseline survey, exchange rate shock is defined as the average change in the exchange rate across migrant/remitter overseas destinations. Exchange rate data are from Thomson Reuters. Migrant definition: anyone who was a member of the household in the past five years but was a migrant (living abroad for 6 months or more) in the first round of the survey. Remittances received from migrants of the household are reported, as well as any money received from overseas in the past 12 months from any other person who does not live in the household. Annual non-food consumption is the combined total of the Non-food Expenditure Annual Recall module of the survey and the Non-food Expenditure Monthly Recall categories of expenditure, aggregated to an annual basis. Annual income is an aggregated measure which includes international remittances, income accruing to various forms of employment, income-in-kind, social safety nets and other income. Definition of the sample: households with an overseas migrant member and/or in receipt of international remittances in the first round of the survey. Observations at the household level.

Table 2

Baseline characteristics of international migrants

	Mean	Std. Dev.	10th pctile	Median	90th pctile
Age	32.15	10.50	21	30	48
Male indicator	0.99				
<i>Occupation indicators (3)</i>					
- Wage labour/salaried worker	0.81				
- Self-employment	0.15				
- Other	0.04				
<i>Education level indicators (5)</i>					
- Never attended/did not complete primary	0.18				
- Completed primary	0.21				
- Some secondary	0.39				
- Completed secondary	0.14				
- Some higher secondary and above	0.08				
<i>Position in household indicator (5)</i>					
- Male head of household/primary respondent	0.01				
- Spouse of primary respondent	0.34				
- Child of head	0.55				
- Sibling of head	0.06				
- Other relation to head	0.04				
<i>Months overseas at survey first round indicators (5)</i>					
- 0-11 months	0.14				

- 12-23 months	0.11
- 24-35 months	0.09
- 36-47 months	0.16
- 48 months or more	0.50

Notes. Number of observations: 436. Data source: Bangladesh Integrated Household Survey, IFPRI. Other occupation category includes farming and non-earning occupations. Observations at the individual level, from 394 households.

Exchange rate shocks

The geographical spread of Bangladeshi migrants across different destinations means that migrants were exposed to substantially varied exchange rate shocks. Table 3 presents a summary of the migrants' destinations from sample households, and the exchange rate shock to which they were exposed by 2015.

Table 3
Destination of international migrants from sample households (2011-12)

Location	Number of over-seas workers	% of total	Mean exchange rate shock
Saudi Arabia	136	31.19%	0.035
UAE	104	23.85%	0.036
Malaysia	64	14.68%	-0.083
Oman	40	9.17%	0.036
Kuwait	17	3.90%	-0.012
Singapore	17	3.90%	-0.005
Bahrain	13	2.98%	0.041

Maldives	8	1.83%	-0.064
USA	7	1.61%	0.038
Qatar	6	1.38%	0.038
India	5	1.15%	-0.216
Other	15	3.44%	
Total	436		

Notes. Data source: Bangladesh Integrated Household Survey, IFPRI. Other comprised of 14 countries: Germany, Iraq, Italy, Jordan, Mauritius, New Zealand, Pakistan, South Africa, Taiwan, Yemen. Table includes only those overseas workers in the sample for empirical analysis. Exchange rate shock definition: change in Bangladeshi taka per currency unit in destination country of overseas worker in first round of the survey. Change is the average of the 12 months prior to the month that the household was surveyed in the first round less the average of the 12 months leading to the month that the household was surveyed in the second round, over the latter (such that a 5% decrease is -0.05). Observations at the individual level, from 394 sample households.

There are large diasporas in Southeast Asia and the Gulf Cooperation Council (GCC) (of which five currencies are pegged to the US dollar), and the India-Bangladesh migrant corridor is the third largest in the world (World Bank 2016). Notably, a number of these destinations experienced a substantial depreciation in their currency between the first and second round. A depreciation in a country's exchange rate is an unfavourable shock to a migrant in that destination foreign currency earned in the destination can now be exchanged for fewer Bangladeshi taka once remitted. Much of the variation in the empirical analysis which follows is driven by the devaluation of the Malaysian ringgit between the first and second round

of the survey. In the first half of 2015, and therefore by the time the second round was completed and in the period over which remittances were reported, the ringgit had fallen by 9.8% against the dollar. This was the largest depreciation the currency had experienced since the Asian Financial Crisis. It was attributed to declining commodity prices, on which the Malaysian economy is heavily dependent, as well as the slowdown in China which is Malaysia's largest trading partner. The depreciation was exacerbated by alleged government corruption, namely the 1Malaysia Development Berhad scandal, which reduced investor confidence (The Economist 2015). It is assumed in the analysis which follows that these factors and the consequential depreciation of the ringgit was unanticipated.

Whilst the remittance-sending period reported in the BIHS (12 months prior to the second round; hence May 2014-April 2015 for those surveyed earliest in the second round and August 2014-July 2015 for those surveyed latest in the second round) does not capture the full extent of the depreciation, remittances are sent very frequently (Yang 2011) and therefore at least some of the effect of the depreciation on remittances is expected to be captured⁶. The destinations of other Bangladeshi migrants were also affected. For example, the euro depreciated significantly, owing to the European Central Bank's (ECB) quantitative easing programme and the deepening of the Greek crisis. Figure 1 visually depicts ERs for a set of key destinations of Bangladeshi migrants. The prominent feature of this graph is the relative

⁶ The average number of times the sample of households report receiving remittances in the 12 months prior to the first round is 6.5.

sharp decline in the Malaysian ringgit and the euro in the 12 months prior to the second

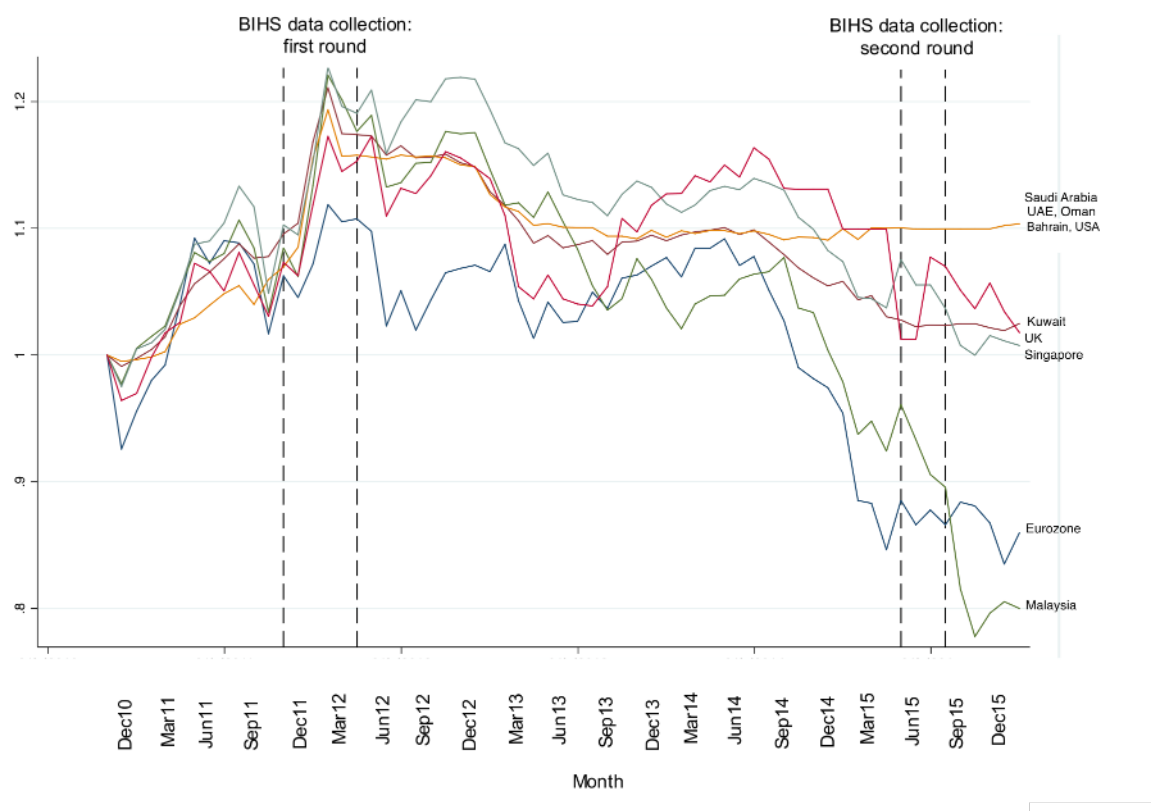


Fig. 1. Exchange rates in key destinations of migrant Bangladeshis, October 2011-December 2015

Notes. Data source: Thomson Reuters. Exchange rates are as of last day in each month.

round.

III. Empirical strategy

For each household ER_i , the measure of the change between the year prior to the first round of the survey (2011-12) and the year prior to the second round of the survey (2015), is defined as follows:

$$ER_i = (a/b) - 1$$

where:

a is the average country j exchange rate in the 12 months prior to the month that the household was surveyed in the second round;

b is average country j exchange rate in the 12 months prior to the month that the household was surveyed in the first round

A 10% appreciation in the currency of destination country j would therefore be expressed as 0.1. I emphasize that since, E_i is constructed from the migrants' destinations prior to the shock, I avoid issues of reverse causality. An implicit assumption is therefore that migrants did not change destinations in the 12 months prior to the first-round survey⁷. For households with multiple migrants in the first round, ER_i is defined as the average change in the exchange rate across migrant destinations, weighted by the number of migrants in each destination.

By exploiting the fact that households were surveyed in different months to one another in the first and second rounds of survey (which were conducted over six-month and four-month periods respectively), the exchange rate shock variable can actually be constructed at the household-level, thus increasing sample variation⁸. To make this point clear, consider two households in the data that sent migrants to Malaysia. The first household was surveyed in January 2012 for the first round and June 2015 for the second; the effective exchange rate shock that this household experience was -9.4%. By contrast, a second household was surveyed in December 2011 for the first round and April 2015 for the second; the effective exchange rate shock that this household received was -5.8%.

⁷ At baseline, households were only asked where the migrant was/where the migrant sent remittances from at the time of the survey hence it is not possible to ascertain migrants' movement in the twelve months prior to baseline. It is therefore assumed that their location at the time of the baseline survey is where they had been the entire 12 months.

⁸ By comparison, Yang (2008) uses a similar strategy but defines the shock as identical for all households with a migrant in the same overseas destination. For a very small number of households (<0.01%) the date of the second-round survey is missing. For these households, the exchange rate shock is defined as an average across the four months of the second-round survey. This still allows for household-level variation in "exposure to treatment," since these households were surveyed at different dates in the first round.

To analyse the impact of exchange rate shocks on household labor supply and agricultural investment between 2011-12 and 2015, a first-differenced estimator is estimated by OLS. The regression specification is therefore⁹:

$$\Delta Y_{it} = \beta_0 + \beta_1 ER_i + \varepsilon_i \quad (1)$$

where:

ΔY_{it} is the difference between outcome Y_i in the first round and the second round;

ER_i is the household-specific exchange rate change between the year anteceding the first round and the year anteceding the second round.

The parameter of interest is β_1 which captures the causal effect of interest. Since all specifications are conditioned only on whether households had a migrant in the first round, the estimates constitute the intent-to-treat effect. β_0 captures the average change in the outcomes of interest across all rural Bangladeshi households in the sample. For example, it accounts for the average changes in the outcome variables in response to the growth of the Bangladeshi economy over this period¹⁰.

The quasi-experimental approach and identification strategy employed in this empirical analysis follows that of Yang (2008). It corrects for a number of the empirical problems which are pervasive in the literature which considers remittance income and make it difficult to establish causality. First, households select to send members abroad to work. Propensity score matching methods, which construct artificial “no-migration” counterfactuals from observa-

⁹ An alternative approach would be to use the exchange rate shocks as an instrument for the change in remittances. However, it is unlikely that the change in remittances that occur as a result of an exchange rate shocks is equivalent to the total shock to a migrant’s income when denominated in Bangladeshi taka. Because of the absence of data on migrant savings and wages abroad, which are also affected by the shocks, I proceed as per specification (1) and therefore all estimates constitute the reduced form effect of the exchange rate shocks.

¹⁰ which exceeded 6% in every year between the first and second round.

tions on households without migrants, ignore unobserved characteristics such as risk aversion, which may affect a household's decision to select into migration. This paper addresses selection bias more appropriately than other methodologies employed in the literature by comparing households with migrants to other households with migrants. Second, by employing an identification strategy which exploits exogenous changes in the exchange rate across the migrants' destinations, the approach mitigates the risk of simultaneity bias since decisions on remittances, labor supply and investment are made simultaneously; that is, characteristics which determine migration and remittances also influence labor supply. Third, it also eliminates biases stemming from the reverse causality between income shocks and the outcome variables. Whilst the effect of a positive income shock on household labor could be negative if individuals increase their reservation wage, reduced labor supply (due for example due to job loss) could induce higher remittances. Finally, the use of panel data and first-difference estimation eliminates omitted variable bias which persists in methodologies that consider only one period. Effective economic policies in Bangladesh for example, could concurrently increase demand for agricultural products thus leading households to work more intensively and also stimulate higher remittance income purposed for investment in the domestic economy. Consequently, a comparison of households with and without a migrant labor supply and income shocks would be positively associated without a causal interpretation.

Previous empirical work suggests that the effect of the income shock is likely to be dependent on household and migrant characteristics including duration of the migrant's stay abroad (Dustmann and Görlach 2016). The existing literature therefore provides the rationale to include these baseline characteristics of households with migrants.

The inclusion of relevant household and migrant characteristics also constitutes a partial test of the parallel trend assumption, on which a causal interpretation relies. Specifically, in the absence of any income shocks, it is assumed that changes in outcomes would not have differed systematically across migrants on the basis of their destination; that is, for example, if households with migrants in Malaysia and households with migrants in the GCC region had in fact experienced an exchange rate shock of the same magnitude, changes in outcomes would have been identical across households. A violation of the parallel trend assumption would be if households whose migrants were in the GCC region differed in terms of baseline characteristics (whether at the household or individual migrant-level) from households whose migrants were in Malaysia *and* if changes in the outcome variables would have varied on the basis of such characteristics, even if changes in the exchange rate had been homogenous across migrant destination.

In order to partly test the parallel trend assumption in the absence of an earlier round of data, the exchange rate shock variable is first regressed on baseline characteristics at the household-level and at the individual migrant-level as follows:

$$ER_i = \beta_0 + \boldsymbol{\gamma}'\mathbf{X}_{it-1} + \varepsilon_i \tag{2}$$

where:

\mathbf{X}_{it-1} is a vector of characteristics for household i in the first round¹¹.

This constitutes a baseline balance test, which serves to identify whether baseline characteristics are correlated with the exchange rate shocks. If the characteristics are not significantly correlated with the shocks, it supports the idea that households receiving different shocks are

(3)

¹¹ i.e. baseline characteristics. See notes of Table 4 for details.

plausibly similar. Next, the following specification is estimated to assess whether the inclusion of baseline characteristics alters the estimated effect of the exchange rate shocks, compared with the estimates from (1):

$$\Delta Y_{it} = \beta_0 + \beta_1 ER_i + \boldsymbol{\gamma}' \mathbf{X}_{it-1} + \varepsilon_i$$

If the coefficients on the exchange rate shock variable from (3) are sufficiently close to the coefficients estimated from (1), then it supports the idea that exchange rate shocks are not proxying for baseline differences across households.

The results from the baseline balance check are reported in Appendix Table A.1. The household size variable is significantly associated with the exchange rate shocks, and the overseas worker occupation indicators are jointly significant. It is therefore particularly important to ensure that the coefficients on the exchange rate shock from (3) are sufficiently close to the coefficients estimated from (1), to confirm that exchange rate shocks are not proxying for baseline differences across households and that households receiving different shocks are plausibly similar.

For all specifications, standard errors are clustered at the level of the migrant destination because migration is a choice variable and therefore outcomes of households sending migrants to the same country will tend to be correlated¹². However, as the number of clusters is small (22), the cluster-robust standard errors are biased downwards. To account for this, the wild cluster bootstrap-t procedure is employed as to not overstate the precision of the estimates or inflate the possibility of Type I errors. Whilst any bootstrap improves on the case without

¹² For households with migrants in multiple destinations in the first round, standard errors are clustered according to the destination of the oldest worker

bootstrapping, wild bootstrap allows the variance matrix to differ across clusters and relaxes the assumption that all clusters are the same size (Cameron, Gelbach, and Miller 2008).

IV. The impact of the exchange rate shocks

Table 4 describes the main results. Column 1 presents the results as per specification (1): excluding migrant and household characteristics. Column 2 includes a full set of controls including household fixed effects.

Table 4
Impact of exchange rate shocks, 2015

	Regressions			
	Initial mean	Mean change	(1)	(2)
Remittance receipts	0.656	0.950	0.755 (3.662)	4.208 (4.308)
Migrant returns	n/a	0.145	0.166 (0.206)	0.252 (0.301)

Change in ownership of productive capital

- Agricultural land	2.923	-0.109	5.936 (3.700)	7.009 (3.095)***
- Large livestock	0.894	-0.178	0.130 (0.700)	0.108 (0.679)
- Fishing equipment	0.496	-0.072	2.288 (1.528)	1.970 (1.120)**
- Non-mechanized farm equipment	2.266	1.321	0.755 (3.607)	3.603 (2.580)
- Mechanized farm equipment	0.095	1.321	-0.840 (1.217)	-1.446 (1.505)
- Cell phone	1.414	0.517	0.883 (0.953)	0.371 (1.196)
- Vehicles	0.266	0.172	-0.619 (0.343)*	-0.290 (0.333)
Asset index	n/a	0.329	3.903 (1.451)**	4.690 (2.265)
Pre-crisis household and migrant characteristics				X

Notes. Data source: Bangladesh Integrated Household Survey, IFPRI. Each cell in regressions columns 1-2 presents the point estimate on the exchange rate shock variable of a separate regression. Standard errors in parentheses, clustered by destination country of household's eldest overseas worker. All dependent variables (except migrant returns) are first-differenced variables. For remittance variable, change is between 12-month reporting periods prior to first round survey (Oct 2011-March 2012) and second round survey (March 2015-July 2015), expressed as fraction of initial household income. Ownership of productive capital variables are changes in numbers of items in respective categories of capital. Initial means are of levels of respective outcome variables prior to crisis. See Table 1 for notes on exchange rate shock definition and definition of household sample. Household location controls are 7 indicators for divisions within Bangladesh. Pre-shock household-level controls are as follows. Income variables: log of per capita household income; indicators for being in lowest, 2nd, and 3rd quartile of sample distribution of household per capita income. Demographic and occupational indicators: household size (excluding overseas members); five indicators for head's education level (never/attended did not complete primary, completed primary, some secondary, completed secondary; some higher secondary and above omitted); head's age; indicator for head's marital status is single; head's gender; six indicators for head's occupation (farming & livestock poultry related work, self-employed, wage labour/salaried worker; non-earning occupation omitted). Migrant controls are means of the following variables across household's overseas migrants in the first round of the survey: indicators for months away (0-11, 12-23, 24-35, 36-47; 48 or more omitted); indicators for education level (never/attended did not complete primary, completed primary, some secondary, completed secondary; some higher secondary and above omitted); occupation indicators (salaried worker/wage labourer, self-employed; other occupation omitted); relationship to household head indicators (household head, spouse, child, sibling; other relative omitted); years of age. Sample includes 394 observations at the household level.

* significant at 10%; ** significant at 5%; *** significant at 1%

Remittances

The first row of Table 4 shows the estimated coefficients from equations (1) and (3), the impact of the exchange rate shocks on the change in remittances received from abroad between October 2011-March 2012 and April 2015-July 2015, as a share of baseline household income. It is notable that the coefficient on the exchange rate shock variable in column 2 is

large in magnitude. While not statistically significant at conventional levels, the coefficient implies that a one-standard-deviation increase in the exchange rate shock (0.0587) is associated with an increase in remittances equal to 24.7¹³ percentage points of 2011-12 household income. The increase in the magnitude of the coefficient when migrant and household characteristics are included in column 2 suggests that the characteristics of households with migrants in countries experiencing a depreciation, are associated with increases in remittances between 2011-2012 and 2015.

Supplemental analysis indicates that a small number of outliers cause this result to be insignificant. After first ruling out the possibility that the effect of the treatment on the treatment group (i.e. migrants in Malaysia) was for them to move to the GCC¹⁴, I re-estimate (3) with robust standard errors for remittances, omitting three households with migrants in South Africa in the first round of the survey. A multitude of factors led to a 33.7% devaluation of the rand by 2015. This equates to 5.78 standard deviations of the measure of household-level exchange rate shock in this paper. Any outlying increases in remittances sent by these migrants will heavily impact the results. The regression of the change in remittances on the exchange rate shock variable with a full set of controls is significant (p-value = 0.074) when repeated but excluding these three households and estimated with robust standard errors. This there-

¹³ Whilst the magnitude of this effect may appear unreasonably large, note that remittances account for two-thirds of income for households with migrants. The exchange rate shocks result in large shifts in household income.

¹⁴ If this was a likely explanation, outmigration between the rounds should itself be affected by treatment. A regression of an outmigration dummy (equal to 1 if the household reports having a member migrate by the second round, and 0 otherwise) on the exchange rate shock variable, to test the endogeneity of patterns of migration by 2015, provides no evidence of a statistically significant effect. The slowdown of the economies in the GCC region across the study period led to a reduction in employment opportunities for migrant workers, thus diminishing their capacity to send remittances (International Monetary Fund 2017). This is also an unlikely explanation for the null effect since Malaysia experienced a downturn of comparable magnitude over the same period. A regression of the change in remittances on the exchange rate shock variable, controlling for the change in log GDP of destination countries, could validate this argument empirically. The ~20% fall in cost of sending remittances from Malaysia (World Bank 2018) alongside earlier empirical evidence which suggests that remittances are very sensitive to the cost of remitting (Aycinena, Martinez, and Yang 2010) may explain the null finding to some extent.

fore provides evidence of an empirical link between the exchange rate shocks and remittances. Whilst the relationship between the exchange rate and remittances is not particularly strong, one may not consider this a surprising result since migrants may partially offset the devaluation of the Malaysian currency by increasing the nominal value of the remittances they send.

An additional finding from the regression of the change in remittances on the exchange rate shocks is that the constant term is significant. Whilst the relationship between the change in remittances and the change in the ER is positive, the mean difference in remittances for households with migrants in countries experiencing a depreciation (e.g. Malaysia) is still positive. The significance of the constant term provides empirical evidence that remittances are systematically higher in the second round. There are a number of possible explanations for this. For example, it is possible that migrants earn more after spending more time in a country and therefore, can send more remittances home.

Migrant returns

There is also the possibility that any changes in household investment in agriculture and labor supply are due to the return of migrants from abroad, a non-income channel. For example, returning migrants can facilitate the transfer of knowledge about better technologies¹⁵ from destination countries. Moreover, it is reasonable to expect that the depreciation of the Malaysian ringgit was accompanied by a downturn in the Malaysian economy. If migrants in Malaysia were more likely to lose their jobs as a result, this may affect their decision to return and investments in agriculture on their return correspondingly. The second row of Table 4

¹⁵ e.g. by encouraging the uptake of high-yielding seed technology. The small number of migrants employed in agriculture while abroad suggests that the channel would not be one of direct skill acquisition, but there could be more general improvements in capability.

shows the estimated coefficients from equations (1) and (3), giving the impact of the exchange rate shocks on the number of migrants who returned between October 2011-March 2012 and April 2015-July 2015. When controlling for migrant and household characteristics, coefficients are positive, though not significant. The point estimates suggest that migrants in destinations experiencing a depreciation were less likely to return to Bangladesh. This may seem counterintuitive if negative exchange rate shocks worsened the economic conditions faced by migrants in destination countries. However, it can be rationalised if the length of migrants' stays abroad are determined by the target-earnings motive (Yang 2006)¹⁶. These estimates are consistent with the hypothesis that the exchange rate shocks had no impact on migrant returns to Bangladesh. While migrant returns may not be fully captured¹⁷, this strengthens the interpretation that the shocks operate primarily through transitory shocks to household income.

Investment in productive capital

To assess the impact of the exchange rate shocks on investment, the analysis now employs specifications (1) and (3), where the dependent variable is the source household's change in ownership of productive capital between the first and second round. The large livestock and fishing equipment variables give an indication of whether households increasingly diversify

¹⁶ Target-earners, who stay abroad until they achieve a certain savings threshold which the household invests on their return, are theoretically predicted to be in the middle of the foreign wage distribution. An interesting extension to the following section which considers the impact of the exchange rate shocks on investment, might consider heterogeneous effects i.e. whether the impact of the exchange rate shocks varies across quartiles of foreign earnings. The lack of data on foreign earnings renders such analysis beyond the scope of this paper. Moreover, this would not be suitable in the context of first-differences analysis. This would require the parallel trend assumption to hold for households with high-earning migrants in "control" destinations such as the GCC region, households with low-earning migrants in the GCC region, households with high-earning migrants in "treatment" destinations such as Malaysia and households with low-earning migrants in Malaysia.

¹⁷ See Appendix for a detailed construction of this measure

into high-value agriculture, which is strategically important in the creation of jobs and promotion of income growth in rural areas (Banerjee et al. 2015). The measure of mechanized farm equipment captures another key area of investment for agricultural productivity.

Controlling for migrant and household characteristics, column 2 of rows 3-9 of Table 4 signify that exchange rate shocks and investment are positively correlated. Despite large standard errors, the estimated coefficients on agricultural land and on fishing equipment are robust to the wild cluster bootstrap-t procedure (p-values = 0.005 and 0.038 respectively). The estimated change in agricultural land at the intensive margin implies that a 10% currency appreciation (depreciation) in the destination country leads to a 0.7 increase (decrease) in the number of plots of agricultural land (compared to a median value of 2 and a mean value of 2.81)¹⁸. The point estimate on fishing equipment implies that a 10% shock to the exchange rate is associated with a 0.197 change in the amount of fishing equipment (compared to a median value of 0 and a mean value of 0.439). That is, positive exchange rate shocks are associated with investment in fishing equipment and negative exchange rate shocks with disinvestment in fishing equipment. These changes in the various types of productive capital are non-trivial in magnitude.

To further probe the relationship between investment and the exchange rate shocks, I standardize the seven measures of productive investment in Table 4 and collapse them into a single index¹⁹. This may be the most appropriate measure on which to focus, as households report ownership of very few productive assets in these types of productive capital separately. Robust to the wild cluster bootstrap-t procedure, the estimated coefficients on the exchange rate

¹⁸ An interesting extension might consider a decomposition by gender on who owns the land as well as who is reported to have control over income generated from the land.

¹⁹ Because all seven measures are in standard units, the index is a simple sum of the seven standardized values.

shock variable is statistically significant at 5%²⁰. This estimate implies that a 10% increase (decrease) in the exchange rate shock increases (reduces) the value of the asset index by 0.39 standard deviations²¹.

Household labor supply

Table 5 presents coefficient estimates of the impact of exchange rate shocks on various measures of household labor supply. The implication of these estimates is that negative exchange rate shocks are associated with decreases in participation in food and cash crop farming by both men and women. In addition to those regressions which are significant using robust standard errors, Table 5 presents a number of statistically significant results which are robust to the wild cluster bootstrap-t procedure. First, the participation in income-generating activities variables capture the change in an indicator of whether the individual reports participation in the respective activity in the 12 months prior to the first and second round (thus take the values -1, 0 and 1). For example, the coefficient on food cropping for men implies that a negative exchange rate shock of 10% reduces the likelihood that men participate in food cropping by 7.61%. The results are somewhat more disparate across men and women in terms of livestock raising, non-farm economic activities, and wage and salaried employment. The directions of the coefficients imply that a negative exchange rate shock reduces men's participation in livestock raising and non-farm economic activities whilst increasing wage and salary employment. For women, it has little effect on participation in livestock raising

²⁰ The estimate in column 4 is significant at 10% with standard errors clustered by destination country of household's oldest migrant but is not robust to the wild cluster bootstrap-t procedure (*p-value 0.146*).

²¹ These regressions do not include the four households from the full sample that appear not to have completed the "Access to Productive Capital" module of the survey in the second round.

but *increases* participation in non-farm economic activities and *reduces* wage and salary employment²². These results provide evidence that exchange rate shocks have significant effects on the within-household allocation of labor across activities. These findings are highly consistent with estimates from an ordered probit specification which demonstrates that the results are robust to changes in functional form and if anything, increase in magnitude.

Table 5
Impact of exchange rate shocks on household labour supply, 2015

	Men and women				Women				Men				
	Initial		Mean		Initial		Mean		Initial		Mean		
	(3)	(4)	(3)	(4)	(3)	(4)	(3)	(4)	(3)	(4)			
<i>Participation in income-generating activities indicators</i>													
- Food crop farming					0.359	0.153	0.746	0.985	0.359	0.016	0.761	0.753	0.285
							(0.610)	(0.479)*			(0.247)**	(0.285)	
- Cash crop farming					0.266	0.074	0.874	1.017	0.252	0.034	0.639	0.590	0.380
							(0.448)*	(0.338)**			(0.367)	(0.380)	
- Livestock raising					0.351	0.303	0.0125	0.195	0.298	0.098	0.502	0.366	0.246
							(0.373)	(0.514)			(0.216)	(0.246)	

²² The differences between men’s and women’s participation in non-farm economic activities, and in wage and salary employment are statistically significant at 5% and 10% respectively when estimated using robust standard errors. This provides suggestive evidence of statistically significant differences between the labor outcomes of men and women.

hours worked by all members of the household, although this effect is heterogeneous across types of work and gender. The direction of the coefficients suggests that whilst households increase (reduce) total hours worked on average, this effect is driven by the change in hours worked by men whose hours worked without pay²⁴ and in self-employment change in the direction of the income shock (such that positive income shocks are associated with increases in hours worked without pay and in self-employment). Women's hours, on the other hand, appear to move in the opposite direction of the shock (women work more as a result of negative income shocks). An increase in self-employment and in work without pay appear to be driving these results²⁵. Whilst an increase of 1.33 in hours worked without pay by women as result of a negative exchange rate shock of 10% may appear modest given that the effect is aggregated to the household-level, a substantial number of households in the sample consist of a mother and her children. Thus, the magnitude is non-negligible if the reduction is across only one working household member. This could indicate that female labor acts as a cushion against transitory income shocks and is in line with findings from Egypt, where women in rural areas increase their supply of subsistence work to substitute for migrant labor (Binzel and Assaad 2011)²⁶.

Finally, additional analysis concerns the impact on labor usage in agriculture (not shown).

Measures of labor hours in agriculture are the change in the total number of hours by all members, all women, and all men in the household, in the 12 months prior to the first and

²⁴ Whilst it is possible that the measure of labor hours is affected by the timing of the rounds of the survey, if this was the main driver of the result, it would be expected that men's hours in work without pay should *decrease* by the second round since the first coincided with boro rice season. This is a very high labor demand season for men. In this sense, these estimates may suffer from attenuation bias thus represent a lower bound.

²⁵ The differences between men's and women's hours worked, and hours worked without pay are statistically significant at 10% and 5% respectively when estimated using robust standard errors. This provides further suggestive evidence of statistically significant differences between the labor outcomes of men and women.

²⁶ With more observations, it would be interesting to determine whether in fact, this result is driven by households with absent spouses.

second round. This mitigates concerns about the role of seasonality. Though none of the estimated coefficients are statistically significant at conventional levels, the coefficients are consistently large and negative, males and females, and across all categories of labor usage. The coefficients on hired agricultural labor are also negative, thus providing no suggestion that hired labor substitutes for household labor usage in agriculture.

Further results

An additional test which includes return migration as a control in a regression of the change in remittances on the exchange rate variable, can help validate that the effect is operating via the income channel. The return variable is potentially endogenous thus introduces bias into the regression. However, the fact that there is little change on the coefficient on the exchange rate is a good indication that the income channel interpretation is appropriate²⁷.

As a formal, partial test of the parallel trend assumption, I test whether the difference between the coefficients on the exchange rate shock variable when estimated with and without controls is statistically significant, for each of the 19 main outcomes variables from Tables 4 and 5. This is only statistically significant at 10% for non-mechanized farm equipment. Moreover, these tests were estimated using robust standard errors which are biased downwards thus making it more likely to falsely reject a true null. This is convincing evidence that the results are not driven by a violation of the parallel trend assumption.

²⁷ If the propensity to return from abroad is related to migrant occupation, and migrant occupation is correlated with migrant location, a concern is that the effect of the exchange rate shocks on household labor supply is operating via the return migration channel. Similar robustness checks, which include return migration as a control in regressions of the change in labor outcomes on the exchange rate variable, find a similarly miniscule effect on the coefficients. Moreover, it is difficult, to reconcile the impact of the exchange rate shock on *women's* participation in food-cropping with the return migration channel since migration is almost a uniquely male phenomenon (unless male and female labour are complementary in production).

To further test the robustness of the results, tests which include indicators for the months in which households were surveyed in the first and second rounds are conducted. This verifies that changes in outcome variables are not explained by the differences in the time of year at which households were surveyed. The general pattern of the main results is unchanged, while the coefficient on ownership of agricultural land actually increases in size and remains significant at 1%.

As a final robustness check, p-values are adjusted to correct for multiple hypothesis testing for the full sample. The multiple testing procedure proposed by Benjamini, Krieger, and Yekutieli (2006) is conducted. This method is preferred to the Bonferroni adjustment which fails to account for correlation among outcomes and is probable in this case. Despite the modest sample size who are “treated” by negative exchange rate shocks and the study being under-powered to detect non-zero effects, only the impact of the exchange rate shocks on men’s participation in food crop farming and wage and salary employment are not robust to this procedure²⁸.

Discussion

Given the careful and plausibly exogenous identification strategy employed, the results provide credible estimates of the effect of transitory income on household investment and labor supply. The modest evidence that household investment changes in response to the shocks may be explained by the argument that positive income shocks reduce discount rates (Haushofer, Fehr, and Schunk 2013). These results are also indicative of the existence of financial market imperfections in developing countries which inhibit productive investment

²⁸ The multiple testing procedure indicates a false discovery rate sharpened q-value of 0.137 on the coefficients on men’s food crop farming and wage and salary employment thus implies that the expected false discovery rate is 13.7% if these coefficients are statistically significant.

within households. In this sense, positive transitory income shocks may enable households to overcome credit constraints which impair their capacity to invest in productive assets while negative transitory income shocks may be absorbed by disinvestment²⁹.

The change in the number of hours worked by men in accordance with the direction of the income shock is a seemingly counterintuitive result. However, if these activities are capital-intensive, the implication may be that labor supply increases (falls) because investments (disinvestments) are made in men's enterprises. The finding that greater remittances increase labor supply is very important and is in line with a recent strand of the literature which shows that cash transfers among populations close to the poverty line do not generally discourage work and, in many cases, can actually foster employment by relaxing credit constraints (Banerjee et al. 2017). The change in the number of hours worked by women in the opposite direction to the income shock in hours can be argued to fit the neoclassical model. However, since this is driven by changes in work *without* pay, the fall in women's hours is unlikely due to an increase in reservation wage. A reduction in women's work without pay, reduced labor usage in agriculture and simultaneous increases in ownership of agricultural land and in food crop and cash crop farming at the extensive margin as a result of positive income shocks could be explained by an improvement in agricultural productivity³⁰. Future research which considers output, is therefore essential to elucidate the impact of transitory income shocks on productivity.

²⁹ It would be beneficial to use the third round of the BIHS to better understand the welfare implications of changes in investment in the medium run, including an analysis of whether spillover effects on households without migrants are favourable.

³⁰ There is no suggestion however, that households use mechanized farm equipment more intensively or increase their use of fertilizers between the first and second rounds (not shown). Additional tests confirm that the results are robust to controlling for Feed the Future households, the global food security initiative of the US government which aims to improve agricultural production (USAID 2017). Feed the Future households may adopt different technologies or cultivate less labor-intensive crops as a result of the programme.

It is difficult to make any normative assessment of the change in composition of household labor supply. While the results are driven by negative exchange rate shocks, they also imply that, as a result of a positive transitory income shock, there is a simultaneous reduction in women's participation in non-farm economic activities at both the extensive and intensive margins, a reduction in their hours in work without pay and an offsetting increase in salaried employment at the extensive and intensive margins. This could be positive if women are able to substitute hours worked for additional leisure and if their increased participation in formal work furthers their empowerment. On the other hand, it could reflect an increase in the responsibility borne by women for unpaid care and housework as men work more intensively. There are few opportunities for women to find high-quality jobs outside of the home. Future research should therefore consider men's and women's time use in order to make a normative assessment of these changes. When considered alongside the results for household investment, the change in composition of household labor supply could also reflect the tendency of men to move into farming as the returns become higher, owing to increases in agricultural productivity.

Implications for policy

The results imply that in a partial equilibrium framework in Bangladesh, remittance shocks do not dis-incentivize work and can increase investment in productive capital at the household-level. Consequently, policies which seek to induce higher migration (and therefore higher remittances from abroad) may contribute to poverty alleviation in rural Bangladesh, and supplements evidence of substantial welfare gains from seasonal rural-urban migration in Bangladesh (Lagakos, Mobarak, and Waugh 2017). This is not to assume however, that policies in destination countries that facilitate migration inflows would be without substantial po-

litical resistance. Domestic policies to promote outmigration, through the provision of information to potential migrants for example, and those policies aimed at promoting remittances are more likely to be politically palatable. It would be interesting to trial an intervention which offers households with migrants the opportunity to have remittances deposited into new bank accounts. The effect of this could be to facilitate formal savings for agricultural or other productive inputs, as was the case in a field experiment which sought to initiate the use of formal saving devices by Malawian farmers (Brune et al. 2016). Such policies could also propel the development of the financial system and improve the financial literacy of the poor. Moreover, this strengthening of the financial infrastructure could help reduce the costs of sending remittances. Parallels can be drawn between the findings of this paper and what would be expected to happen as a result of a decrease in the cost of sending remittances, an effective appreciation of the exchange rate in migrants' destinations. Thus, these findings provide empirical evidence on the likely impact of the direct reduction of such costs. The empirical analysis presented cannot rule out the return migration channel in explaining the positive effects thus these policies are advocated as complements to, as opposed to substitutes for, policies which seek to capitalize on return migration (e.g. maintaining links with the diaspora). Benevolent governments may also look to intervene in order to mitigate the market failures which cause divergence between private and social returns to migration (McKenzie and Sasin 2007). In Bangladesh, positive externalities may accrue if investment in agriculture generate employment opportunities in rural areas.

VI. Conclusion

Better harnessing the benefits from international migration on origin households is a critical policy issue since it not only helps to alleviate poverty in the current period but supports the

realization of other development goals. Despite the large volumes of remittance inflows to developing countries, little is understood about their effect. Using data from the BIHS, this paper studies the effect of exogenous exchange rate shocks via the transitory income shock channel on investment in productive capital at the household-level, finding evidence of a change in accordance with the direction of the shock. While the possibility that return migration is not fully captured reiterates the need for the collection of better migration data, the results provide some evidence to challenge the conjecture that because the propensity to consume out of remittance income is high, they are unlikely to play a principal role in a nation's development (Bodvarsson and Van den Berg 2013). Analysing the changes in hours worked, a second notable finding of this paper, reveals heterogeneous impacts by gender. Whilst the total number of hours worked by households increases as a result of a positive shock, which implies that the substitution effect dominates the income effect in the Bangladeshi context, the results suggest that the impact of the exchange rate shocks on women's hours worked is negative whilst men work more. Future research should explore the generalizability of these results to other contexts and seek to better disentangle the channels via which international migration impacts investment and labor supply, to best enable productivity gains in the developing world.

A.1 Appendix

The BIHS does not contain a variable on migrant returns to Bangladesh. It is important to construct such a measure in order to explore whether changes in the dependent variables are due to a non-income channel. The measure is constructed by using the household roster from the second round to identify those individuals who have been abroad in the last five years, their member status (i.e. to determine whether they were a member in the first round) and

their relationship to the household head. These observations are then matched with migrants from the first round by relationship to the household head if the migrant from the first round is not observed in the second round. A limitation of the data therefore concerns the fact that those who in the first round, had been members of the household in the past five years and were now overseas migrant workers, as well as other remitters who had not been members of the household in the past five years, do not have unique identifiers. Additionally, not all migrants affiliated with the household during the first round are observed in the second round, only those who have migrated since the first round and those still sending remittances.

The second part of the construction of this measure matches, by relationship to household head, senders of domestic remittances in the second round with migrants as of the first round. To do this, a household which does not receive remittances from the international destination from which it received during the first round, nor does it have domestic migrants in the first round who can be matched with senders of domestic remittances in the second round of the survey, nor does it experience the domestic outmigration of one of its members are identified. If these three criteria are satisfied, the domestic remitter in the second round is deemed to be the same individual as the international migrant in the first round. There are two reasons to expect this definition gives an accurate measure. Firstly, there exists complete data on domestic migrants as at the first round and domestic outmigration between rounds. Secondly, transfers sent by permanent migrants tend to be lower (Dustmann and Görlach 2016). It is very unlikely therefore, that an individual who has not lived in the household for in excess of 8 years (since they were not identified as a member of the household in the past five years in the first round) thus a permanent migrant, is responsible for the sending of the new domestic remittance receipts observed in the second round. In the case that a household receives remittances from a child who is an international migrant and a child who is a domestic migrant in

the first round, and only from a child who is a domestic in the second round, the individual observed in the second round is assumed to be the domestic remitter from the first round.

This assumption could lead to an underestimate of migrant returns thus the empirical analysis which includes this measure is the lower bound. Returns to Bangladesh are also underestimated in the case that international migrants from the first round are not observed as sending international remittances in the second round because they have in fact returned but not to the household itself thus do not appear on the roster or do not send domestic remittances.

The measure of migrant returns also accounts for changes in household head. For example, households are defined as having an international migrant return if the male spouse of the female head is observed as an international migrant in the first round of the survey and as a male household head, who is a new member and has been overseas in the last five years, in the household roster in the second round. Lastly, the measure defines returns = 0 who are unable to be matched on these additional characteristics. On the one hand, the ability to verify migrants by age and education level as well as relationship to the household head suggests that the measure of migrant returns is reliable. On the other, there exists some measurement error in these migrant characteristics. Take the example of a male, 28-year-old child of the household head who has no education and is observed remitting from the UAE in the first round and for the same household, a male 30-year-old child of the household head who has no education and is observed as a new member of the household who has been abroad in the last five years in the roster in the second round. Assume also that we no longer observe remittances from the international source in the second round. In this case, migrant returns to the household is defined as 0. This is very likely to be the same individual but owing to the three years which elapsed between the first and second round, this individual would have to be aged 31 or 32 by the second round. The analysis therefore proceeds by assuming that such

measurement error affects the outcomes for households with migrants in destinations experiencing different exchange rate shocks identically and is uncorrelated with control variables. Whilst the comparability of the magnitude of migrant returns (13.1%) to others in the literature (Yang 2008) provide reassurance about its accuracy, it does not entirely mitigate the potential that these returns are assigned the incorrect households.

Appendix Table 1
Baseline balance check

		F-stat: joint significance of P- these variables	P- value
<i>Household per capita income percentile</i>			
- 0-25th percentile	-0.016 (0.010)		
- 25th-50th percentile	-0.014 (0.008)*		
- 50th-75th percentile	-0.006 (0.004)		
<i>(Highest quartile excluded)</i>			
		1.12	0.362
<i>Household head's education level</i>			
- Did not complete primary	0.019 (0.012)		

- Completed primary	0.028 (0.014)*		
- Some secondary	0.005 (0.013)		
- Completed secondary	0.013 (0.016)		

(Some higher secondary and above omitted)

1.36 0.282

Household head's occupation

- Farming & Livestock related work	0.057 (0.029)**		
- Non-earning occupation	0.063 (0.029)**		
- Trader	0.067 (0.037)*		
- Self-employment	0.041 (0.044)		
- Wage labour	0.056 (0.032)*		
- Salaried worker	0.057 (0.040)		

(Other omitted)

1.18 0.353

Household size	0.002 (0.001)**		0.024
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Household location indicators		0.36	0.894
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Workers' months overseas at baseline

- 0-11 months	0.080 (0.013)
- 12-23 months	0.000 (0.014)
- 24-35 months	-0.0026 (0.009)
- 36-47 months	-0.007 (0.012)

(48 months or more omitted)

1.23 0.330

Overseas workers' education level

- Did not complete primary	-0.023 (0.011)**
- Completed primary	-0.022 (0.012)*
- Some secondary	-0.023 (0.014)
- Completed secondary	-0.014 (0.012)

(Some higher secondary and above omitted)

1.4 0.230

Overseas workers' occupation

- Salaried worker	0.006 (0.008)
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- Self-employment	0.017 (0.006)***		
- Other (including trader & farming)	-0.031 (0.027)		
<i>(Wage labour omitted)</i>			
		3.72	0.027
<i>Overseas workers' position in household indicator</i>			
- Primary respondent	-0.044 (0.034)		
- Spouse of primary respondent	-0.004 (0.016)		
- Child of head	-0.008 (0.014)		
- Sibling of head	0.003 (0.0030)		
<i>(Other relation to head omitted)</i>			
		0.81	0.533
R-squared	0.119		
Number of observations	394		

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