Does the Impact of Remittances on Poverty and Human Development Depend on the Climate of Receiving Areas?

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Abstract

This chapter uses matching techniques and a recent nationally representative household survey for Yemen combined with weather data to measure the impact of remittances, both domestic and international, on poverty and human development outcomes (school enrolment, immunization, and malnutrition). The estimations are carried both nationally and in areas with favorable and unfavorable climate. Remittances are found to have a statistically significant impact on many of the indicators, and this is especially the case for international remittances which tend to provide more resources to their beneficiaries. The impact of remittances on measures of poverty and malnutrition is also found to be stronger in districts that are affected by unfavorable climate (as measured through higher temperatures or lower levels of rainfall), while the impact of remittances on school enrollment is found to be stronger in areas with better climate. The results are consistent with households in the least favorable areas using their remittances to meet basic needs first, while households in better areas can use remittances flows for education investments.

1. Introduction

Migration of household members and the potential resulting remittances are part of livelihood strategies used by households to insure against shocks in regions which are prone to natural disasters and adverse weather conditions. There is ample evidence that migration and especially remittances may reduce poverty and improve human development outcomes for receiving households. According to Mansuri (2007), school enrollment rates increase by 54 percent for girls in migrant households in rural Pakistan (the increase is lower for boys at seven percent). Frank and Hummer (2002) find that infants born into Mexico-to-US migrant households have better birth outcomes: while nine percent of infants in international migrant households have low birth weights, 11 percent of those in non migrant households have this condition. Hildebrandt and McKenzie (2005) and McKenzie (2006) suggest that international migration has positive effects on both infant mortality and child weight among Mexican households.

Remittance receiving households typically have better asset ownership and are more entrepreneurial. Taylor and Mora (2006) suggest that international migrant households have the largest marginal budget share for investments in rural Mexico. Makdissi and Wodon (2004) suggest that households with migrants have better housing. Osili (2004) shows that in Nigeria, a ten percent increase in migrants' income increases the probability of investing in housing by three percentage points in the country of origin. Remittances also help to smooth consumption during adverse shocks – both through ex- ante preparedness and ex post adaptation.

Controlling for the endogeneity of the remittance receiving status of households, remittances help to smooth consumption after floods in Bangladesh and build disaster resilient housing in Ghana and Burkina Faso and ensure sufficient liquidity during food shortage in Ethiopia (Mohapatra et al, 2011). Gubert (2002) finds that households in rural Mali use remittances to insure themselves against adverse shocks, with a 500 kilogram drop in grain output leading to a 48 percent increase in remittances; if that drop in grain output is coupled with a death in the family, remittances rise by 124 percent.

There is also evidence that migration and remittances reduce poverty. Lokshin et al. (2007) show that in Nepal almost 20 percent of the decline in poverty between 1995 and 2004 was linked to migration. Adams and Page (2005) suggest that a ten percent increase in per capita international remittances leads to a 3.5 percent decline in the share of people in poverty. International remittances reduce poverty in Latin America by 0.4 percent for each percentage point increase in the remittances to GDP ratio (Acosta et al., 2006). Conversely, a drop in international remittances may lead to higher poverty, as observed in Burkina Faso after the crisis in Côte d'Ivoire reduces the ability of migrants to remit (Siaens and Wodon, 2011).

The question investigated in this chapter is somewhat different. We are interested in assessing whether the impact of remittances on poverty and human development indicators depends on the areas in which households live. Our hypothesis is that remittances may have a larger impact in areas affected by unfavorable climate because it is in those areas that households tend to be most vulnerable. By combining climate and household survey data from Yemen, we test whether domestic and international remittances reduce poverty and improve education and malnutrition indicators more in areas with high temperatures and low rainfalls.

Yemen is an interesting case study for this work. First, it has high levels of migration, both domestic and international, and as a result many households do benefit from remittances. In the nationally representative household survey for 2006 that we use for the analysis, 43.63 percent of the population benefits from either domestic or international remittances (the

proportions are 33.90 percent for domestic remittances, 14.10 percent for international remittances, and 4.38 percent for both.) Yemen's topography is diverse, with a mountainous core at the center, coastal plains in the east, west, and south, and upland deserts to the north, towards the Saudi Arabia border. The country suffers from a relatively harsh climate in many areas. Rainfall is limited and the population must deal with high levels of water scarcity as well as persisting economic reliance on water dependent sectors such as rainfed agriculture. The average annual mean temperature is 22 degrees Celsius in our data from BIOCLIM, but there are large differences between various parts of the country as well as over the year, and temperatures have peaked to well above 50 degrees. Climate change is likely to progressively bring in even higher temperatures and lower rainfalls in the future. Climate is not only likely to play an important role in decisions by household members to migrate and remit, but it is also likely to affect poverty and human development outcomes both directly and indirectly through its impact on livelihoods. In turn, as a coping mechanism, the impact of remittances may differ between areas.

The chapter is structured as follows. Section two presents the data and methodology. Section three presents the results from the estimation of the impact of remittances, both domestic and international, on poverty and human development outcomes. A conclusion follows.

2. Data and Methodology

We use the most recently available nationally representative household budget survey implemented in Yemen, whose data were collected in 2005-2006. The survey includes 13,136 households (98,941 individuals) living in 309 of the country's 333 districts. Apart from the location of households, the survey provides information on a wide range of socio-economic characteristics including among others demographics, education, health and anthropometrics, employment and occupation, consumption and assets, and income including remittances. Data are available on both domestic and international remittances, with 43.6 percent of households receiving some form of remittances (33.9 percent for domestic remittances and 4.38 percent for international sources, and some overlap between both; we treat households receiving remittances from domestic and international sources as international remittance receiving households.)

Beyond the household survey, and based on the location of households proxied through the most populous city in the district in which the household lives, we also use information on the distance between the household/district location and the coast, as well as the distance to the nearest airport; these distances are calculated using an Euclidean distance function in ESRI ArcGIS 9.3 software. We also use measures of travel time to the nearest city with 100,000 populations using a methodology developed from Nelson (2008) with regionally specific information (World Bank, 2011). The percentage of irrigated land is taken from Global Map of Irrigated Areas version 4 (Siebert et al., 2005; Siebert et al., 2006). Weather data on annual mean temperature and rainfall and their variability are collected from BIOCLIM (Busby, 1991). All weather variables are computed on observations for the period 1990 to 2000.

The estimation method – a standard matching procedure – enables us to look at the impact of remittances on a range of outcomes. These include the poverty status of the household (based on consumption per equivalent adult), as well as education enrollment for children below the age of 15, immunization for children below the age of 5, and malnutrition. Using standardized z scores for height for age, weight for age and body mass index; based on World Health Organization (1995) guidelines, all children whose height for age and weight for age z score is less than -2 are deemed stunted and wasted respectively; similarly, all children whose body mass index is less than 16 are deemed as underweight (grade 3 thinness). The logit

regressions used for the matching procedure are available upon request, with some examples provided in appendix – care was applied to make sure that balancing properties were respected. We used k-nearest neighbors matching, with k equal to four, a radius of 0.02, and we excluded the one percent of observations with extreme values for the indicators of interest.

3. Results

In principle, we would expect remittances to have a potentially large impact on poverty and human development indicators. The average transfer received by households who benefit from domestic remittances is YER 46,654 (US$ 252 at the average exchange rate in 2004 of US$ 1 = YER 185), and the average amount for international remittances is as expected significantly higher, at YER 218,786 (US$ 1,183). Given rather low standards of well-being in the country as a whole, these are substantial transfers which should make a difference for households.

Tables 1 to 3 provide the results from the matching for all, domestic, and international remittances respectively Consider first table 1 which accounts for any type of remittances received, whether domestic or international. Using a cut-off point for t-statistics of 1.96 corresponding to a 95 percent confidence interval, the impact of remittances is statistically significant at the national level for six variables: the three poverty measures (for example, with a reduction of six points for the headcount index from 28.71 percent to 22.81 percent), male and female school enrollment (increase of three points for boys and two points for girls), and stunting (reduction of two points).

Note that statistical significance is easier to obtain at the national level than for subsets of the districts, given the larger number of observations available at the national level. For our purpose, the interesting comparison is between districts with high or low temperatures, as well as between districts with high and low levels of rainfall. Specifically, we will consider the top 20 percent districts with high temperature and the bottom 20 percent districts in terms of rainfall, and compare these groups with respectively the bottom 20 percent districts in terms of temperatures and the top 20 percent districts in terms of rainfall. Our prior is that we expect larger impacts of remittances in districts with high temperatures or low levels of rainfall.

Consider again table 1. In districts with high mean temperatures, the impacts of remittances are statistically significant for five variables, namely the poverty measures, as well as the measures for stunting and wasting. In districts with low temperatures, the effects are also statistically significant for the poverty measures, but not for the nutrition measures. When comparing districts with low or high rainfall, there are even more differences. In districts with low rainfall, the effects of remittances are statistically significant for the same five measures as observed in the case of high temperatures. By contrast, in districts with high rainfall, the effect of remittances is statistically significant for none of these indicators, but it is for male and female school enrollment. Taking both statistical significance and the magnitude of the effects when they are statistically significant, the results suggest that remittances have a larger impact on poverty and especially nutrition measures in areas affected by more difficult climate, while in areas with better climate (especially higher rainfall), education gains tend to be larger.

Table 1: Matching Results – Any Remittances, Yemen 2005/06

	Before matching		After matching		
	Remittances	No remittances	Remittances	No remit.	t statistic
	National				
Poverty headcount	22.40	24.97	22.81	28.71	-6.42
Poverty gap	5.56	6.59	5.68	7.94	-7.49
Squared poverty gap	2.06	2.51	2.11	3.15	-6.87
Male Enrolment (age 6-14)	80.60	78.20	80.58	77.81	3.23
Female Enrolment (age 6-14)	65.74	64.84	65.74	63.58	2.04
Male Immunization	57.58	56.19	57.62	57.56	0.06
Female immunization	57.91	58.31	57.85	57.12	0.62
Stunted	45.35	44.18	45.51	47.69	-2.13
Wasted	29.65	30.60	29.80	31.49	-1.79
Underweight	54.29	55.72	54.60	53.92	0.67
	Top 20% Districts in Terms of Mean Temperature				
Poverty headcount	19.73	21.38	19.45	26.37	-3.20
Poverty gap	4.36	5.30	4.30	6.67	-3.55
Squared poverty gap	1.53	1.99	1.50	2.53	-3.15
Male Enrolment (age 6-14)	76.69	71.37	76.32	72.54	1.44
Female Enrolment (age 6-14)	68.56	63.39	68.35	64.61	1.24
Male Immunization	57.95	58.46	57.71	60.78	-1.03
Female immunization	59.23	58.40	59.79	57.36	0.71
Stunted	36.38	42.67	36.29	43.49	-2.61
Wasted	32.12	36.39	32.87	38.84	-2.21
Underweight	63.93	65.25	64.33	66.33	-0.75
	Bottom 20% Districts in Terms of Mean Temperature				
Poverty headcount	13.69	16.03	13.76	21.29	-2.23
Poverty gap	3.07	4.14	3.10	6.45	-3.18
Squared poverty gap	1.02	1.50	1.03	2.63	-3.36
Male Enrolment (age 6-14)	85.95	84.63	86.33	82.73	1.01
Female Enrolment (age 6-14)	72.34	73.89	75.87	70.38	1.41
Male Immunization	59.83	59.50	60.40	59.51	0.14
Female immunization	59.69	64.76	61.13	58.07	0.58
Stunted	46.59	43.96	45.52	43.34	0.41
Wasted	26.32	30.66	26.48	28.51	-0.42
Underweight	51.49	52.75	52.44	55.34	-0.54
	Bottom 20% Districts in Terms of Mean Rainfall				
Poverty headcount	17.49	21.10	16.94	22.93	-3.06
Poverty gap	4.11	5.66	3.81	6.37	-4.02
Squared poverty gap	1.58	2.27	1.40	2.67	-3.81
Male Enrolment (age 6-14)	79.27	78.14	79.46	77.78	0.74
Female Enrolment (age 6-14)	72.62	70.02	73.20	71.29	0.74
Male Immunization	55.96	56.05	56.04	57.16	-0.38
Female immunization	55.43	55.23	55.37	55.12	0.08
Stunted	25.19	34.51	25.19	32.52	-2.89
Wasted	19.34	27.87	19.61	26.51	-2.91
Underweight	57.12	62.88	57.01	62.26	-1.93
	Top 20% Districts in Terms of Rainfall				
Poverty headcount	21.94	23.97	22.14	25.85	-1.23
Poverty gap	5.39	5.73	5.47	7.11	-1.77
Squared poverty gap	2.00	2.02	2.03	2.81	-1.81
Male Enrolment (age 6-14)	85.07	82.22	84.94	79.18	2.25
Female Enrolment (age 6-14)	72.31	72.80	72.53	63.41	2.95
Male Immunization	58.92	60.15	58.47	53.47	1.31
Female immunization	59.11	62.03	59.35	60.09	-0.18
Stunted	50.40	47.76	49.79	46.62	0.81
Wasted	33.04	31.38	33.08	35.11	-0.56
Underweight	58.01	57.16	58.32	57.98	0.09

Source: Authors' estimation.

Table 2: Matching Results – Domestic Remittances, Yemen 2005/06

	Before matching		After matching		
	Remittances	No remittances	Remittances	No remit.	t statistic
	National				
Poverty headcount	22.83	24.97	23.35	28.17	-4.61
Poverty gap	5.71	6.59	5.87	7.55	-4.86
Squared poverty gap	2.12	2.51	2.18	2.91	-4.22
Male Enrolment (age 6-14)	79.69	78.20	79.63	78.29	1.34
Female Enrolment (age 6-14)	64.63	64.84	64.58	64.16	0.34
Male Immunization	57.48	56.19	57.59	58.81	-0.94
Female immunization	58.75	58.31	58.61	60.21	-1.14
Stunted	48.83	44.18	49.18	49.35	-0.14
Wasted	31.55	30.60	31.82	32.51	-0.62
Underweight	54.82	55.72	55.23	55.53	-0.25
	Top 20% Districts in Terms of Mean Temperature				
Poverty headcount	21.89	21.38	21.53	27.86	-2.48
Poverty gap	5.14	5.30	5.10	7.23	-2.66
Squared poverty gap	1.87	1.99	1.85	2.78	-2.39
Male Enrolment (age 6-14)	75.81	71.37	75.52	72.46	0.99
Female Enrolment (age 6-14)	68.97	63.39	69.19	63.26	1.66
Male Immunization	55.05	58.46	54.08	62.98	-2.48
Female immunization	58.58	58.40	58.41	55.16	0.77
Stunted	39.55	42.67	39.44	50.29	-3.10
Wasted	36.18	36.39	37.12	42.72	-1.62
Underweight	70.34	65.25	71.69	69.72	0.61
	Bottom 20% Districts in Terms of Mean Temperature				
Poverty headcount	12.81	16.03	12.55	20.32	-2.15
Poverty gap	2.79	4.14	2.77	6.74	-3.66
Squared poverty gap	0.88	1.50	0.88	2.87	-3.98
Male Enrolment (age 6-14)	84.58	84.63	85.79	86.50	-0.12
Female Enrolment (age 6-14)	69.73	73.89	71.49	70.39	0.24
Male Immunization	59.01	59.50	59.06	53.05	0.89
Female immunization	59.37	64.76	59.53	62.42	-0.46
Stunted	47.84	43.96	48.61	41.76	1.11
Wasted	26.20	30.66	27.38	25.78	0.28
Underweight	51.48	52.75	52.23	54.53	-0.36
	Bottom 20% districts in terms of Mean Rainfall				
Poverty headcount	19.50	21.10	19.08	25.02	-2.29
Poverty gap	5.03	5.66	4.60	6.49	-2.21
Squared poverty gap	2.05	2.27	1.75	2.57	-1.82
Male Enrolment (age 6-14)	78.20	78.14	78.99	73.22	1.97
Female Enrolment (age 6-14)	74.65	70.02	74.93	73.24	0.53
Male Immunization	54.14	56.05	54.41	60.28	-1.43
Female immunization	53.62	55.23	53.63	56.34	-0.64
Stunted	28.33	34.51	27.58	33.48	-1.75
Wasted	23.33	27.87	24.23	30.03	-1.81
Underweight	62.14	62.88	64.43	61.53	0.83
	Top 20% Districts in Terms of Rainfall				
Poverty headcount	22.94	23.97	23.10	27.13	-1.13
Poverty gap	5.56	5.73	5.63	7.57	-1.75
Squared poverty gap	2.03	2.02	2.06	3.00	-1.80
Male Enrolment (age 6-14)	84.04	82.22	83.75	77.87	1.77
Female Enrolment (age 6-14)	71.36	72.80	71.79	64.27	2.09
Male Immunization	57.91	60.15	58.19	56.65	0.35
Female immunization	59.51	62.03	59.55	62.67	-0.61
Stunted	52.03	47.76	51.24	44.21	1.55
Wasted	33.41	31.38	33.67	35.92	-0.53
Underweight	58.39	57.16	59.04	57.06	0.44

Source: Authors' estimation.

Table 3: Matching Results – International Remittances, Yemen 2005/06

	Before matching		After matching		
	Remittances	No remittances	Remittances	No remit.	t statistic
	National				
Poverty headcount	20.49	24.97	20.76	29.88	-7.20
Poverty gap	5.13	6.59	5.22	8.31	-7.35
Squared poverty gap	1.94	2.51	1.98	3.33	-6.26
Male Enrolment (age 6-14)	81.53	78.20	81.54	77.66	3.30
Female Enrolment (age 6-14)	67.61	64.84	67.54	63.67	2.68
Male Immunization	57.25	56.19	57.48	56.19	0.81
Female immunization	56.20	58.31	56.27	56.24	0.02
Stunted	36.91	44.18	37.05	44.20	-4.89
Wasted	24.95	30.60	25.05	28.94	-2.94
Underweight	52.89	55.72	53.28	54.54	-0.85
	Top 20% Districts in Terms of Mean Temperature				
Poverty headcount	13.16	21.38	12.62	24.57	-4.62
Poverty gap	2.69	5.30	2.59	6.06	-4.48
Squared poverty gap	0.94	1.99	0.93	2.38	-3.72
Male Enrolment (age 6-14)	77.78	71.37	77.96	69.21	2.50
Female Enrolment (age 6-14)	67.12	63.39	66.99	66.77	0.05
Male Immunization	64.13	58.46	63.47	64.16	-0.17
Female immunization	62.09	58.40	61.62	60.68	0.22
Stunted	28.82	42.67	27.96	41.97	-4.10
Wasted	27.08	36.39	25.81	34.52	-2.62
Underweight	55.21	65.25	54.48	64.07	-2.65
	Bottom 20% Districts in Terms of Mean Temperature				
Poverty headcount	16.67	16.03	13.02	14.51	-0.52
Poverty gap	4.03	4.14	2.72	3.77	-1.28
Squared poverty gap	1.46	1.50	0.92	1.33	-1.07
Male Enrolment (age 6-14)	90.27	84.63	93.17	84.82	2.97
Female Enrolment (age 6-14)	79.42	73.89	85.15	69.43	4.28
Male Immunization	60.91	59.50	65.22	66.51	-0.27
Female immunization	56.47	64.76	61.31	61.90	-0.11
Stunted	42.67	43.96	40.31	36.78	0.79
Wasted	21.98	30.66	23.47	26.89	-0.87
Underweight	45.69	52.75	51.02	47.86	0.7
	Bottom 20% districts in terms of Mean Rainfall				
Poverty headcount	17.26	21.10	16.67	23.57	-2.79
Poverty gap	4.23	5.66	3.85	6.42	-3.13
Squared poverty gap	1.70	2.27	1.45	2.69	-2.89
Male Enrolment (age 6-14)	78.96	78.14	79.46	75.58	1.33
Female Enrolment (age 6-14)	69.01	70.02	69.05	69.65	-0.18
Male Immunization	58.06	56.05	57.94	58.99	-0.28
Female immunization	56.92	55.23	57.42	53.80	0.94
Stunted	22.78	34.51	22.71	27.69	-1.56
Wasted	18.35	27.87	18.75	21.51	-0.93
Underweight	55.24	62.88	55.42	62.64	-2.08
	Top 20% Districts in Terms of Rainfall				
Poverty headcount	15.64	23.97	15.49	29.44	-4.53
Poverty gap	4.14	5.73	4.10	6.41	-2.45
Squared poverty gap	1.57	2.02	1.58	2.20	-1.41
Male Enrolment (age 6-14)	87.25	82.22	87.53	79.46	3.16
Female Enrolment (age 6-14)	72.12	72.80	74.13	60.49	3.62
Male Immunization	60.63	60.15	62.41	56.40	1.52
Female immunization	57.01	62.03	58.74	60.24	-0.35
Stunted	42.32	47.759	41.87	49.20	-1.97
Wasted	30.73	31.379	30.85	31.21	-0.1
Underweight	56.68	57.16	57.30	54.55	0.74

Source: Authors' estimation.

Similar results tend to be observed in tables 2 and 3 when considering domestic and international remittances separately, although there are differences between the impacts of both types of remittances. One would expect that for households benefitting from remittances, the impacts on the various indicators would be larger in the case of international remittances simply because the average level of international remittances among beneficiaries is much higher than the average level of domestic remittances among beneficiaries. This is indeed observed through the fact that at the national level for example, impacts are statistically significant for only three indicators with domestic remittances (the three poverty measures), while impacts are statistically significant for seven indicators in the case of international remittances (the three poverty measures, as well as school enrollment for both boys and girls, and stunting and wasting).

But what about the comparison between districts in terms of climate? Consider first domestic remittances. When looking at temperatures, apart from the results for the poverty measures which tend to be similar in both sets of districts, we see that for domestic remittances, there is a statistically significant impact of remittances on stunting in districts with high temperatures, while this is not the case for districts with low temperatures. (There is also a curious reduction in male immunization with remittances in high temperatures districts – but this is the only case of unexpected result, and the only time that the effect is statistically significant for immunization, so one can probably discount that observation). When looking at rainfall, we see that the effects on poverty are statistically significant for two of the poverty measures in low rainfall areas, while this is not the case in high rainfall areas. As for education, we see a (marginally) statistically significant gain in school enrollment for boys in areas with low rainfall, while there is a gain for girls in areas with high rainfall. Still, overall, the evidence points to a larger impact of domestic remittances in districts with either high temperatures or low rainfall.

This is also observed for international remittances, especially when comparing districts with low and high temperatures. In districts with low temperatures, the impact of international remittances is statistically significant for school enrollment only, while in districts with high temperatures, the impacts are statistically significant for the poverty measures, school enrollment for boys, and the three measures of malnutrition. The differences in impact are lower when comparing districts with high and low levels of rainfall – there the impacts are similar in terms of statistical significance and often as well magnitude for the poverty measures, but school enrollment gains tend to be statistically significant in areas with high rainfall (both types of districts in terms of rainfall levels exhibit some gains in nutrition measures from international remittances, with one of the three impacts being statistically significant, albeit not the same one in the two types of districts).

4. Conclusion

Is the Impact of remittances on poverty and human development different in various areas depending on their climate? By combining nationally representative household survey data with climate data, we have tried to answer this question in the case of Yemen. Our main results can be summarized in four main points. First, remittances – which are substantial in Yemen – tend to have positive impacts on poverty measures, school enrollment, and measures of malnutrition. Second, the impact of international remittances tends to be larger than that of domestic remittances, probably because among beneficiaries, the amount of remittances received tends to be higher for international than for domestic remittances. Third, the impact of remittances – and especially international remittances – on measures of poverty and malnutrition tends to be larger in areas affected by high temperatures, and also to some extent in areas with

lower levels of rainfall, which in both cases tend to be more vulnerable. Fourth, and by contrast, in areas with higher levels of rainfall or lower levels of temperatures, where issues of poverty and malnutrition may be less severe, remittances – and again especially international remittances – tend to have a larger impact on school enrollment. Thus, the results suggest, as might be expected, that in areas with unfavorable climate, remittances help first for meeting basic needs in order to escape poverty and malnutrition, while in areas with more favorable climate, remittances can be used by households for investments, such as investments in the education of children.

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