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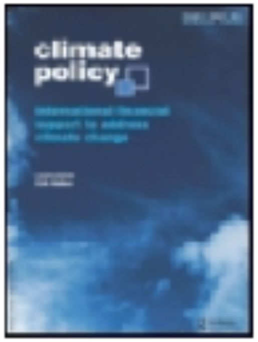
Migration as a way to address climate instability: international and country-based evidence

Migration as a way to address climate instability: international and country-based evidence

- ➢Motivation
- ➢Two main points are raised:
  1. the channel through which climate plays a role
  2. Migration can be regional or international
- ➢International migration: our estimate of the migration potential
- ➢Regional migration: evidence from Tanzania
- ➢Conclusions



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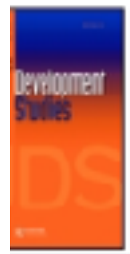
Adaptation to climate change in Bangladesh

Isaure Delaporte & Mathilde Maurel



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Climate Instability, Urbanisation and International Migration

Mathilde Maurel & Michele Tuccio

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Weather Shocks, Agricultural Production and Migration: Evidence from Tanzania

Zaneta Kubik & Mathilde Maurel

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A Key Policy Issue

Climate-induced migration is a small share of international migration : 16%

Myers, N. (2002). Environmental refugees: A growing phenomenon of the 21st century. Philosophical Transactions of the Royal Society B: Biological Sciences, 357(1420), 609–613.

Christian Aid (2007), Human Tide: The Real Migration Crisis, Christian Aid Report, May, accessible at

www.christianaid.org.uk.

A Key Policy Issue

Climate induced migration : perceived as problematic

- International: from the poorest countries to the richest countries

  Solana, J (2008), Climate Change and International Security: Paper from the High Representative and the European Commission to the European Council, European Commission, Brussels

- Within countries: rural-urban versus rural-rural

A Key Policy Issue

Tacoli, C. (2009). Crisis or adaptation? Migration and climate change in a context of high mobility. Environment and Urbanization

A Key Policy Issue

1. Is there a direct link between migration and climate?

    Beine, M., & Parsons, C. (2015). Climatic factors as determinants of international migration. The Scandinavian Journal of Economics, 117(2), 723–767.

2. Predictions regarding the climate are difficult

3. The migration decision must be depicted on the basis of a clear understanding of the different forces at work: *a complex relationships between environmental change and human agency...*

The main Channel through which climate operates

- The channel is the agricultural income: Weather is a crucial risk factor for households involved in rain-fed agriculture (Cranfield et al., 2003)

- Impact of climate change and climate variability on agricultural yields
  - Sharpest losses to be experienced by the lowest income countries (Deryng, Sachs, and Ramankutty, 2009)
  - Cereals to be most affected by climate change (Schlenker and Roberts, 2006)
  - Cereal yields to decline by 10% by 2050 in Sub-Saharan Africa (Schlenker and Lobell, 2009)

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International and regional migration must be formalized. Two steps :

Rural towards urban:

$$urbanisation_{it} = a + bCI_{it} + Z^1_{it} + \tau_t + \sigma_i + u_{it}$$

From the cities to the rest of the world, because of the decrease in the urban wages

$$\log(m_{ijt}) = \alpha \ income \ differential_{ijt} + \beta \ urbanisation_{it} + Z^2_{ij} + \tau_t + \sigma_i + \sigma_j + u_{ijt}$$

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Table 6. Robustness checks

	(1)	(2)	(3)	(4)
	Countries in the South	Excluding large countries	Excluding neighbouring countries	Country fixed effects
PANEL A. Dependent variable = Urbanisation				
Temperature (coeff. variation)	0.015	0.011	0.015	0.009
	(14.47)***	(11.07)***	(15.06)***	(17.11)***
Rainfall (coeff. variation)	0.080	0.076	0.058	0.017
	(13.17)***	(12.92)***	(10.12)***	(2.74)***
Population	0.007	0.006	0.006	0.328
	(11.30)***	(9.69)***	(10.58)***	(33.41)***
GDP/capita	0.033	0.027	0.031	0.035
	(63.21)***	(53.06)***	(63.55)***	(26.84)***
Openness	0.050	0.053	0.050	−0.016
	(53.93)***	(57.38)***	(58.85)***	(13.86)***
Population*area	0.001	0.001	0.000	−0.009
	(17.41)***	(17.91)***	(15.87)***	(11.28)***
PANEL B. Dependent variable = International migration				
Urbanisation	2.886	2.780	2.708	0.558
	(7.95)***	(6.46)***	(7.18)***	(4.12)***

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Hansen, Sato, and Ruedy (2012) argue that 'an important change is the emergence of a category of summertime extremely hot outliers, more than three standard deviations (3σ) warmer than the climatology of the 1951–1980 base period'.

The climate-induced growth rate in migrant stocks over 10 years varies from 8.6 per cent to 12.8 per cent, to be compared to the actual growth rate of migrant stock over 1990–2000 (2000–2010) of 13 per cent (26 per cent).

This means about 20 millions.

Far from being as alarming as the figures in official communications and research reports (for a critical review see Gemenne, 2011).

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- Weather risk in agriculture
- In situ measures:
  - Depleting assets (Kazianga and Udry, 2004; Fafchamps, Udry and Czukas, 1998)
  - Low-risk low-return investment (Rosenzweig and Binswanger, 1993)
  - Income diversification (Dercon, 1996)
- Weather risk spatially covariant (Rosenzweig and Stark, 1989)
- Spatial diversification of income through migration

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Do rural households engage in internal migration as a response to weather-related shock?

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- Household data:
  - Tanzania National Panel Survey (TZNPS)
    - 2008/09 : household characteristics and agricultural production
      - households involved in agricultural activity (1,583 households, 10,165 individuals)
    - 2010/11 : migrants identification
      - **Migrant**: any individual who permanently moved out of the village between the two waves
      - **Dependent variable**: household with at least one migrant
  - FAO Rural Income Generating Activities database
- Climate data:
  - Standarized Precipitation-Evapotranspiration Index (SPEI) (Vicente-Serranto et al., 2009)
  - Climate Research Unit (cru_ts_3.21)
    - **Temperature and precipitation shock**: deviations from the 30-yr trend, seasonal data

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- 14% of households with at least one migrant
  - Documented reluctance towards migration in Tanzania (Dercon et al., 2004; Majule et al., 2011)
  - Flow of migrants
  - 46% households have at least one previous migrant
- 40% - male, 60% female migrants
- 28% - rural – urban
- Internal migration, mainly within adjacent regions

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New Economics of Migration (Stark and coauthors 1982, 1985, 1986)

Crop production regression

$$Y_{crop,ij} = f\left(N_{ij}, L_{ij}, LS_{ij}, S_{ij}, Shock_j\right) + \epsilon_{ij} \qquad (1)$$

IV Probit model for eq (2) with $Y_{farm,\ ij}$ instrumented with weather

$$M_{ij} = f\left(Y_{crop,ij}, X_{ij}, C_j\right) + \varepsilon_{ij} \qquad (2)$$

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Weaher shocks have a significant negative impact on crop production

Table 2. Crop production

Dependent variable: logarithm of crop production	OLS					Moulton				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
HH labour	0.138***	0.128***	0.134***	0.130***	0.133***	0.138***	0.128***	0.134***	0.130***	0.133***
	(0.0189)	(0.0188)	(0.0189)	(0.0190)	(0.0190)	(0.0200)	(0.0200)	(0.0200)	(0.0201)	(0.0201)
Land	0.00421***	0.00391**	0.00396**	0.00425***	0.00421***	0.00421**	0.00391**	0.00396**	0.00425**	0.00421**
	(0.00155)	(0.00155)	(0.00155)	(0.00156)	(0.00156)	(0.00185)	(0.00185)	(0.00185)	(0.00185)	(0.00186)
Cattle	0.0246***	0.0216***	0.0229***	0.0217***	0.0221***	0.0246***	0.0216***	0.0229***	0.0217***	0.0221***
	(0.00574)	(0.00573)	(0.00573)	(0.00584)	(0.00583)	(0.00639)	(0.00639)	(0.00639)	(0.00651)	(0.00652)
Slope	0.0196***	0.0262***	0.0252***	0.0195***	0.0189***	0.0196***	0.0262***	0.0252***	0.0195***	0.0189***
	(0.00464)	(0.00469)	(0.00465)	(0.00472)	(0.00471)	(0.00672)	(0.00682)	(0.00676)	(0.00687)	(0.00690)
SPEI12	0.310***					0.310***				
	(0.0686)					(0.115)				
SPEI24		0.241***					0.241**			
		(0.0569)					(0.0954)			
SPEI48			0.286***					0.286**		
			(0.0676)					(0.113)		
Temperature				0.459*					0.459	
				(0.241)					(0.403)	
Temperature squared				-0.0112**					-0.0112	
				(0.00529)					(0.00887)	
Temperature shock					-0.0469***					-0.0469**
					(0.0135)					(0.0229)
Constant	12.31***	12.06***	12.17***	7.806***	12.19***	12.31***	12.06***	12.17***	7.806*	12.19***
	(0.0633)	(0.0752)	(0.0635)	(2.820)	(0.0636)	(0.106)	(0.126)	(0.106)	(4.725)	(0.107)
Observations	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583	1,583
R-squared	0.082	0.081	0.081	0.081	0.078	0.082	0.081	0.081	0.081	0.078

Coefficients for precipitation and precipitation squared (col. 4 and col. 9), and precipitation shock (col. 5 and col.10) not reported

Standard errors in parentheses

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

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1% reduction in agricultural income induced by weather shock increases the probability of migration by 13pp on average

Table 3. Migration

Dependent vaiable: probability of migration	SPEI12 (1)	SPEI24 (2)	SPEI48 (3)	Temperature Precipitation (4)	Temperature Precipitation Shock (5)
Logarithm of crop production	-0.129***	-0.0942**	-0.107***	-0.110**	-0.139***
	(0.0333)	(0.0430)	(0.0393)	(0.0547)	(0.0513)
HH labour	0.0404***	0.0384***	0.0393***	0.0394***	0.0408***
	(0.00545)	(0.00618)	(0.00584)	(0.00625)	(0.00556)
Education	0.00816***	0.00838***	0.00833***	0.00832***	0.00806***
	(0.00293)	(0.00298)	(0.00297)	(0.00298)	(0.00297)
Female head	0.0126	0.0270	0.0223	0.0211	0.00893
	(0.0246)	(0.0267)	(0.0259)	(0.0301)	(0.0300)
Cattle	0.00472***	0.00408**	0.00430***	0.00429**	0.00477***
	(0.00157)	(0.00169)	(0.00164)	(0.00175)	(0.00167)
Migration experience	0.0402**	0.0411**	0.0413**	0.0409**	0.0397**
	(0.0170)	(0.0173)	(0.0172)	(0.0172)	(0.0171)
Distance	-0.000244	-0.000234	-0.000237	-0.000240	-0.000244
	(0.000213)	(0.000220)	(0.000217)	(0.000218)	(0.000210)
Observations	1,583	1,583	1,583	1,583	1,583
Wald test of exogeneity Prob>chi2	0.0012	0.046	0.0158	0.0774	0.0294

Instrumented: logarithm of crop production
Main instrument(s):SPEI12 (col.1), SPEI24 (col.2), SPEI48 (col.3), temperature, temperature squared, precipitation, precipitation squared (col.4), temperature and precipitation shock (col.5)

Results presented in terms of the average marginal effects
First-stage regressions omitted
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The effect is significant for households in the middle of wealth distribution, but is insignificant for the poorest and the wealthiest households: the poorest cannot afford the cost.
The impact of weather shocks on migration decision is more important for households specialized in agriculture: the necessity for them to diversify and to find out a solution is higher.

Table 4. Migration, initial endowment and specialisation

Dependent vaiable: probability of migration	Wealth tertiles			Specialisation	
	1st	2nd	3rd	Farm specialisers	Diversified
	(1)	(2)	(3)	(4)	(5)
Logarithm of crop production	-0.116	-0.165***	-0.0658	-0.220***	-0.0913*
	(0.0865)	(0.0383)	(0.0609)	(0.0692)	(0.0494)
HH labour	0.0600***	0.0398***	0.0283***	0.0512***	0.0332***
	(0.0154)	(0.00791)	(0.0102)	(0.00775)	(0.00859)
Education	0.00801	0.00476	0.0195***	0.00676	0.0142***
	(0.00534)	(0.00525)	(0.00683)	(0.00443)	(0.00430)
Female head	0.0181	0.0108	0.0690	0.0292	0.0238
	(0.0443)	(0.0346)	(0.0542)	(0.0325)	(0.0377)
Cattle	0.00180	0.00495**	0.00514*	0.00335*	0.00290
	(0.00304)	(0.00249)	(0.00294)	(0.00174)	(0.00357)
Migration experience	0.0535*	0.0512*	0.0305	0.0315	0.0458*
	(0.0311)	(0.0273)	(0.0387)	(0.0233)	(0.0259)
Distance	-0.000433	-0.000222	-6.12e-05	0.000172	-0.000738*
	(0.000379)	(0.000302)	(0.000547)	(0.000327)	(0.000404)
Observations	564	593	426	827	756
Wald test of exogeneity Prob>chi2	0.1944	0.0006	0.5326	0.0099	0.0800
Instrumented: logarithm of crop production					
Main instrument: SPEI12					

Wealth tertiles based on asset-based index based on the polychoric principal component analysis (Kolenikov and Angeles, 2004)
Farm specialiser: hh deriving >75% of income from agriculture
Results presented in terms of the average marginal effects
First-stage regressions omitted
Standard errors in parentheses

Conclusion

It seems unlikely that the alarmist predictions of hundreds of millions of environmental refugees will translate into reality: 20 millions according to our estimate

High mobility, Income diversification, will continue and intensify: we provide evidence from Tanzania, many other examples in the empirical literature, see in particular the works of Kathrin Millock.

The very poor and vulnerable in many cases unable to move.

What is also necessary is a radical change in perceptions of migration:

Policies might accommodate changes in migration patterns that result from environmental degradation, the lack economic growth, crisis

This seems to be an essential ingredient of adaptation to climate change and other development goals.