Technical Appendix:

What Is the Link Between Hunger and Migration?[1]

David Laborde and Tess Lallemant. May 23, 2017.

This technical appendix describes the econometric analysis done in support of the IFPRI-IISD policy brief *What Is the Link Between Hunger and Migration?* by David Laborde, Livia Bizikova, Tess Lallemant and Carin Smaller.

This appendix is not an exhaustive and definitive assessment of the complex relations between migration, demographic, political stability, economic and agriculture development. Based on data limitations and econometric issues, our goal was to simply illustrate how complex the story is and how oversimplification based on mere correlation between variables can be misleading. If some migration drivers are robust (population, political stability), others appear to be dependent on the sample considered (e.g., level of development of origin countries), and can reveal more complex story (e.g., impact of productivity gains at the farm level) or emphasize the importance of discriminating between joint symptoms (migration and undernourishment) and common drivers (low level of income or economic opportunities). Lastly, we do not tackle the feedback effects of migration on poverty through remittances.

We have estimated various model specifications, aiming to explain how the number of migrants is affected by economic and non-economic variables (e.g., political stability), as well as farm productivity metrics using alternative variables. The explained phenomena, our *regress and* or dependent variable, are the international migrations. These could be measured in different ways: the absolute number of migrants (people outside their country of birth), the relative number of migrants (expressed as a share of the home country population), the flow of migrants (variation of stocks between two periods), the relative flow of migrants, or the absolute or relative changes in the flows. Of course, each model has its own implication about model specifications, distribution of error terms and robustness. For instance, considering a model regressing variables in levels, even in flows, will generate a high R^2, but with no explanatory power due to spurious regression and stationary behaviour for various variables.

We present results for our preferred and more robust specification with low risk of endogeneity issues: five-year step changes in the logarithm of explained (stock of migrants) and explanatory variables, or first order difference depending on the explanatory variables. The five-year step is directly driven by the update frequency on the raw migrant stock data. With only five points by country over the period 1990–2015, we do not exploit the panel structure[2] of the dataset, but we pool the different time periods together in our cross-country analysis.

Lastly, we introduce the lag of some of variables to consider delayed effects.

[1] https://www.iisd.org/sites/default/files/publications/link-between-hunger-migration.pdf

[2] We explore the panel structure of the dataset in additional regressions, but no qualitative changes in our conclusions were observed.

1 Data

The indicators listed in Table 1 were used to conduct our econometric analysis. The dependent variable is the change in the number of migrants, while the explanatory variables included, among others, population, poverty headcount and prevalence of undernourishment.

In the next section, each variable used in a regression can have a prefix "*d*" for a first order difference between *year+*5 and *year* or "*dlog*" for the same time difference applied to the logarithm of the variable.

Data availability varies across each indicator and will limit the size of the sample for different specifications.

In some specifications, we also extend the set of independent variables to include GDP, youth male population and stunting indicators. No significant effects where noted.

Table 1. Description of indicators used in econometric analysis

Variable Code	Description	Coverage	Source and version
MigStock	Migrant Stock (by origin)	1990–2015	UN - Department of Economic and Social Affairs (2015 Revision)
pop	Population, total	1990–2015	World Bank Development Indicators (02/01/2017)
GDPpp	GDP per capita, PPP (current international $)	1990–2015	World Bank Development Indicators (02/01/2017)
pov	Poverty headcount at USD 1.90 a day (2011 PPP) (number)	1990–2015	World Bank Development Indicators (02/01/2017) and PovCalNet (2005 ppp at $1.25)
pou	Number of people affected by undernourishment (Prevalence of Undernourishment % x population)	1990–2015	World Bank Development Indicators (02/01/2017)
pos	Political stability and absence of violence/terrorism: Percentile rank	1990–2015	Worldwide Governance Indicators (10/19/2016)
valag	Agriculture value added per worker in constant 2010 USD. Indicator of labour productivity.	1990–2015	World Bank Development Indicators (02/01/2017)
yield	Cereal yield (kg per hectare). Indicator of land productivity.	1990–2015	World Bank Development Indicators (02/01/2017)

Source: Authors' list.

2 Results

2.1 Full Sample

Table 2 displays results when we consider the full sample. The full sample will include all countries in the world (developed and developing), as well as positive and negative flows of migrants and for the whole period.

Still, depending on the model (1 to 6), the number of observations will vary depending on the availability of independent variables. Therefore, comparison between models and level of significance should not be compared directly.

Based on this overall situation, we see that two robust drivers on the evolution of the flows of migrants are:

- Demographic evolution: countries with stronger demographic changes will have more changes in migrants (positive relation: larger population increase leads to larger outflows of migrants).
- Political stability: countries with larger changes in political stability will have larger changes in migrants (negative relation: larger political stability increase leads to smaller outflows of migrants).

Variables linked to poverty and undernourishment do not appear as significant. This is not surprising since:

- In the unrestricted dataset, North-North migrations flows, like the intra-European ones are not explained by relative changes in extreme poverty or undernourishment since this region does not display such extreme situations.
- Poverty has ambiguous effects on migrations since non-linear effects are expected. Indeed, while fleeing an impoverished situation is a strong motive to migrate, people in extreme poverty do not have the monetary or social means to migrate internationally. Reducing extreme poverty could be associated with increased migration since that provides enabling conditions to move.

Interestingly, we see a positive relation (Model 6) between increases in the productivity of farmers and the flows of migrants with a lag of five years. This can illustrate the structural effects of increased farm productivity with lower labour needs, while there is often lag time until the domestic economy is able to absorb these people, which leads to an increase in migration. In addition, increased agricultural labour productivity can provide financial means to support international migrations of some members of the farm household. Obviously, existing microeconomic literature on migrations (domestic and international) is key to understanding the drivers at a household level.

Table 2. Results: Full Sample

Sample:	**Full Sample: 5-year time period and 215 reporting countries or territories**					
Case:	(1)	(2)	(3)	(4)	(5)	(6)
Dependent:	*dlog*MigStock					
***dlog*gdpp**	0.02	-0.08	-0.09	0.02	0.01	-0.02
	(0.0473)	(0.0877)	(0.0595)	(0.0546)	(0.0631)	(0.061)
***dlog*pop**	0.38***	0.66***	0.26**	0.43***	0.42***	0.48***
	(0.0929)	(0.205)	(0.133)	(0.103)	(0.107)	(0.109)
***dlog*pos**	-0.06***	-0.06***	-0.04**	-0.06***	-0.05***	-0.05***
	(0.0181)	(0.0236)	(0.0185)	(0.018)	(0.0205)	(0.0202)
***dlog*pou**		-0.06				
		(0.0527)				
***dlog*pov**			-0.01			
			(0.0143)			
***dlog*yield**				0.00		
				(0.035)		
***dlog*val**					0.03	
					(0.0512)	
***dlog*val with 1 lag**						0.10**
						(0.048)
Observations	727	355	472	670	637	593
R-squared	3.8%	5.4%	3.2%	4.3%	3.5%	5.0%

Note: Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Constant included in the regression but omitted in the table.

2.2 Sub-Sample

Table 3 shows results for some sub-samples, especially when we limit the dataset with a significant level of poverty (above 7.5 per cent of the population above the $1.90 poverty line, the median poverty headcount ratio in our dataset for countries with available poverty rate) or to African countries.

As before, population and political instability have the expected impacts.

For these subsets of poor and/or vulnerable countries, we find that economic growth, measured as the percentage change (log variation) of GDP per capita measured in purchasing power parity, has strong and negative impacts on the flow of migrants.

Other variables of interest listed in Table 1 do not have a significant impact except in two cases:

- For Africa, we find the same positive relation between lagged agricultural labour productivity and migration. See discussion in the previous sub-section to understand these results.
- For poor countries, we have an illustration of the ambiguous results regarding extreme poverty reduction, where some negative relation can be observed between the evolution of the number of poor people and the number of migrants. The previous sub-section also discusses this possibility. Due to the relative scale of the two phenomena, we do not believe that direct endogeneity here is a strong explanation—that is to say, poverty is reduced through migrations by sending poor people abroad. Similarly, without lag, the remittances linkage may be limited here.

.

Table 3 Results Sub-Sample

Sample:	Countries with poverty rate above 7.5%			African Countries			
Case:	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Dependent:	*dlog*MigStock						
***dlog*gdpp**	-0.19*	-0.29***	-0.21	-0.13	-0.12	-0.43**	-0.46**
	(0.107)	(0.0979)	(0.134)	(0.105)	(0.105)	(0.164)	(0.18)
***dlog*pop**	0.71***	-0.3	1.01***	1.06***	1.20***	1.15***	1.36***
	(0.252)	(0.256)	(0.29)	(0.361)	(0.367)	(0.384)	(0.398)
***dlog*pos**	-0.08***	-0.06**	-0.07**	-0.13***	-0.13***	-0.15***	-0.15***
	(0.0297)	(0.026)	(0.0351)	(0.0396)	(0.0394)	(0.0468)	(0.0482)
***dlog*pou**						-0.04	
						(0.108)	
***dlog*pov**		-0.11*					
		(0.0579)					
***dlog*yield**							
***dlog*val**							
***dlog*val with 1 lag**			0.02				0.28**
			(0.115)				(0.136)
Observations	244	223	208	200	200	155	165
R-squared	7.9%	8.3%	8.6%	9.2%	10.7%	14.1%	15.6%

Note: Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Constant included in the regression but omitted in the table