Essay Contest – Economics and the Future

Poverty and climate change in developing countries: an assessment

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1. Introduction

Motivation

> CO_2 emissions and temperatures are growing (Hertel and Rosch, 2010)

> First Sustainable Development Goal: **to eradicate poverty** in all its forms by 2030

Poor people may suffer more severely with **climate change** as they live in weak conditions and depend of activities directly related to the environment

Goals

> Give a portrait of poverty and climate change around the world

> Describe the mechanisms through which climate change impacts the poor

> Measure the impact of climate change on poverty in developing countries

1. Introduction

Research question

> How are the absolute poor affected by climate change in developing countries?

Relevance and contribution of this research

> Impact of climate change on poverty is a recent topic of research and with sparse analysis

> Academic research predominantly focused on specific regions and countries and frequently adopting a case study approach

> Climate change can have catastrophic effects in our livelihoods (Stern, 2007) and poverty is still very present in the world (Campagnolo and Davide, 2019)

2.1. Poverty and Climate Change definitions

The concept of **poverty** has changed over time (Misturelli and Hefferman, 2010). A person can be considered poor if lacking the "equivalent sum of money required to attain minimum desired nutrition" (Seebohm Rowntree *apud* Mabughi and Selim, 2006 p. 184)

Climate change can be defined as the lasting alteration of climate and it can occur in various forms (*e.g.* increased average temperature, decreased annual precipitation, greater occurrence of natural disasters (Todaro and Smith, 2015)

2.2. Poverty and Climate Change

There are **many channels** through which climate change can affect poverty. Even though they are normally presented in a static way, they **commonly work interconnected**

> Consumption, assets, productivity, and opportunities (Hallegatte *et al.,* 2014)

> Direct and indirect channels (Leichenko and Silva, 2014)

Examples of climate change impact channels on poverty

Main Channel	Mechanism	Specific channels	Direct/ Indirect	Example
Consumption channel	A change in the price vector will provoke change in the vector of consumption.	Food prices	Direct Channel	1. Climate shock 2. Higher food prices (crop destruction) 3. Poverty increases
Opportunity channel	A household can increase its income by expanding its range of activities. Climate change can constrain the activities' expansion	Economic growth	Indirect Channel	1. Economic growth driver of poverty reduction 2. Climate change slows down economic growth 3. Lower poverty alleviation

Source: own elaboration with information from Leichenko and Silva (2014) and Hallegatte *et al*. (2014).

2.2. Poverty and Climate Change

Empirical research on poverty and climate change

> Several different methodologies and topic combinations that can be explored to understand how climate change and poverty relate

> Climate change may contribute to different poverty outcomes, depending on the type of climatic variable and countries' specific characteristics and level of development

Main empirical research on the impact of climate change on poverty

Author (s)	Sample	Method	Explained variable(s)	Explanatory variable(s) and estimated effect		Does climate change impact poverty?
Park *et al.* (2018)	Household data: 52 LDC; Survey years between 1994 and 2013	OLS	Poverty exposure bias for country *i*	Temperature	(+)	**Yes**, but while its impact is **regressive** in hot countries, it may be **beneficial** in colder countries
Azzarri and Signorelli (2020)	Household data: 24 Sub-Saharan African countries	OLS SAC	HCR	Rainfall Temperature Flood shock Drought shock Heat shock	(-) (+) (+) (-) n.S	**Yes**, but **different** forms of climatic impacts have **different** outcomes in poverty

3. Methodology

Model: $y_{it} = \beta_1 X_{it} + \beta_2 Z_{it} + \alpha_i + \mu_{it}$

Estimation method: OLS, Fixed Effects Model

Sample: 76 low- and middle-income countries (WB classification), 1998-2014

Model Variables

Dependent variable (y_{it})	**Poverty**: Poverty Headcount Ratio (HCR) at 1.90 dollars a day, in 2011 prices at PPP				
Explanatory variables (X_{it})	**CO2 emissions** in kg per GDP in dollars, in 2011 prices at PPP (CO2GDP)		**Temperature** annual average in degrees Celsius (TEMP)		
	Forest area percentage in terms of total land area (FOREST)		**Precipitation** average annual frequency in millimetres (PRE)		
Control variables (Z_{it})	**Log GDP *per capita***, in 2011 constant international dollars at PPP (LOGGDP)	**GINI index** (GINI): inequality on a country's income distribution	**Public expenditure in health and education**, in % GDP (EDUCH)	**Inflation** (INF): consumer price index	**Unemployment** (UNEMP): % of labour force with-out work in terms of total labour
	Gross capital formation (GCF), in % of GDP	**Population growth** (POPGROWTH)	**Extractive goods exports** (EXTRACTIVE): % of all merchandise exports. Sum of agricultural raw material, fuel,		**Urban population** (URBAN): nº of people living in urban areas as a ratio of

4. Results: full sample

Dependent Variable: Poverty Headcount Ratio (HCR)				
	Model I	Model II	Model III	Model IV
Constant	180.6276 (0.0000)***	80.92801 (0.0522)*	103.2495 (0.0138)**	105.3728 (0.0132)**
CO2GDP	-36.42075 (0.0000)***			
TEMP		1.166336 (0.0567)*		
PRE			0.001527 (0.2239)	
FOREST				0.029943 (0.9056)
LOGGDP	-21.47535 (0.0000)***	-12.87023 (0.0060)***	-13.30619 (0.0048)***	-13.40032 (0.0059)***
GINI	0.092365 (0.5432)	0.062111 (0.6921)	0.086318 (0.5808)	0.080047 (0.6102)
EDUCH	-0.778675 (0.0000)***	-0.811195 (0.0000)***	-0.830169 (0.0000)***	-0.826489 (0.0000)***
INF	0.011839 (0.3259)	-0.012758 (0.3412)	-0.010441 (0.4119)	-0.010326 (0.4198)
UNEMP	0.103060 (0.5477)	0.026588 (0.8828)	-0.012470 (0.9439)	0.008045 (0.9639)
GCF	-0.014072 (0.8617)	-0.157771 (0.0779)*	-0.162097 (0.0691)*	-0.161532 (0.0655)*
POPGROWTH	-0.055501 (0.9409)	1.360452 (0.0511)*	1.469706 (0.0420)**	1.430176 (0.0526)*
URBAN	0.613730 (0.0014)***	0.523708 (0.0067)***	0.519091 (0.0074)***	0.517624 (0.0107)**
EXTRACTIVE	0.118589 (0.0191)**	0.120046 (0.0322)**	0.123588 (0.0301)**	0.121661 (0.0307)**

> Two explanatory variables are significant:

- **CO2 emissions** negatively impact HCR (model I)
- **Temperature** (model II) positively impact HCR

> Five controls are significant:

- **LogGDP**, **public expenditure on education and health**, and **gross capital formation** have a negative impact on HCR
- **Population growth**, **urbanization**, and **extractive goods exports** have a positive impact on HCR

5. Conclusions

Policy implications:

> **CO2 emissions** are found to decrease poverty, meaning developing countries might need to increase emissions to further develop and eradicate extreme poverty

> Mitigation and adaptation measures must be taken to protect the most vulnerable exposed to **temperature increase**

> Policies should aim to promote GDP *per capita* growth, health and education, and investment as they all are important for the reduction of poverty

> Urbanization and population growth must be sustainable, while income equality and a lower dependency of extractive goods exports should be targeted by policymakers

5. Conclusions

Research limitations and further research paths:

> Sample should have a higher number of low-income countries with more complete information

> Research lacks a multidimentional variable of poverty to better access the impact of climate change on the poor

> Microdata (*e.g.* household level surveys) would have allowed for a better understanding of the impact of climate change near the poor affected by it

> Poor people living in specific areas (rural vs. urban) inside countries can severely suffer with climate change and our research does not cover them properly

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