THE PENNSYLVANIA STATE UNIVERSITY
SCHREYER HONORS COLLEGE

DEPARTMENT OF ECONOMICS

The Poor Man's Burden: How Climate Shocks Impact Migration in Rural Bangladesh

ANIKA SINHA
SPRING 2024

A thesis
submitted in partial fulfillment
of the requirements
for a baccalaureate degrees
in Economics and Psychology
with honors in Economics

Reviewed and approved* by the following:

Grace Toufeili
Visiting Assistant Professor of Economics
Thesis Supervisor

Bee-Yan Roberts
Professor of Economics and Asian Studies
Faculty Reader

Nima Haghpanah
Associate Professor of Economics
Honors Adviser

* Electronic approvals are on file.

ABSTRACT

As climate change worsens, the frequency and intensity of natural disasters increases, impacting millions of people worldwide. Rural communities in Bangladesh, characterized by poverty and heavy dependence on agriculture, are particularly vulnerable. While projections estimate that millions of people will be displaced due to climate shocks, very few specify the demographic that is most likely to migrate. This thesis challenges the notion that migration is a predominant coping mechanism in response to climate shocks, by examining the impact of flooding on the income of poor households in rural Bangladesh. To explore this topic, this work evaluates whether poor communities migrate to the same extent as proposed by previous literature. Utilizing a differences-in-differences approach, the model concludes that flood depths negatively impact income. Although the results suggest that there is no direct relationship between climate shocks and migration, income is identified as a 'push' factor for migration. These findings serve as a stepping stone for future research on the direct relationship between income and migration.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGEMENTS

Dr. Grace Toufeili,

for constantly supporting my growth as a scholar throughout this unfamiliar process. I am immensely grateful for your time, patience, and mentorship.

Dr. Bee-Yan Roberts,

for igniting a spark of curiosity that has pushed me to be a better student, and for exhibiting a level of passion in your work that I strive to reach.

My cherished friends,

for making me want to be the best version of myself, every day. I feel incredibly blessed to have you all in my life.

My dad, Projesh, and my mom, Monali,

for fearlessly immigrating to the United States. This thesis allowed me to sit with the uncertainty behind the decision to migrate, like it was my own. I hope to carry your bravery with me through every new experience I navigate. Onek ador.

Laura,

for teaching me to do things because I can, not because I have to.

Chapter 1

Introduction

"It is the poor countries […] which will suffer the most from climate change even though they are the least responsible for global warming." —Ba Ki-moon, Former UN Secretary-General (UNEP, 2007)

The World Bank's 2021 *Groundswell Report* highlights the alarming projections of climate-induced displacement in three developing regions of the world: Sub-Saharan Africa, South Asia, and Latin America. By 2050, approximately 143 million people in these regions, constituting about 2.8% of the population, may be compelled to migrate within their own countries to escape the gradual, long-term impacts of climate change (Clement et al., 2021). Of particular concern is South Asia, where an estimated 40 million people, accounting for 28% of all projected migrants, face displacement (Clement et al., 2021).

Among the countries in South Asia, Bangladesh emerges as a compelling case study. In 2022 alone, over 7.1 million Bangladeshis were displaced by climate change, a figure projected to rise to 13.3 million by 2050 (World Health Organization, 2022). The nation's vulnerability to climate-related disasters is further affirmed by its ranking as the seventh most extreme disaster risk-prone country in the world, according to the Global Climate Risk Index of 2021 (Eckstein et al., 2021).

Bangladesh's unique geography makes it more likely to be affected by climate change. As the world's most populous delta, it's low-lying physical makeup and extensive network of rivers make it particularly vulnerable to natural disasters such as tropical cyclones, floods and droughts.

Bangladesh is at an inherently high risk for flooding because approximately 80% of its land consists of flood plains, nearly two-thirds of the country lies less than five meters above sea, and its southern coastline is surrounded by the Bay of Bengal (Zami, 2023).

The economic repercussions of Bangladesh's volatile climate are staggering. By 2050, projections suggest that the country could face a loss of up to one third of its agricultural GDP, and an estimated 13 million people may be forced to migrate internally due to climate-related factors (World Bank, 2022). Shockingly, it is anticipated that one in seven Bangladeshis will experience displacement by 2050 (Chowdhury et al., 2020). Furthermore, the World Bank (2022) reports that tropical cyclones cost Bangladesh millions of dollars annually. For instance, in June 2022, monsoon rains triggered a flash flood in northeastern Bangladesh, killing over 100 people and displacing more than 7 million in need of aid and shelter, ultimately causing economic damages estimated at approximately $1 billion (Zami, 2023). When factoring in the recurrent threat of severe flooding, which is worsened by the country's geography, projections indicate that Bangladesh's GDP could potentially fall by up to 9% (World Bank, 2022).

The topic of climate migration is incredibly timely. As climate change continues to grow in its intensity with minimal, effective intervention methods, researchers project that climate migration will only be exacerbated. While the aforementioned projections may seem like a problem for the future, their implications will only worsen without proactive research to inform policy decisions. This thesis contributes to the existing literature on Bangladeshi migration patterns by taking a more pointed look at rural, poor communities within the country. An individual's decision to migrate is influenced by a multitude of factors, including both 'push' and 'pull' factors. A majority of the existing literature suggests that climate-induced shocks are a significant 'push' factor driving migration decisions. This thesis analyzes household survey data across all seven

districts of Bangladesh to investigate whether this 'push' factor influences poor, rural households to the same extent. Flooding will be analyzed as the main climate shock within this thesis, ultimately investigating whether or not there is a relationship between flood depths and income. This thesis is intended to solidify a relationship between flood depths and income to serve as a step toward understanding the relationship between climate shocks and migration.

The following chapter creates a foundation of existing literature upon which this thesis is built. Chapter 3 highlights this thesis' hypothesis, the variables that go into the final model, and the methodology that is followed to prepare the data for analysis. Chapter 4 covers the differences-in-differences approach that is employed to investigate the relationship between flooding and income and presents the model's findings. Finally, Chapter 5 discusses the model's results and comments on the possibilities for future research.

Chapter 2

Existing Literature

2.1 Background

Although climate change has become a polarizing word in the world of politics, very little is still known about its adverse impacts. As a result, climate change-induced migration and its consequences have yet to be extensively investigated. In order to build a comprehensive foundation of the existing literature, this chapter starts by evaluating the existing literature on the relationship between climate change and migration at a high level and then delves deeper into notable papers on climate migration in Bangladesh. This literature review offers insight into how researchers have conceptualized climate migration and evaluated its impacts in Bangladesh, to date. Drawing upon these conceptual debates and gaps in the literature, this thesis takes a holistic approach by analyzing the only nationally representative household data across rural Bangladesh to determine the extent to which poorer communities are prone to migration as a result of climate shocks.

2.2 Relationship Between Climate Change and Migration

While the evidence on the effect of climate change on migration presents conflicting perspectives, it predominantly suggests a positive relationship. The main disagreement within the literature revolves around the distinction between macro-level and micro-level migration. In this

context, macro level migration pertains to international migration across borders, whereas micro-level migration is limited to movements within a single country.

There are two specific papers that find no relationship between macro-level migration and climate shocks. The first study, conducted by Beine and Parsons (2015), utilizes a utility maximization model and finds no direct effect of long-run climatic factors on international (macro-level) migration across the entire sample of migration flows spanning from 1960 to 2000. The authors emphasize the significance of origin-country characteristics, finding evidence that variables such as precipitation actually constrain migration from countries with a high reliance on agriculture (Beine and Parsons, 2015). This counterintuitive finding challenges the notion that factors like precipitation would increase out-migration in countries particularly susceptible to climate shocks, given their heavy reliance on agriculture. Climate shocks, such as unpredictable precipitation patterns, can impact agriculture yields, therefore jeopardizing the livelihoods and incomes of agricultural workers. Consequently, one may expect an increase in migration as a coping mechanism in the face of such pivotal climate events. However, over the 40-year period Beine and Parsons analyzes, no correlation between agricultural dependency and migration is observed.

Similarly, the findings of Gröschl and Steinwachs (2017) regarding the relationship between natural hazards and international migration are consistent with Beine and Parsons. Their study constructs a stylized theoretical gravity model of migration and finds that a mean hazard event, such as earthquakes, storms, and droughts, leads to a mere 1.7% increase in bilateral migration, which is not statistically significant (Gröschl and Steinwachs, 2017). Additionally, they find no evidence that individuals from poor, low-income countries migrate internationally in

response to natural hazards, since that adaptation strategy may not be financially feasible for economically constrained individuals.

On the other hand, Wesselbaum and Aburn (2019) constructed a panel data set with 16 destinations and 198 origin countries from 1980 to 2015, directly challenging the findings of Beine and Parsons (2015). Their study finds that countries with a heavier reliance on agriculture tend to experience more outward migration. Similar to Wesselbaum and Aburn, Reuveny and Moore (2009), Drabo and Mbaye (2014), and Coniglio and Pesce (2015), identify environmental factors and natural disasters as 'push' factors for migration, leading to increased out-migration. While many of these studies utilize an aggregate measure of weather-related disasters, some researchers stress the importance of examining not only the total number of weather-related disasters, but also their specific subcategories. For example, Backhaus et al. (2015) analyzes two specific variables, temperature and precipitation, finding a positive correlation between temperature changes and migration, whereas changes in precipitation are only associated with small changes in migration. Wesselbaum and Aburn further categorize climate-related variables up into three groups: temperature, weather-related disasters (such as floods, storms, droughts, and extreme temperature events), and non-weather disasters (including earthquakes, wildfires, landslides, volcanic events, and epidemics). Through regression analysis, the authors conclude that the impact of climate variables on migration depends on the severity of climate change-induced damage. Moreover, they identify temperature anomalies and weather-related disasters as the two significant and quantitatively important categories of climate variables. Out of the many shocks that households can face, this thesis will isolate flooding as the main covariate shock analyzed.

In addition to reviewing the available literature on the relationship between climate change and migration, it is important to examine how a countries' demographics influence the

vulnerability of its population to climate-induced migration. Across the board, high-income and low-income countries exhibit different migration patterns in response to climate change due to disproportionate impacts and varying consequences. Many victims of rapid-onset phenomena, such as tropical cyclones, torrential rains, and floods, belong to poor communities that lack resources to relocate, especially to distant regions. Kniveton et al. (2008) emphasizes that different regions hold varying levels of vulnerability, which can be explained by the region's dependence on the environment for livelihood. The vulnerability to nature is ultimately influenced by socioeconomic forces, leading to the assertion that poor, developing countries are inherently more vulnerable than rich, developed countries, which trickles down to the individuals residing in said countries. Piguet et al. (2011) corroborates this by demonstrating that natural hazards are unlikely to affect migration in rich and politically stable economies. The dichotomy between the rich and poor will be further investigated in the context of Bangladesh within this thesis.

Overall, the existing literature offers three primary insights into the relationship between climate change and migration. Firstly, while some research results point to a lack of a relationship between climate change and migration, the majority of the research strongly supports a positive relationship between the two. Secondly, the relationship between climate change and migration is dependent on the socioeconomic status of the country being evaluated. Individuals in low-income countries inherently have less flexibility when it comes to migration, which comes as a result of generalized attributes such as individuals having low income, countries having weak infrastructure, and individuals being dependent on jobs that are directly impacted by climate shocks. Paradoxically, these vulnerable populations bear a disproportionate burden of the impacts of climate change and may be forced to migrate despite lacking resources to do so. Lastly, there is

an ongoing debate regarding the migration patterns of individuals whose income relies on the agricultural sector.

This thesis aims to contribute to all three of these understandings by analyzing survey data from households in rural Bangladesh–a region characterized by poverty and heavy dependence on agriculture–to identify a relationship between climate change and migration. Since it is evident that a countries' distinct features influence its susceptibility to climate change, it is important to independently evaluate Bangladesh's relationship with climate migration.

2.3 Climate Migration in Bangladesh

Bangladesh's location, size, population density, and socioeconomic status make it an ideal case study to analyze climate migration. Existing literature consistently supports the notion that Bangladesh not only is vulnerable to climate migration, but also experiences it. Ahsan et al. (2014) conducted a field survey that found about half a million people were forced to leave their homes in May 2009 after cyclone Aila, concluding that migration is an adaptive measure to different climate-driven factors. Similarly, research by the Centre for Climate Change and Environmental Research at BRAC University in 2012 tracked 1,500 families primarily migrating to Dhaka, citing environmental changes such as diminishing freshwater sources due to rising seas levels, as the primary driver for their relocation (McPherson, 2015). These environmental hazards, particularly prevalent in rural areas, often prompt a 'push' to migration to adjacent cities. Furthermore, the United Nations Population Fund (2016) reports a significant increase in migrations from rural to urban areas between 1991 and 2011, with Dhaka capturing 42% of lifetime migrants. While economic opportunities in urban areas are a major 'pull' factor for migration, climate change

exacerbates this movement. Projections suggest that by 2050, over 34 million people in coastal Bangladesh will face migration risks due to climate change, with 19 coastal districts deemed at highest risk of disasters (IDMC, 2022).

Gray and Mueller (2012) utilize a 15-year longitudinal survey of 1,700 households to create a multivariate event history model to estimate the effects of flooding and crop failures on local population mobility and long-distance migration. The authors' work concludes that while flooding has modest effects on mobility that are most visible at moderate intensities and for women and the poor, households living in areas severely affected by crop failures unrelated to flooding are the most likely to move (Gray and Mueller, 2012). There are fundamental similarities between Gray and Mueller's work and this thesis. While both studies analyze longitudinal survey data, this paper expands the sample size to cover 6,500 households by utilizing nationally representative data from Bangladesh. Although Gray and Mueller's work finds a connection between climate shocks and migration in Bangladesh, they do not specifically identify the demographic characteristics of the population most likely to move. Thus, the question still stands: are the rich or poor migrating? Unlike Gray and Mueller's work, this thesis focuses on rural Bangladesh, analyzing whether or not the communities with the least number of resources are still prone to migrate as a result of covariate climate shocks. This approach will in turn isolate this socioeconomic factor as it clearly impacts migration capabilities and decisions.

Another study utilizing survey data to analyze climate migration patterns is the work done by Bernzen et al. (2018). In this study, the researchers conduct standardized household interviews in nine unions within five districts of coastal Bangladesh in 2014. The researchers choose this particular sample because it is representative of rural populations in the most vulnerable areas of Bangladesh (the coast). Migration is measured as any move from the household (both within and

outside the same union) and is defined by whether or not the person ate meals at the household table. Environmental stressors are measured through five indicators covering three of the most frequently addressed environmental stressors: saltwater shrimp farming, distance of household to next major river or coastline, arable land loss, household expenditures related to cyclone damage, and freshwater availability due to salinization. The researchers conduct statistical analysis through bivariate tests between their independent and dependent variables. Across the 1,188 households they surveyed, the study concludes that those with greater human capital, access to land, off-farm occupational skills, and gender/age roles that promoted a "breadwinner" model were more likely to migrate (Bernzen et al., 2018). The survey data that was collected in this study also found that economic and social opportunities are cited as the most important reason for migrating, overall.

While migration, in general, has a plethora of 'push' and 'pull' factors, the 'anchoring' factors that keep a household from moving can weigh heavily on a migration decision. The act of migration is far more difficult than the concept may seem on paper. Migrants must be able to afford to leave their occupation (income), home (family), and community (support system) for a new, foreign city where they are not guaranteed anything. In fact, 40—50% of the residents of urban slums in Bangladesh are made up of rural immigrants (Ishtiaque and Ullah, 2013). No matter the kind or severity of the shock, the rich have the resources to migrate. This thesis aims to understand whether or not this holds true for the poor, rural communities in Bangladesh, a sample that has not been extensively studied in this discussion.

Chapter 3

Data

This chapter will cover this study's hypothesis, the Bangladesh Integrated Household Survey (BIHS) data set, and the methodology that is applied to prepare this dataset for analysis.

3.1 Hypothesis

As discussed in Chapter 2, given the relatively recent emergence of climate change, there has been limited research conducted on the relationship between climate shocks and migration in Bangladesh. However, a significant area of debate within the existing literature revolves around the disparity in adaptive capabilities between the rich and poor in response to climate shocks. The decision of an individual to move is incredibly complicated to model and accurately predict. However, there are some notable 'push' and 'pull' factors that contribute to an individual's ultimate decision to migrate.

Table 1: List of Migration Push, Pull, and Anchoring Factors

Push Factors	Pull Factors	Anchoring Factors
Poverty	Prospects for higher wages	Familial Ties
Unemployment	Improved living standards	Community connections
Low wages	Personal development	Access to familiar resources
Lack of basic health	Job opportunities	Cultural attachments
Climate change	Good welfare standards	Job security
Lack of basic education	Labor demands	Language and cultural barriers

Table 1 summarizes the most common 'push' and 'pull' factors that influence migration. It also touches on possible 'anchoring' factors that prevent a household from moving. Amongst these

factors is climate change, the main scope of this thesis. Because of varying community capabilities, this thesis analyzes whether or not climate change is a true 'push' factor in rural Bangladesh. Drawing upon observations of climate migration patterns and their impacts in Bangladesh, this thesis hypothesizes two potential effects of climate shocks on poor communities:

1. Following a climate shock, poor, rural communities may experience temporary migration as a strategy to maintain consumption levels.
2. Conversely, following a climate shock, individuals from impoverished rural communities may lack the necessary resources or motivation to relocate and thus choose not to migrate.

To explore which effect, if any, predominates, this study utilizes data from the Bangladesh Integrated Household Survey (BIHS). Conducting over three rounds spanning eight years (2011-2012, 2015, 2018-2019), the BIHS surveyed 6,500 households across 325 primary sampling units. Notably, the survey covers four key areas:

1. Agricultural production and practices at the plot level
2. Dietary intake of individual household members
3. Anthropometric measurements (height and weight) of all household members
4. Data related to the Women's Empowerment in Agricultural Index (WEAI)

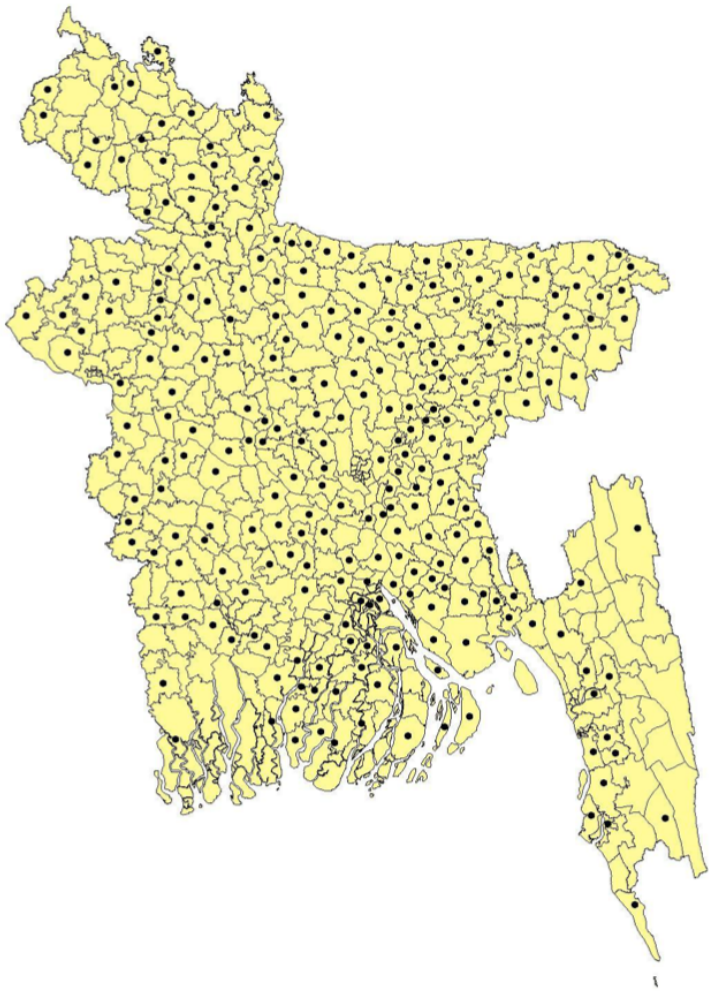
Furthermore, the sample is statistically representative at both national and divisional levels within rural Bangladesh.

3.2 Household and individual characteristics

Bangladesh is divided into seven administrative divisions: Barisal, Chittagong, Dhaka, Khulna, Rajshahi, Rangpur, and Sylhet. The BIHS sample includes representation from all seven

divisions. Below the division level, the administrative units known as upazilas serve as crucial sub-district regions responsible for local governance and development in rural Bangladesh. Figure 1 illustrates the surveyed upazilas, indicated by black dots, highlighting their significance in the context of the study's geographic coverage and focus.

Figure 1: Map of Bangladesh Illustrating the Survey Upazilas



Source: (Ahmed, 2013)

The national survey encompasses rural areas across the entire country. Table 2 outlines the number of survey households by division across all three rounds of surveying.

Table 2: Number of Survey Households by Division

Division	2011	2015	2018
Barisal	700	660	381
Chittagong	960	915	889
Dhaka	1,980	1,884	1,599
Khulna	1020	991	503
Rajshahi	580	566	553
Rangpur	543	516	504
Sylhet	720	692	666
Total households	**6,503**	**6,224**	**5,095**

The data consists of four main levels of variables: (a) the household level, (b) the individual member level, (c) the crop level, and (d) the plot level. Each of these levels of data highlights specific variables that are ultimately used in the final regression analysis. Within the household-level data, the only variable of interest is the household identification variable, which is important because it uniquely identifies each household across all three rounds of surveys. Instances of households splitting between rounds, such as when a son of the household head marries and relocates, are addressed by assigning decimal places to the original household's identification number. This method enables the identification of specific households that split in subsequent rounds. To ensure sample consistency and to facilitate accurate merging across all three years, only the households still containing the head member from the first round of surveys are retained in the dataset, while all other split households are excluded. This process does not affect the total number of unique households in each round, though variations may occur due to the inability to follow up with certain households because of external factors that decrease this sample size.

Average household demographics are computed based on responses provided by each household's head or primary responder. The household head is an example of the individual level

of data described in the BIHS survey. This level of data is appropriate for capturing the specific demographic variables sex, age, marital status, literacy status, region of work, education level, and income. These variables provide insight into the overall socioeconomic status of the individuals that make up the households, that could later be generalized to the household, at large. Table 3 describes the typical household within the sample, indicating that the majority of household heads are married men in their mid-forties working in rural settings. The table also highlights the most common occupations held by household heads, with agricultural work being the most popular, reflecting the importance of the agriculture sector in rural Bangladesh. Additionally, the average household size varies across the three survey rounds, with the smallest average size recorded in 2018 (3.54 persons) and the largest in 2011 (4.20 persons).

Table 3: Household Demographics (2011—2018)

	2011	**2015**	**2018**
Household head demographics			
Percent male	82.25	81.27	78.84
Average Age	44.17	46.19	47.68
Percent married	90.71	89.57	88.09
Percent work in rural area	90.89	90.88	91.73
Percent can read and write	47.02	48.99	51.09
Average number of members per HH	4.20	3.65	3.54
Most common occupations	(percent of household heads)		
Working own farm (crop)	21.90	19.87	19.00
Sharecropper / tenant	10.53	10.54	11.64
Housewife	8.66	9.96	16.90
Agricultural Day Worker	11.93	10.25	7.93
Medium Trader (shop or small store)	4.67	6.04	6.40
Rickshaw/Van Pulling	4.21	3.70	3.55
Small Trader (roadside stand or stall)	4.15	4.53	4.16

The literacy rate, a key indicator for assessing poverty levels within the sample, is represented by the percentage of individuals capable of reading and writing, which ranges from

47–51% of the population. Similarly, Figures 2, 3, and 4 exhibit the percentage of household heads that have never attended school, the average years of schooling, and average daily wage per person across all three rounds of survey.

Figure 2: Household Heads Never Attended School by Division (2011—2018)

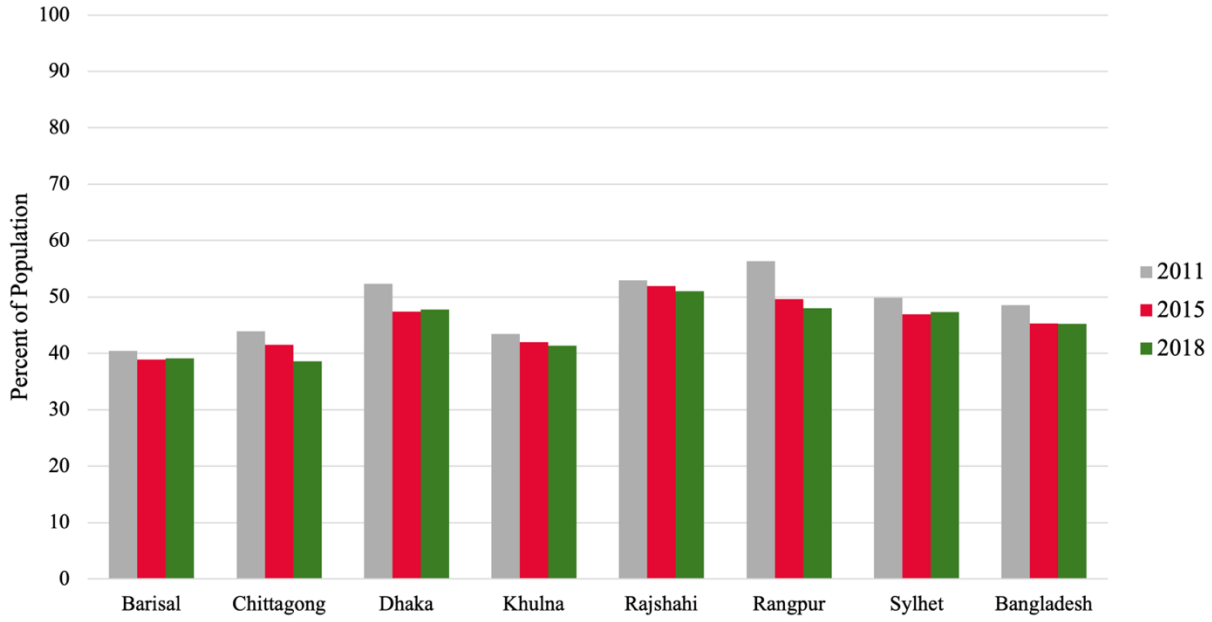
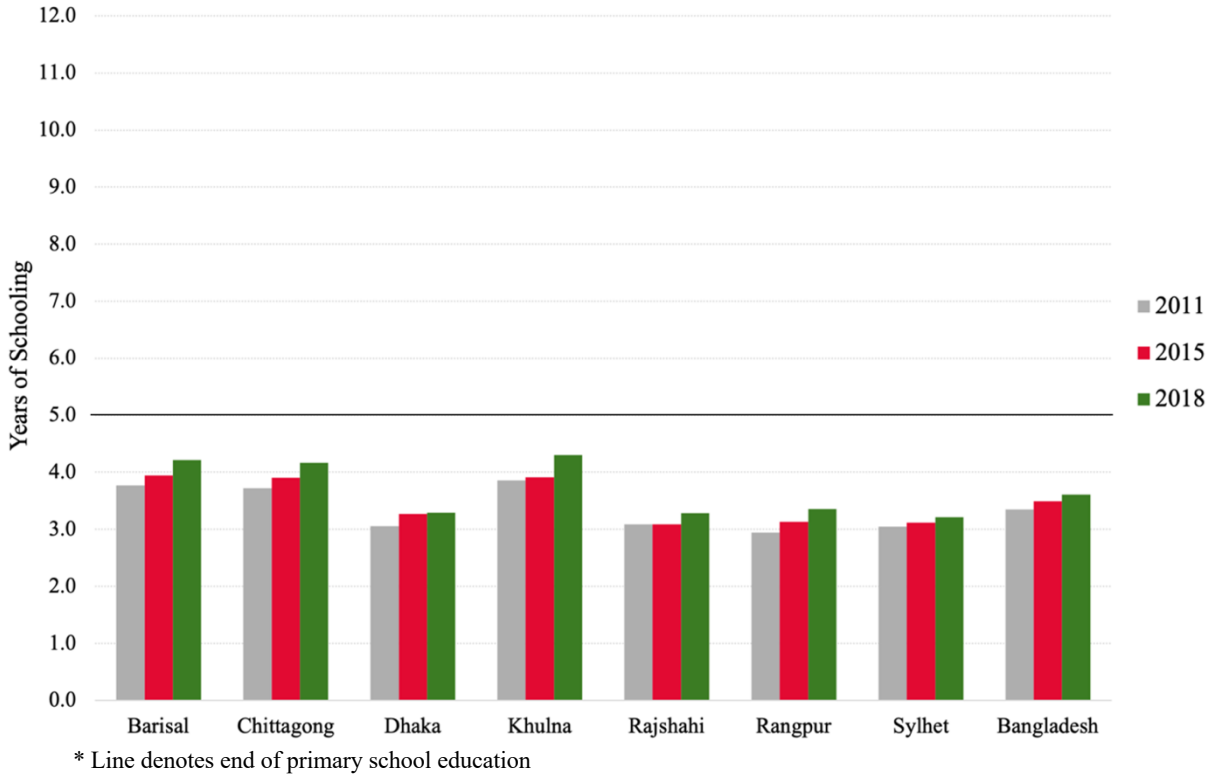


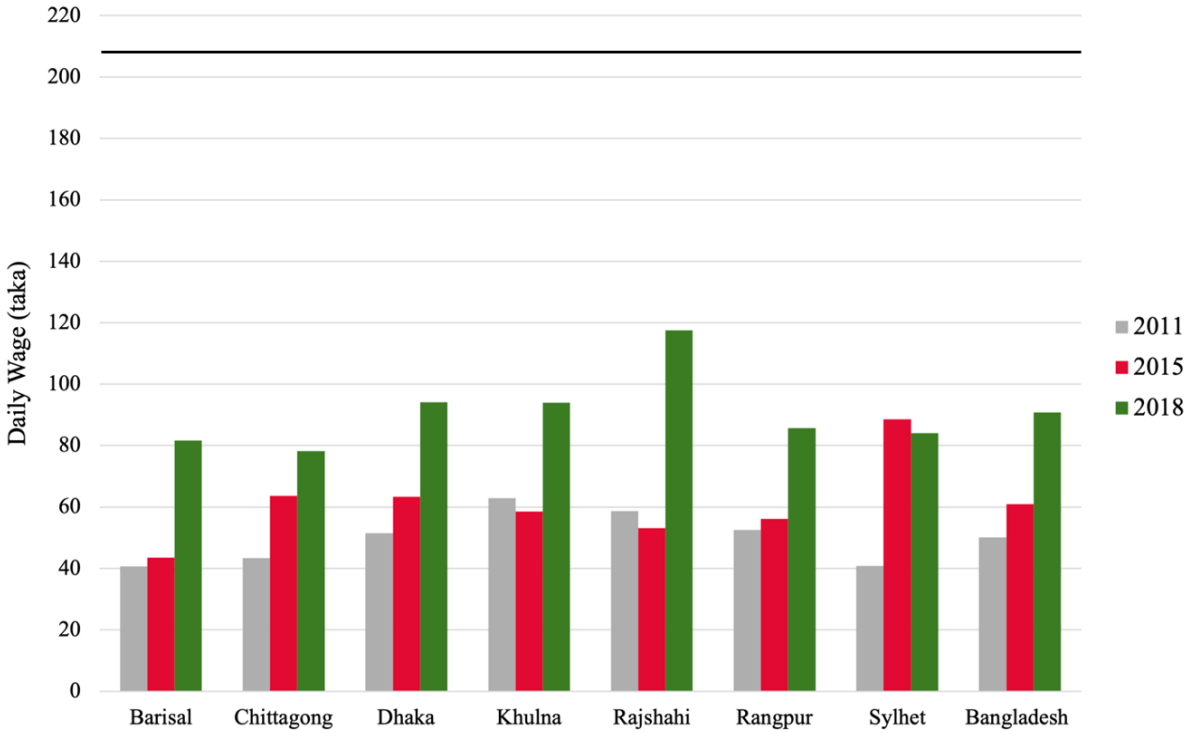
Figure 3: Household Heads Average Years of Schooling by Division (2011—2018)



* Line denotes end of primary school education

Figures 2 and 3 provide insights into the educational attainment of household heads, an important factor in poverty alleviation efforts. Education is widely acknowledged as a powerful tool for combating poverty, as individuals with higher levels of education are often qualified for higher paying jobs. However, the data indicates that the average household head in the sample has limited formal education, with district averages reflecting completion below primary school. Moreover, daily income serves as a significant indicator of socioeconomic status. Figure 4 highlights the average daily wage of an individual in the sample compared to the international poverty line set at $1.90 per person per day, equivalent to approximately 208 Bangladeshi Taka. Although wages show improvement compared to 2011 across the country, they still fall significantly below the intentional poverty threshold. This emphasizes the ongoing socioeconomic challenges the individuals in this sample face.

Figure 4: Average Daily Wage per Person (2011—2018)



* Line denotes national poverty line (in taka)

3.3 Crop and plot characteristics

Given that approximately 40–50% of household heads work in the agriculture sector, climate shocks affecting crops and their yields could significantly affect income levels and stability. This, in turn, may influence an individual's decision to migrate. Thus, among the over 20,000 crop plots in the survey data, rice crops are selected as the primary focus of analysis due to their prevalence within the sample. Table 4 outlines the distribution of crops by division, highlighting the overwhelming majority of rice crops.

Table 4: Crop Breakdown by Division

Crop	Barisal	Chittagong	Dhaka	Khulna	Rajshahi	Rangpur	Sylhet	Bangladesh
				(percent of all crops)				
Rice	70.74	69.11	67.94	62.42	73.80	77.14	90.34	70.79
Wheat	0.22	0.39	1.38	2.21	2.19	2.45	0.00	1.50
Jute	0.98	1.25	9.74	8.79	2.44	3.10	0.23	5.47
Chili	1.15	2.32	1.59	1.30	0.38	0.74	0.72	1.22
Onion	0.02	0.37	3.03	2.04	1.36	0.65	0.03	1.58
Garlic	0.07	0.46	0.75	0.37	1.23	0.15	0.03	0.56
Potato	0.70	3.79	0.87	0.37	6.18	4.25	2.67	2.37
Other	26.12	22.31	14.70	22.51	12.42	11.51	5.98	16.51
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Two main variables are analyzed at the crop level, quantity harvested and quantity damaged, giving insight into how much a household's livelihood can be impacted in light of a climate shock. Table 5 provides a detailed breakdown of all rice harvest and damage quantities (measured in kilograms). It is worth noting that due to the reduction in sample size from 2011 to 2018, the total number of rice plots decreases over time, as indicated in the last row of the table. While not all households face damage to crop yields, some explicitly cite the perceived reason for crop damage. Table 6 provides insight into why some crop yields were damaged. The percentage of crops damaged due to flooding increases from 9.57% in 2011 to 25.74% in 2015 and decreases back down to 20% in 2018.

Table 5: Average Rice Quantity Harvested and Damaged by Division (2011—2018)

Division		2011		2015		2018	
		Mean	SD	Mean	SD	Mean	SD
				(kilograms)			
Barisal							
	Quantity Harvested	376.55	457.43	404.60	444.12	439.05	482.20
	Quantity Damaged	0.73	5.27	0.60	4.75	0.11	1.19
Chittagong							
	Quantity Harvested	387.30	424.76	446.21	410.40	463.35	438.46
	Quantity Damaged	0.22	1.56	0.06	0.55	0.57	8.10
Dhaka							
	Quantity Harvested	527.50	664.87	517.32	614.73	544.07	534.66
	Quantity Damaged	0.24	2.87	0.29	4.08	1.05	8.49
Khulna							
	Quantity Harvested	419.77	478.95	502.33	541.84	525.65	461.66
	Quantity Damaged	0.47	4.42	0.17	1.54	0.29	1.49
Rajshahi							
	Quantity Harvested	434.15	580.63	505.39	640.87	535.74	626.21
	Quantity Damaged	0.00	0.00	0.08	1.02	0.29	2.31
Rangpur							
	Quantity Harvested (kg)	523.52	612.64	555.10	595.09	530.96	536.11
	Quantity Damaged (kg)	0.57	2.39	0.01	0.19	0.01	0.14
Sylhet							
	Quantity Harvested (kg)	622.30	841.83	776.52	1059.39	792.48	792.48
	Quantity Damaged (kg)	0.39	2.12	0.00	0.06	0.56	5.10
Total # of Rice Plots		16,607		13,297		10,328	

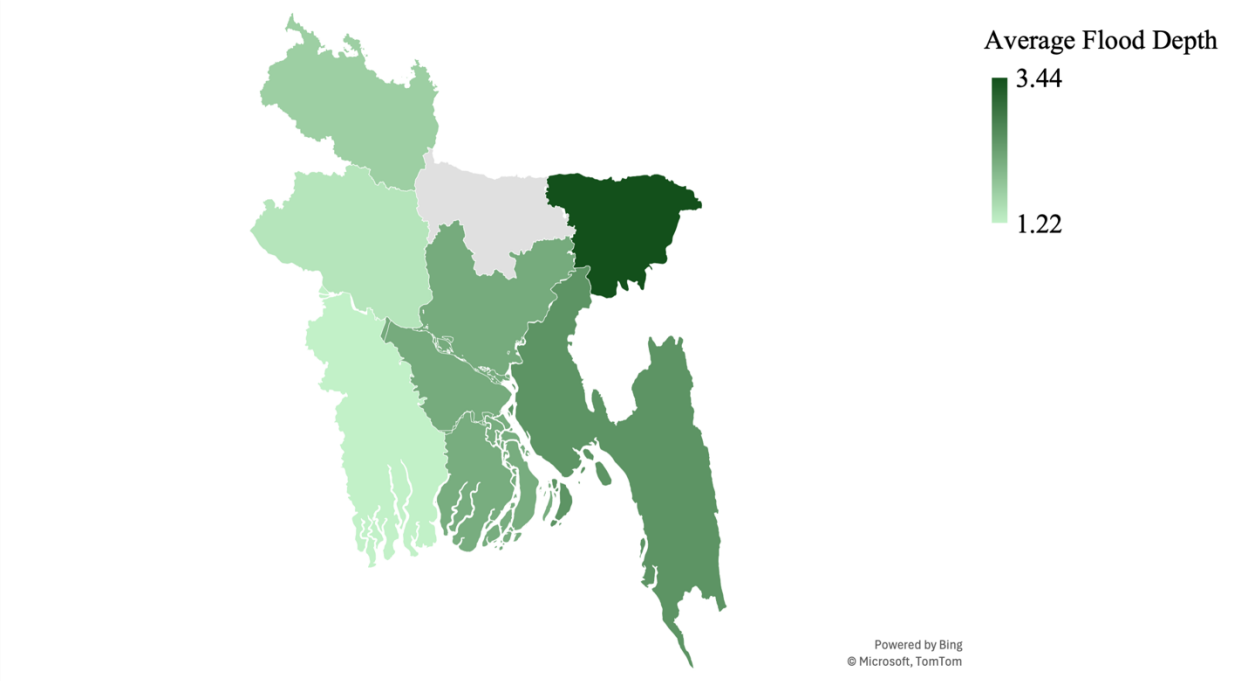
Table 6: Reasons for Damage to Rice Crops (2011—2018)

Reason for damage	2011	2015	2018
		(percent of respondents)	
Flood/rain	9.57	25.74	20.01
Pest attack	31.38	37.13	31.59
Infested by rats	57.53	33.64	46.54
Drought, storm or cyclone	0.51	2.39	0.93
Other	1.01	1.92	0.93
Total	100.00	100.00	100.00
Total Responses	784	544	535

The survey data meticulously maps every crop to a specific plot owned by a household. Occasionally, crop plots are considered 'split' (similar to the households) across all three rounds of data. However, there is no accompanying survey documentation explaining the rationale behind split plots. Consequently, the data-cleaning process operates under two primary assumptions. First, unlike split households, where the original household from round one was denoted "10" and subsequent rounds were labeled "10.1" if the household had split, split plots per household were designated as 2, 2.1, 2.2, and so on, even in the baseline data. It is assumed that split plots are identified based on the different crops planted on the same physical plot. For instance, if the plot identification numbers for three crops–rice, onion, and garlic–were labeled 2, 2.1, and 2.2, respectively, it is inferred that all three crops were cultivated on the same plot but were identified separately, hence the decimals after '2'. Consequently, based on this assumption, when assigning average flood depths per plot, split plots are linked to the flood depth attributed to the original plot, as it is anticipated that the entire plot (regardless of crop) will experience the same degree of flooding due to its identical location.

Flood depths are chosen as the main covariate climate shock analyzed in this thesis. The consistency in reporting flood depths across all rounds makes it a robust measure of climate shock. Additionally, given the fact that a large proportion of households are associated with the agricultural sector, flood depths are also a relevant climate shock that has influence over a household's income and livelihood since it has the opportunity to directly impact crops and their yields. Figure 5 visually depicts the average flood depths recorded across Bangladesh by division. Further detailed breakdowns of average flood depths by division and year can be found in the Appendix.

Figure 5: Average Flood Depths by Division



3.4 Covariate shocks and household coping mechanisms

Many households are vulnerable to damage caused by shocks, which often result in sudden losses of real income and livelihood. These shocks, characterized as covariate, affect all households within a specific community. Examples of such shocks include floods, cyclones, and droughts, which exert adverse effects by leading to lower real incomes due to crop losses or reduced employment opportunities. The BIHS sample, consisting largely of a poor population, is particularly susceptible to these shocks. Poor households face more intense impacts from shocks such as crop failures or the death or serious illness of the primary income earner, as they typically have little to no savings to fall back on, making them especially vulnerable to significant losses. Table 7 describes the shocks that are most commonly faced by households and the coping mechanisms they employed post-shock. The respondents in 2011 were asked to list any shocks

that occurred in the last five years, while the respondents in 2015 and 2018 were asked to list the shocks that occurred in the time period between the last round of surveys. The most common shock households faced was a medical expense due to illness and injury, while major crop loss as a result of flooding was faced by about 2–3% of the respondents. Given the limited resources available to a majority of these households, the most common coping mechanism in response to shocks was found to be inaction, followed by resorting to taking loans or seeking help from others.

Table 7: List of Shocks and Coping Mechanisms (2011—2018)

	2011	**2015**	**2018**
Shock name	(percent of respondents)		
No effect negative shocks in this household	37.8	55.12	36.93
Medical expenses due to illness or injury	19.10	15.00	25.04
Loss of livestock due to death	3.95	3.12	3.31
Loss of income due to illness or injury of household member	3.48	3.90	3.08
Major loss of crops due to flood	2.74	2.08	2.38
Major loss of crops due to other reasons (drought, storms)	2.48	1.61	0.00
Other costs of wedding	2.12	3.15	1.07
Death of main earner	1.36	1.77	1.71
Death of other than main earner in the family	0.95	1.20	3.03
Lost home due to river erosion	0.70	0.37	0.34
Other	25.32	12.68	23.11
Total	100.00	100.00	100.00
Coping Mechanism	(percent of respondents)		
None	38.88	37.71	40.09
Took loan from Mahajan/non-institutional source	14.05	15.77	11.02
Took help from others	12.60	12.11	16.86
Took loan from NGO/institution	9.62	11.95	14.43
Ate less food to reduce expenses	3.72	3.43	2.37
Sold land	3.23	2.55	1.70
Mortgaged/leased land	3.19	3.07	1.34
Other	14.71	13.41	12.19
Total	100.00	100.00	100.00

Prior to examining the BIHS dataset, it was anticipated that migration would emerge as a coping mechanism, especially in light of climate shocks. However, migration is not identified as a prominent coping strategy for this sample. Upon analyzing this data, it becomes evident that migration is not a coping mechanism used within this population in the face of a climate shock. In fact, poor households in this sample would rather do nothing or utilize the resources they have around them than relocate to another area. Intuitively, this makes sense. The shocks faced in Bangladesh are still not exacerbated by climate change to a large enough extent that they occur frequently enough to cause widespread destruction every time. This contributes to the understanding that without ample resources, migration is not often a sound option for households, calling into question the impact of 'anchoring' factors over 'push' factors. While devastating climate shocks may leave individuals with no option but to move, regular climate shocks in Bangladesh have not grown severe enough to spur this reaction. This data alone rejects the first hypothesis that poor, rural communities may experience temporary migration as a strategy to maintain consumption levels. Before coming to this conclusion, one last variable was analyzed: the reason households cited for migration in a migration roster. Households in all three rounds were surveyed on members of the family that have migrated in the past five years for 2011, since the baseline survey and away for more than 6 months in 2015, and since the midline survey and away for more than 6 months in 2018. Their survey results are shown in Table 6.

Table 8: Reasons for Migration (2011—2018)

Reason for Migration	2011	2015	2018
	(percent of respondents)		
Employment	72.16	63.56	50.88
Education	8.18	8.19	12.34
Marriage	10.76	6.10	17.24
Escape war/violence	0.06	2.25	0.30
Escape drought/famine/disease	0.12	0.32	0.24
Others	8.72	19.58	19.00
Total	100.00	100.00	100.00
Total Responses	**1663**	**623**	**1653**

The prominence of pull factors, such as employment and education, appear to outweigh push factors, including fleeing war, violence, and disease, in migration decisions. Notably, climate shocks like flooding were not cited as reasons for migration across all three survey rounds. Consequently, the portion of the population compelled to migrate solely due to climate-related shocks is considered insignificant. Based on the findings of Tables 7 and 8, which indicate that migration is not utilized as a coping mechanism by this sample, this thesis shifted its focus from migration to income as the primary outcome, while retaining flooding as the independent variable. This decision stems from the assumption that if flooding, a covariate climate shock, significantly affects income over time, households may need to adopt coping strategies to address this shock. Although migration could serve as one of these coping mechanisms, its likelihood may increase if other means of mitigating the impact on income are ineffective. To examine this relationship, the isolated variables described throughout this section are employed in a differences-in-differences model.

Chapter 4

Differences-in-Differences Model

A differences-in-differences (DID) model is utilized to examine the effect of average flood depths on income over time, estimating the causal impact of flooding by comparing changes in income between the treatment and control groups. This methodology is considered optimal for understanding the influence of flooding on income because it isolates the effect flooding has on incomes before and after households experience flooding. The model is defined as:

$$income_{it} = \beta_0 + \beta_1 treat_i + \beta_2 post_t + \beta_3 (treat_i \times post_t) + \gamma_i + \varepsilon_{it}$$

where i represents a single household in the sample, t represents the year 2018, and γ_i represents the control variables utilized in the model.

In this model, $treat$ is a dummy variable that takes on a value of 1 if the household experiences flooding and 0 if not. The $post$ variable is also a dummy variable that takes on the value of 1 if the household was surveyed in 2018 and 0 otherwise. The interaction term, which captures the 'difference in differences' in the outcome variable, income, between the flooded and not flooded population over time is found through the interaction between $treat$ and $post$. The coefficient on the interaction term will explain the difference in income between the treatment and control groups before and after a flood event. It is important to note that this model operates under the assumption that the impacts of flooding are immediate and do not persist into the following survey rounds, given the relatively low average flood depths reported in the survey. Thus, it is reasonably assumed that a flood in 2011 will not influence income levels in 2018.

The control variables in this model are sex, age, marriage status, literacy status, area of work, average rice crop quantity damaged, and average rice crop quantity harvested. The sample

size was restricted based on which households completed all three rounds of survey. The regression analysis accounts for both the potential clustering of data within the households and household-specific characteristics that remain constant over time by adding clustered standard errors and household-level fixed effects. This model was clustered by household for two main reasons. Firstly, because flooding impacts households uniformly rather than individually, clustering can account for any correlated responses within the households to the treatment. Secondly, household members often share common characteristics, behaviors, and environments. Clustering at the household level can capture any commonalities or correlations in responses within the same household.

In order to employ a DID model, the data has to satisfy the parallel trends assumption. This assumption ensures that the income trends before 2015 are similar for both the treatment (flood) and control (no flood) groups. Average monthly income levels were chosen as the trend compared between the treatment and control groups, finding the average monthly income for the treatment group was 1,482.45 taka and 1,578.87 for the control group. A formal t-test was conducted to show whether or not this difference in income was statistically significant. Table 14, located in the appendix, displays the results of the t-test, confirming that the difference between the treatment group and control group is not significant. Therefore, the parallel trends assumption is likely satisfied.

4.1 Results

Table 9 describes the results of the DID model. Not only do these results offer that as flooding increases, income decreases, but also, and more specifically, the coefficient on the interaction variable suggests that an additional foot of flooding may contribute to a loss of 380.30 taka ($p<0.1$) in households that experience flooding in 2018. The $post$ coefficient is statistically significant at the 1% level and represents the change in income over time for both the flooded and not flooded households after flooding occurred.

Table 9: DID Estimation of the Effects of Average Flood Depths on Income

	$treat_i \times post_i$	$treat_i$	$post_t$
Income	-380.80*	202.12	1,610.13***
	(211.449)	(127.98)	(201.66)
Observations	7,117		
R-squared	0.1536		
Number of households	3,117		

Robust standard errors in parentheses
*** p<0.001, ** p<0.05, * p<0.1

Table 10 expands on the results in Table 9, by describing the covariates included in the model to mitigate omitted variable bias. The coefficient on sex, 977.15, is significant at the 1% level, indicating a clear income disparity between men and women in the sample. Based on the male-dominated summary statistics presented in Chapter 3, this finding is expected. While men in

rural Bangladesh usually work in occupations that bring in money for the family, women are housewives and tend to work at home. Additionally, the coefficient on age, 9.05, and the coefficient on area of work, 330.34, are significant at the 10% level, revealing the positive impact urban has on income. This finding makes logical sense, for wages in urban regions are usually higher than those in their rural counterparts. Lastly, this model produces a low R-squared value, which implies that the independent variables in the model do not explain much of the variability in income.

Table 10: DID Estimation — Covariates

	Sex	Age	Marriage status	Literacy status	Area of work	Average Harvest Damage	Average Harvest Quantity
Income	977.15***	9.05*	0.75	229.13	330.34*	-5.037	0.10
	(142.29)	(5.47)	(186.42)	(198.81)	(177.31)	(7.61)	(0.09)
Observations	7,117						
R-squared	0.1536						
Number of households	3,117						

Robust standard errors in parentheses
*** p<0.001, ** p<0.05, * p<0.1

Chapter 5

Discussion

This thesis reveals that in the aftermath of a climate shock, such as flooding, poor rural communities do not turn to temporary migration as a means to sustain consumption levels. Rather, in many instances, they do not adopt coping mechanisms in response to covariate shocks. The failure to adopt coping mechanisms may be because individuals see no need to adapt or may not have the resources available to them to implement said strategy. It is speculated that this decision may be attributed to 'anchoring' factors that keep individuals in their native regions this specific sample's low socioeconomic status. This thesis chose to analyze the impact of flooding on income, a 'push' factor of migration, to indirectly infer upon the relationship between flooding and migration. The underlying rationale was that if climate shocks significantly diminish income to a point where resources available within the region cannot aid recovery, households may then consider migration as a last coping mechanism.

A differences-in-differences (DID) approach was utilized to analyze the impact of flooding on income over time. The estimates suggest that an additional foot of flooding can reduce income by 380.80 taka ($p<0.1$). The model also predicts that sex, particularly being male, and area of work are associated with higher income. Although these results do not directly indicate an impact on migration, they contribute to the discussion on factors that may contribute to a migration decision. Since poor, agriculturally dependent households often lack opportunities for alternative income sources, in the face of a climate shock that causes substantial income loss, households or certain individuals may eventually resort to migration out of necessity.

In general, it is challenging to isolate migration as a coping mechanism in the status quo because climate shocks have not grown frequent or vast enough to permanently impact regions of Bangladesh. It is clear that while small shocks, such as recurring flooding, do tangibly impact income, it is not influential enough to trigger displacement. This may not hold for catastrophic natural disasters that eradicate existing infrastructure and, as a result, displaced households. In light of a calamity of that size, households may be left with no other choice but to migrate. However, the findings of this thesis do not directly support this claim.

Banerjee and Duflo (2019) contend that many people, regardless of any incentives or offers, will not choose to move. Migration remains a luxury that many individuals, especially the poor, cannot afford. This perceived lack of resources coupled with influential 'anchoring' factors stops individuals from migrating. Drastic covariate shocks, such as extreme natural disasters, may take the decision to migrate out of an individual's hands, for there may be no other option but to move. While this extreme 'push' factor was not evident in this analysis, as climate change worsens without effective intervention methods from governments and companies around the world, this may change. Consequently, further research should be conducted as climate change patterns solidify to find a strong, causal link between climate change and migration, if one exists. Over time, as this relationship becomes clearer, research in the field will become more conclusive and impactful and can be used to guide policy decisions to strengthen the most vulnerable regions of the world.

Appendix

Table 11: Average Flood Depths by Division (2011—2018)

Division	2011		2015		2018	
	Average Flood Depth (in feet)	**SD**	**Average Flood Depth (in feet)**	**SD**	**Average Flood Depth (in feet)**	**SD**
Barisal	2.28	1.35	2.16	1.48	2.05	1.26
Chittagong	2.24	1.88	2.63	1.78	2.64	1.64
Dhaka	1.90	2.17	2.41	2.98	2.25	2.76
Khulna	1.40	2.84	1.20	1.50	1.06	1.36
Rajshahi	1.02	1.50	1.57	2.17	1.55	2.19
Rangpur	1.77	1.57	1.55	1.89	1.76	1.82
Sylhet	2.27	1.98	3.63	3.77	4.43	4.83
Total Crop	**16,607**		**13,297**		**10,328**	

Table 12: Variable List

Variable Name	Variable Description
a01	Household number
a01crop	Merge variable
a01cropharvdup	Merge variable
a01mid	Merge variable
a01plot	Merge variable
avg_school year	Average years of schooling
avg_sum_income	Average income per household
b1_01	Sex of member
b1_02	Age of member
b1_03	Relation g to primary respondent
b1_04	Marital status of the member
b1_07	Literacy of the member
b1_08	Education (highest class passed) of member
b1_10	Current main occupation
b1_11	Do you work in rural/urban area?
crop	Crop code

c10	What was the daily wage/salary in cash?
c14	Monthly salary or average monthly income for self-employment
District	District (name and code)
g01	Plot type
g04	Usual flood depth (during monsoon/flood season)
g14	What was the main use of [plot] during the last growing season?
h2_10	Quantity harvested (kg)
h2_11	If partially harvested report quantity in field (kg)
i1_01	Quantity harvested (kg)
i1_09a	Quantity damage (kg)
i1_09b	Reason for damage
i1_10	Quantity sold (kg)
i1_13	Sale price (taka)
mean_g04	Average flood depth
mean_h2_10	Average quantity harvested (kg)
mean_i1_09a	Average quantity damage (kg)
mid	Member identification number
plotid	Plot id
post	1 if household was surveyed in 2018; 0 if otherwise
regnm	Region name from region data
rice	1 if rice; 0 if otherwise
sum_income	Total sum of household income
treat	1 if household flooded in 2015; 0 if otherwise
treat x post	DID interaction term
uncode	Union (name and code)
Upazila	Thana / Upazila (name and code)
year	Year of survey

Table 13: Coding for Education Level

Education Level	Code	Years of School
Reads in class I	0	0
Completed class I	1	1
Completed class II	2	2
Completed class III	3	3
Completed class IV	4	4
Completed class V	5	5
Completed class VI	6	6
Completed class VII	7	7
Completed class VIII	8	8
Completed class IX	9	9
SSC/ Dakhil	10	10
HSC/Alim	12	12
BA/BSC Pass/Fazil	14	15
BA/BSC Honours/Fazil	15	16
MA/MSC and above Kamil	16	17
SSC Candidate	22	10
HSC Candidate	33	12
Any class before Class I (General)	66	0
Mosque based child Class	67	0
Diploma Engineer	74	16
Never attended school	99	0

Table 14: Parallel Trends Assumption

	Average Income	Standard Error	CI	
Control	2,012.49	28.88	1955.88	2069.1
Treatment	2,073.14	244.42	2025.27	2121.01
Difference	-60.65	37.61	2009.8	2083
P-value	0.1068		-134.36	13.05

BIBLIOGRAPHY

Ahmed, A. (2013). *Bangladesh integrated household survey (BIHS) 2011-2012* [Data set]. https://doi.org/10.7910/DVN/OR6MHT

Ahsan R., Kellett J. and Karuppannan S. (2014). Climate-induced migration: lessons from Bangladesh. *The International Journal of Climate Change: Impacts and Responses, 5, 1-14.*

Backhaus, A., Martinez-Zarzoso, I., and Muris, C. (2015). Do climate variations explain bilateral migration? A gravity model analysis. *IZA Journal of Migration*, *4*(1), 3. https://doi.org/10.1186/s40176-014-0026-3

Banerjee, A. V., and Duflo, E. (2019). *Good economics for hard times.* Paperback edition. New York, PublicAffairs.

Beine, M., and Parsons, C. (2015). Climatic factors as determinants of international migration. *The Scandinavian Journal of Economics*, *117*(2), 723–767. https://doi.org/10.1111/sjoe.12098

Bernzen, A., Jenkins, J., and Braun, B. (2019). Climate change-induced migration in coastal Bangladesh? A critical assessment of migration drivers in rural households under economic and environmental stress. *Geosciences*, *9*(1), 51. https://doi.org/10.3390/geosciences9010051

Chowdhury, Md. A., Hasan, Md. K., Hasan, Md. R., and Younos, T. B. (2020). Climate change impacts and adaptations on health of Internally Displaced People (IDP): An exploratory study on coastal areas of Bangladesh. *Heliyon*, *6*(9), e05018. https://doi.org/10.1016/j.heliyon.2020.e05018

Clement, V., Rigaud, K. K., de Sherbinin, A., Jones, B., Adamo, S., Schewe, J., Sadiq, N., and Shabahat, E. (2021). *Groundswell Part 2: Acting on Internal Climate Migration.* http://hdl.handle.net/10986/36248

Coniglio, N. D., and Pesce, G. (2015). Climate variability and international migration: An empirical analysis. *Environment and Development Economics*, *20*(4), 434–468. https://doi.org/10.1017/S1355770X14000722

Drabo, A., and Mbaye, L. M. (2014). Natural disasters, migration and education: An empirical analysis in developing countries. *Environment and Development Economics*, *20*(6), 767—796. https://doi.org/10.1017/S1355770X14000606

Eckstein, D., Künzel, V., and Shäfer, L. (2021). Who suffers most from extreme weather events? Weather-Related Loss Events in 2019 and 2000-2019. *Germanwatch*, *13*. https://www.germanwatch.org/en/cri

Gray, C. L., and Mueller, V. (2012). Natural disasters and population mobility in Bangladesh. *Proceedings of the National Academy of Sciences*, *109*(16), 6000–6005. https://doi.org/10.1073/pnas.1115944109

Gröschl, J., and Steinwachs, T. (2017). Do natural hazards cause international migration? *CESifo Economic Studies*, *63*(4), 445–480. https://doi.org/10.1093/cesifo/ifx005

Internal Displacement Monitoring Centre (IDMC). (2022). *Bangladesh*. https://www.internal-displacement.org/countries/bangladesh/

International Food Policy Research Institute (IFPRI). (2016). *Bangladesh integrated household survey (BIHS) 2015* [Data set]. https://doi.org/10.7910/DVN/BXSYEL

International Food Policy Research Institute (IFPRI). (2020). *Bangladesh integrated household survey (BIHS) 2018-2019* [Data set]. https://doi.org/10.7910/DVN/NXKLZJ

Ishtiaque, A., and Ullah, S. (2013). The influence of factors of migration on the migration status of rural-urban migrants in Dhaka, Bangladesh. *HUMAN GEOGRAPHIES – Journal of Studies and Research in Human Geography*, *7*(2), 45–52. https://doi.org/10.5719/hgeo.2013.72.45

Kniveton, D., Schmidt-Verkerk, K., Smith, C., and Black, R. (2008). Climate change and migration. *IOM Migration Research Series,* 29–36. https://doi.org/10.18356/7b12d19b-en

McPherson, P. (2015). Dhaka: The city where climate refugees are already a reality. *The Guardian*. https://www.theguardian.com/cities/2015/dec/01/dhaka-city-climate-refugees-reality

Piguet, E., Pécoud, A., and de Guchteneire, P. (2011). Migration and climate change: An overview. *Refugee Survey Quarterly*, *30*(3), 1–23. https://doi.org/10.1093/rsq/hdr006

Reuveny, R., and Moore, W. H. (2009). Does environmental degradation influence migration? Emigration to developed countries in the late 1980s and 1990s. *Social Science Quarterly*, *90*(3), 461–479. https://doi.org/10.1111/j.1540-6237.2009.00569.x

Wesselbaum, D., & Aburn, A. (2019). Gone with the wind: International migration. *Global and Planetary Change*, *178*, 96–109. https://doi.org/10.1016/j.gloplacha.2019.04.008

World Bank. (2022). *Urgent climate action crucial for Bangladesh to sustain strong growth*. https://www.worldbank.org/en/news/press-release/2022/10/31/urgent-climate-action-crucial-for-bangladesh-to-sustain-strong-growth

World Health Organization. (2022). *Focus on capacity building at WHO's global school on refugee and migrant health in Dhaka*. WHO Regional Office for South-East Asia. https://www.who.int/news/item/28-11-2022-focus-on-capacity-building-at-who-s-global-school-on-refugee-and-migrant-health-in-dhaka

United Nations Population Fund (UNFPA). (2016). *Urbanization and migration in Bangladesh*. https://bangladesh.unfpa.org/en/publications/urbanization-and-migration-bangladesh

United Nations Environment Programme. (2007). *Proceedings of the governing council/global ministerial environment forum at its twenty-fourth session*. https://wedocs.unep.org/20.500.11822/10624.

Zami, M. T. (2023). *Bangladesh confronts growing threat of warming-driven floods*. Context. https://www.context.news/climate-risks/bangladesh-confronts-growing-threat-of-warming-driven-floods

ACADEMIC VITA

ANIKA SINHA

EDUCATION

The Pennsylvania State University | Schreyer Honors College — **University Park, PA**
College of the Liberal Arts | B.S. in Economics and B.S. in Psychology and Minor in Business — *Class of 2024*
Smeal College of Business | Smeal College Business Fundamentals Certificate

RELEVANT EXPERIENCE

PricewaterhouseCoopers LLP — **New York, NY**
Management Consulting Intern | Workforce Transformation – Rewards & Wellbeing — *June 2023 – Aug 2023*
- Balanced 3-5 projects and deadlines at a time by communicating and prioritizing client work while setting expectations with team members, managers, and peers and gaining exposure to PwC payroll, compensation, and financial wellness clients and services
- Supported Rewards & Wellbeing team by building out a matrix and templates for the client's union payroll team to utilize and implement and performed a payment audit to streamline their union payroll system, confirming payments are accurate and timely

Stifel Financial Corp. — **Pittsburgh, PA**
Wealth Management Intern — *May 2022 – Aug 2022*
- Piloted data transfer from Stifel's customer relationship management database to Salesforce by acting as a liaison between advisors and internal salesforce team ultimately ensuring a smooth transition in client and advisor experience
- Analyzed financial advisor's adaptations to client portfolios considering volatile economic climate and prepared reports in Money Guide Pro and Morningstar Research to track financial plan viability

Business Career Center — **University Park, PA**
Career Service Intern — *Aug 2022 – Present*
- Provide advice to around 10 students a week on resume reviews, mock interviews, and cover letter training for successful recruiting
- Selected as student representative to speak on panels for company recruiters, providing insight on the student recruiting experience
- Present to first-year student classes on how to create and develop resumes, conduct job searches on university specific websites and resources such as Nittany Lion Careers, and get involved on campus to cultivate a well-rounded experience at Penn State

Tierney Education — **State College, PA**
Tutor — *Aug 2023 – Present*
- Tailor session plans around student needs and class assignments, building a comprehensive plan outside the classroom
- Foster a supportive and encouraging learning environment by understanding student's strengths and weaknesses and helping them leverage their capabilities while tackling areas of improvement

LEADERSHIP & INVOLVEMENT

Alpha Kappa Psi Co-Ed Professional Business Fraternity — **University Park, PA**
Primary THON Chair — *April 2022 – April 2023*
- Increased Alpha Kappa Psi's previous fundraising total by 39% to $77,191 by organizing alternative fundraisers, communicating with companies and alumni, and igniting passion within the brotherhood, making the fraternity a 'Top 5 General Organization'
- Oversaw all logistics leading up to and during THON weekend, a 46-hour dance marathon, through creating a detailed calendar, relaying information from THON liaisons to the brotherhood, and managing financial and personnel data on various databases

Public Relations Chair — *Oct 2021 – April 2022*
- Supervised social media accounts, created content to promote the fraternity, and spearheaded a national social media advertisement campaign for the Gamma Epsilon chapter to attract new potential brothers

Epsilon Sigma Alpha Service Organization — **University Park, PA**
Standards Chair — *Jan 2022 – Dec 2022*
- Influence the sisterhood to uphold all academic, social, and philanthropic values to the highest standard while exemplifying these principles as one of the faces of the organization internally and externally to the Penn State community, at large

Vice President — *Jan 2021 – Dec 2021*
- Served on 5-person executive board for sisterhood of 168, organizing monthly meetings discussing upcoming service opportunities, managing relationships with other organizations and Penn State representatives, and acting as a point of contact for the organization

Schreyer Honors College — **University Park, PA**
Schreyer Ambassador — *Aug 2021 – May 2023*
- Represent the College by attending alumni and donor events, providing campus tours, and meeting with visiting families
- Guided 250 incoming second and third-year Scholars in transitioning to the honors college acting as a point of contact when navigating through honors courses, workload, and activities

HONORS, SKILLS & INTERESTS

Honors: Academic Excellence Scholarship, Deans List (7/7), International Baccalaureate Diploma Recipient
Skills: Microsoft Office: Word & PowerPoint, Fluent in Bengali, STATA, Bloomberg Market Concepts
Interests: Bharatanatyam, Field Hockey, Fireworks, Indian and Venezuelan Cuisines, Lana del Rey, Public Forum Debate, Sunsets