Climate, Culture, and History

Essays in Development Economics

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Essays in Development Economics

Steve Berggreen-Clausen

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Climate, Culture, and History

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Essays in Development Economics

by Steve Berggreen-Clausen

LUND UNIVERSITY

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Abstract
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In the first chapter, we study the effect of waterborne disease risk on children's health and learning in Tanzania. Using a hydrological model to simulate stagnant water occurrence and a difference-in-differences approach, we find that stagnant water increases the probability of diarrhea among young children, and reduces test scores among school-going children. The effect is primarily driven by urban households that lack access to safe water and sanitation. We find that climate change may have a dramatic impact on the future disease burden. Fortunately, our results suggest that policymakers can mitigate this risk by optimally targeting water and sanitation investments.

The second chapter aims to improve our understanding of how poor rural households cope with climate risks. I identify a new variable that drives rural households' financial coping strategies: climate instability, defined as the average difference in yearly climate conditions. Using novel global data on financial decision-making, I find that exposure to climate instability increases both saving and credit uptake. This is driven primarily by unskilled rural households, and saving is deliberately precautionary, reducing the threat of future food shortages.

In the third chapter, we examine the effect of traditional kinship norms on parental investment in children's human capital, focusing on the two predominant types: patrilineal and matrilineal systems. Using detailed survey data on parental investment behavior from Tanzania and a fuzzy spatial regression discontinuity design, we find that matrilineal parents devote less time and attention to their children's learning. Matrilineal children exhibit lower cognitive skills, as captured by standardized test scores. Exploring mechanisms, we find that matrilineal spouses experience more conflict and family instability, cooperate less, and experience different labor market conditions. Lastly, we find that a nation-building reform did not counteract the influence of traditional norms.

In the fourth chapter, we revisit the effect of the slave trade on mistrust in Africa. We show that the slave trade led to a culture of mistrust only in those societies where ancestral slavery was present. Furthermore, in societies with greater exposure to preexisting slave markets, and where slave labor was more common, the effect on mistrust is greater. We shed more light on the mechanism by showing that the proportion of child slaves – a proxy for the likelihood of being kidnapped into slavery – was higher in areas that were more integrated into preexisting slave markets.

Key words
Waterborne Diseases, Sanitation, Test Scores, Child Health, Human Capital, Climate Instability, Climate Change, Saving, Kinship Norms, Human Capital, Parental Investment, Slavery, Mistrust

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MADE IN SWEDEN

To Sepideh, Freya, and Kian

Contents

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Acknowledgements

C'est le temps que tu as perdu pour ta rose qui fait ta rose si importante.[1]
— Antoine de Saint-Exupéry

What better captures the feeling of completing a PhD thesis? This quote also reflects the classical endogeneity problem and the concept of fixed preferences. We tend to focus on people's inherent interest in a field of study, but less on how immersion in that field shapes one's passion and identity over time. Economics, much like coffee, is, I believe, an acquired taste. One of the first pieces of advice my supervisor Gunes gave me was: "A PhD is a marathon, not a sprint" and in retrospect, I can only agree.

Here are a few things to know about Gunes: he likes development economics, basketball, and fine dining, and he is very patient – but even he has his limits.[2] Thank you for your wisdom, and for always managing to strike a balance between encouraging pep talks and honest down-to-earth advice. Co-authoring with you has been an incredible experience that has opened up the doors to research for me. You have guided me through the entire research process since day one – from brainstorming ideas and research designs to journal submissions and dealing with peer reviews. I could not imagine doing this journey alone, and I hope that we are only at the beginning.

When I started the PhD, I never imagined I would end up writing three papers on Tanzania. Who better to team up with than Therese, the leading Tanzania expert at the department? Apart from being a wonderful supervisor, you are one of the kindest economists I know. You have turned asking brilliant questions in the nicest way possible into an art form, all while sharply narrowing down research to its essential parts. I have tried to learn both from your explicit advice and from observing how you work. Your ability to produce papers, organize conferences, mentor us, and coach us on the job market is remarkable. If I manage to accomplish a fifth of your achievements so far, I will retire happily.

[1] *It's the time you spent on your rose that makes your rose so important.*

[2] Understand that Gunes had to deal with my scattered ramblings on how Vikings may have shaped feudal institutions in England, to how the foraging behavior of primates may explain seemingly irrational time preferences in humans.

I am deeply indebted to both of you for your support and mentorship over these years and consider you not only as my role models but also as my dear friends. I look forward to future collaborations!

It took me 13 years of civil engineering before realizing that: hey, wouldn't pursuing a PhD in *economics* be a great idea? I want to thank my family: Mom, Dad, and my sister Celine, for your love and support through all my endeavours. The upbringing you provided me with sparked my interest in science, but I blame my dad for my interest in the *social* sciences ever since he introduced me to the epic *Foundation* sci-fi series.[3] The fictional social scientists in its universe had to wrestle with concepts in modern economics, such as general equilibrium effects, the "Lucas critique", and the central role of technology in long-term growth.

My path to the PhD began in 2014 with a Master's program in Economics. However, my daughter, curious like her brother, decided to join this world two months early. Thus, I spent my first economics study session in a neonatal care unit, revisiting linear algebra with Freya in my arms. To (liberally) paraphrase Mike Tyson: everyone has a plan until they get a kid in their life! Yet, I would never have made it to, nor through, the PhD program in Lund without the support of my wife, Sepideh, and my children, Freya and Kian. Sepideh, thank you for always being by my side, from bouncing ideas to seminar rehearsals and interview practice. For the past decade, you have encouraged me to pursue my passion and made countless sacrifices along the way. I hope that I someday will be able to return all the support you have given me. Freya and Kian, thank you for reminding me every day what truly matters in life. You all mean the world to me.

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Special thanks to my cohort: Prakriti, Emelie, Yousef, and Albert, for having each other's backs through exams, ROAs, and thesis defenses. Having outside options from my previous career was a liability, and you guys cheered me up during my motivational

[3] Yes, I finally admit it: I am a PhD student and a huge nerd. What are the odds?

dip in the first semester, for which I will always be grateful.[4] Prakriti, you're the best roommate I could have wished for: quick-witted, observant, contagiously enthusiastic, and with a great sense of humor. Albert, despite your talent for dynamic optimization you went all-in on empirical research, and I hope we will be co-authors one day. Yousef, you set the bar high from day one, from exams to writing papers, and that was inspirational. Emelie, you became a parent midway through the PhD and got to showcase your elite multitasking skills, and you have remained as ambitious and cheerful as when I first met you.

I am also grateful to the many other PhD students I've had the privilege of getting to know. Thank you Linn, for being an awesome co-author. Matthew, for your excellent and sharp feedback. Devon, for being the supportive and warm person that you are. Teppo, our interests overlap so much and I hope we'll write a paper together someday! Negar, for your kind words and self-deprecating humor. James and Demid, for fun times and hangouts. Marcus, for brightening the mood every time you pop by our office. Adrian, for the spill-over effects from your research productivity and running advice. Thank you everyone else for a fantastic time: August, Christina, Danial, David S, David W, Hugo, Iker, Ioannis, Jonas, Kajsa, Ludvig, Lukas, Madeleine, Marco, Maxime, Najmeh, Natalie, Olga, Ovidijus, Qianyan, Pelle, Ruben, Sandra, Shayan, Tilman, Wenting, Yunyi, and Yuqing. I will remember you all.

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Thanks to Dag, Åsa, Thomas, Talina, Marcus, and Madeleine for the collaboration in teaching finance. I recall putting finance dead last on my teaching wishlist in my first year. Ironically, I ended up teaching it every semester, but I have actually grown to enjoy it! When you tell people you're an economist, they often ask for stock advice. My standard answer having taught these courses – buy an index fund and stay in the market – never fails to disappoint.

I would like to acknowledge the generous support provided by the Jan Wallander and Tom Hedelius Foundation, which made my research visit to London School of Economics possible. Thank you Olmo Silva, Noam Yuchtman, and Henry Overman, for your mentorship and support at LSE. You welcomed me into your community and provided opportunities to present my work to leading scholars in my field. Thanks to Mathieu Couttenier and Sophie Hatte for hosting my visit to ENS Lyon.

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[4] People sometimes brag about their CV of failures, so let me contribute: I was the only one in our cohort who failed the first exam, which led me to doubt whether I had made the right decision returning to school.

I am grateful to Anna Tompsett, along with your colleagues Hannah Druckenmiller, Andreas Madestam, and Solomon Hsiang for believing in me, and for your enthusiasm in my work. Thanks Akib for a great co-author experience, seeing you in Stockholm this fall will be a blast!

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I dedicate this thesis to my family. In times when I forget to express my love for you, let this be my testament.

Steve Berggreen-Clausen
Lund, August 2024

[5] I learned through implicit peer feedback that you need more ingredients than just oats, whey protein, and water to make tasty cookies.

Introduction

Introduction

The evolution of modern development economics

Why are some countries rich, and some poor? This has been one of the leading questions in Economics since the discipline was born, following Adam Smith's *The Wealth of Nations* (Smith, 1776), and is arguably the central question in the subfield of development economics. If we had a satisfactory answer, this thesis would not exist.

Development economics sprung from the insight that the economic policies designed for already-industrialized countries may not necessarily be optimal for poor, non-industrialized countries (Nurkse, 1953; Mandelbaum, 1945). Instead, developing countries tend to face widely different economic, social, and institutional conditions, such as weaker states, a missing formal credit market, and a greater reliance on kin networks instead of formal institutions (Ray, 1998). In the subsequent decades, development economists took a *macro*-approach, focusing on teasing out relationships between country-level GDP and other aggregate measures in order to inform optimal growth policy at the country-level (Levine and Zervos, 1993; Durlauf, 2009).

However, with the onset of the "*credibility revolution*", focusing on the importance of causal identification using novel microeconometric approaches (Angrist and Pischke, 2010), much of empirical economics turned to using novel rich data sources measured at the individual level, combined with rigorous quasi-experimental methods.[6] This has been especially prominent in development economics, which has seen a similar development with the "*the experimental approach to development economics*" (Banerjee and Duflo, 2009), based on using randomized field trials to evaluate aid policy (e.g. Miguel and Kremer, 2004a; Duflo et al., 2008; Banerjee et al., 2015).[7] In the absence of an actual randomized experiment, the experimental approach recommends relying on *natural experiments*, where historical circumstances happen to resemble the setting of a randomized trial (Banerjee, 2007). This is the methodology employed

[6] See e.g. Angrist et al. (1996) and Card and Krueger (1994) for some of the early seminal work, leading to the 2021 Nobel Memorial Prize in Economic Sciences.

[7] This development resulted in its own Nobel Memorial Prize in 2018.

throughout this thesis.

There are at least two ways to reconcile recent macro- and micro-approaches in development economics. First, both emphasize a shift towards evaluating and informing effective policy-making, whereas historically, the micro approach was more focused on theory (Rodrik, 2008). Second, the wealth of a nation ultimately depends on the sum of each individual's productive abilities. Arguably, a country with a healthier and more educated population will also become more productive, all things equal. Much like developing countries may need a different set of macro policies, optimal policy targeting households and local communities may look very different in poor locations, and may include unique and context-dependent policies such as conditional cash transfers, microfinance interventions, and a greater focus on cost-effective health and education policies (Banerjee and Duflo, 2011).

A central theme of this thesis is a microeconometric approach to development economics, focusing on the importance of context-specific conditions and quasi-experimental methods, with outcomes spanning health, education, financial well-being, and trust.

Using this approach, the thesis explores two broad areas in development economics: how geography and climate affect development through health, learning and financial decision-making, and how culture and history affect development through their impact on human and social capital.

Geography, climate, and development

The first two chapters examine the role of geography and climate in development. These factors are pivotal to development, influencing natural resource endowments (Engerman and Sokoloff, 2002; Sachs and Warner, 1995), trade accessibility (Frankel and Romer, 1999; Gallup et al., 1999), and the disease environment, particularly the risk of malaria (Gallup et al., 1999; Easterly and Levine, 2003; Gallup and Sachs, 2000).

Notably, the difference in disease environment between low- and high-income countries is not limited to malaria alone. The second most debilitating type of disease in low-income countries is waterborne diseases, which in fact is greater in both incidence and total mortality burden than malaria (Murray et al., 2020). Yet, it has received little attention in the development literature. There are likely two major explanations why waterborne diseases are so debilitating in developing countries. First, sanitation and water, in addition to the general health status of the population, tend to be underdeveloped and are major contributors to ill health and disease (Prüss-Üstün et al., 2004). Second, tropical weather is inherently favorable to waterborne pathogens which thrive in warm environments and spread through floods and intense rainfall (Levy et al., 2016).

In the first chapter, we evaluate the effect of exposure to stagnant water – an important trigger of waterborne diseases – on children's health and learning in Tanzania. Us-

ing a difference-in-differences strategy, we find that stagnant water exposure primarily affects children's health through an increase in diarrhea symptoms. Moreover, stagnant water negatively impacts school-going children's educational performance. Given the importance of human capital for growth (Hanushek and Woessmann, 2012), and the negative impact of stagnant water in a developing country like Tanzania, we show how geography can have a *direct* effect on development.[8]

The most salient effect of climate on poor households is perhaps through its effect on income and food security during devastating droughts. Most rural households in low-income countries rely on rainfed agriculture (Bruinsma, 2017) and tend to be heavily credit-constrained, which means that their main source of income and food security are tied to sporadic weather shocks. For this reason, the optimal saving strategy for these households is some form of precautionary saving (Deaton, 1989), which necessarily differs from the optimal saving strategies of wealthier households. Yet, we still know little about the extent to which rural households adapt to cope with this climate uncertainty (Paxson, 1992).

In the second chapter, I look at how exposure to one measure of climate uncertainty – climate instability – affects households' financial coping strategies. I define climate instability as the average year-to-year shift in climate conditions over a 5-year window. I find that experiencing climate instability leads rural households to save more, specifically for precautionary reasons, and increases credit uptake. This is completely driven by rural households with low education. Interestingly, I find that recent climate instability predicts future changes in climate regimes and increases the likelihood of drought in the following year. Therefore, while the increase in saving is driven by subjective climate experience, it can be considered a rational adaptation.

One of the most pressing issues facing the climate today is the rapid change driven by global warming. While climate change is usually measured by differences in mean temperature, most of the negative impact on poor households will likely come from a greater risk of tail events, such as droughts, heatwaves, and floods.

In the first chapter, we find that climate change may dramatically increase the burden of waterborne diseases. This is because temperature moderates the negative impact of stagnant water on health and learning, with higher temperatures increasing the magnitude of the effect. In combination with this, warmer weather will also increase rainfall variability and flood risk (Ayugi et al., 2021), leading to a greater frequency of stagnant water events. Since the increases in magnitude and frequency from climate change are co-dependent, this has a multiplicative effect on the future burden of stagnant water, which increases exponentially with a warmer climate.

In the second chapter, the treatment variable, *climate instability*, is also heavily dependent on climate variability, specifically the joint variability in precipitation and evaporation. With tail events increasing in frequency, climate will also become more unstable, increasing the risk of droughts and food shortages. To effectively guide

[8] A large literature, discussed in the next section, has argued that geography has only a limited direct effect on development, and matters primarily through its effect on institutions.

climate adaptation policy, it is crucial to understand to what degree rural households themselves already adapt to changes in climate. Although it is encouraging that rural households are adapting to climate instability, additional efforts are necessary to ensure that vulnerable households gain improved access to financial services in the coming decades.

Culture, history, and development

The third and fourth chapter focus on how culture and history shape development. Contrary to the literature on geography and development, a different body of literature argues for the primacy of institutions (North, 1990; Acemoglu et al., 2005), and that geography matters primarily because of its effect on institutions (Acemoglu et al., 2001; Engerman and Sokoloff, 2002). Acemoglu et al. (2001) find that countries with high historical settler mortality are poorer today. They argue that this is because in less hospitable locations, Europeans would be more incentivized to establish extractive rather than inclusive institutions. However, equally true is that European settlers not only established institutions, but also brought their own human capital (Glaeser et al., 2004), as well as their culture, which is endogenous to their institutions (Nunn, 2012; Easterly and Levine, 2016). Similar to institutions, facets of culture such as values, beliefs, and practices tend to evolve slowly over time and are subject to selective pressure based on historical events and geographical heterogeneity (Boyd and Richerson, 2005). These cultural elements also matter for development. For example, historical plough use has been linked to gender inequality (Alesina et al., 2013a), while the historical practice of religion has been shown to lead to greater human capital on the one hand (Becker and Woessmann, 2009; Valencia Caicedo, 2019), and more autocratic institutions on the other (Bentzen and Gokmen, 2023).

One striking cultural difference between low- and high-income countries is the reliance on kin networks for economic support and social security, which strongly correlates with lower economic development (Bahrami-Rad et al., 2022). One reason behind historically weak kinship ties in Europe, besides stronger states and higher levels of development, is that the Catholic church dissolved clan-based kin networks in Europe, contributing to more participatory institutions (Schulz, 2022). However, we know less about the differences *between* kinship systems.

The two most dominant types of traditional kinship systems are patrilineal and matrilineal. In the patrilineal system, children trace their lineage through their father, whereas in matrilineal systems they trace it through their mother. However, there is one important asymmetry: because of both systems' patriarchal nature, in matrilineal systems, it is the maternal uncle rather than the biological mother who is the traditional provider. This may lead to inefficiencies in parental investment and dual loyalties when it comes to the role of the maternal uncle, compared to patrilineal systems, where the father is the designated provider. In anthropology, this is known as the "matrilineal puzzle" (Fox, 1983). While historically this may have been beneficial in areas that required more female agricultural labor (Tene, 2021),

recent field experiments show that matrilineal societies have less spousal cooperation (Lowes, 2022).

In the third chapter, we build on the literature on culture and human capital by showing that matrilineal parents invest less in their children's education, and their children in turn face worse learning outcomes than patrilineal children. We find that matrilineal parents also experience more conflict, family instability, and face different labor market conditions, which may help explain why they invest less in their children's education.

Another important facet of culture is social capital, often measured through levels of trust. Trust is recognized as a key driver of economic development (Algan and Cahuc, 2010; Greif, 1993; Guiso et al., 2006; Tabellini, 2010), and can also be shaped by historical events. Nunn and Wantchekon (2011) show that the European slave trade in Africa led to a culture of mistrust, that still persists today, among those ethnicities most exposed to the slave trade. This can potentially help to explain the persistent negative legacy of the European slave trade on African development (Nunn, 2008). However, indigenous slavery has also been shown to have an independent negative effect on development (Bezemer et al., 2014), and the implications of indigenous slavery on mistrust today is not explored in Nunn and Wantchekon (2011).

In the fourth chapter, we revisit the relationship between the European slave trade, indigenous slavery, and trust in Africa. We find that it is the interaction between the two slave systems that leads to mistrust today. Only in places where indigenous slavery was observed did the European slave trade lead to mistrust. To establish a direction of causality, we show that the negative effect of the European slave trade is driven by predetermined factors associated with slavery, such as distance to Saharan trade routes and agricultural suitability. Furthermore, we provide evidence for the mechanism, by showing that kidnapping became a more common manner of enslavement in areas historically more exposed to indigenous slavery. By providing evidence on the mechanism, and detailing historical interviews together with contemporary oral testimonies, we help "decompress" the historical link between the slave trade and mistrust today, and thereby complement evidence from historical persistence studies (Abad et al., 2021; Malik et al., 2021).

Summary and contributions of the thesis

This section provides detailed summaries of the chapters contained in this thesis, and their respective contributions.

Chapter I: The Curse of Bad Geography: Stagnant Water, Diseases, and Children's Human Capital

Waterborne diseases rank as the second most common type of disease in the world and lead to more than 6 billion diarrheal episodes per year (Murray et al., 2020), with most of the health burden falling on children in low-income countries (Prüss et al., 2002). Despite their high prevalence, and the evidence on the long-term impact of childhood health shocks (Currie and Almond, 2011), we have limited knowledge of the consequences of childhood exposure to waterborne diseases. This chapter aims to evaluate the effect of exposure to one important risk factor of waterborne diseases – stagnant water – on child health and cognitive skills.

Waterborne diseases spread through physical contact with pathogen-contaminated food or water that infect the gastrointestinal system. Stagnant water enables the spread of waterborne pathogens through the fecal-oral route, and is hence a key risk factor of waterborne diseases (Bridle, 2021), especially in areas with low access to safe sanitation (Prüss-Üstün et al., 2004). We develop a novel method to predict stagnant water shocks based on established hydrological engineering principles. Using variation in rainfall, evaporation, topography, and soil infiltration from high-resolution satellite data, we simulate surface water flow over 90 m grid cells across mainland Tanzania over the period 2010-2017. The treatment variable, *Waterborne Disease Potential* (WDP), is defined as the share of the local area covered by stagnant water in the 8 weeks prior to the survey date.

To estimate a causal effect of WDP on children's health and learning we use repeated cross-sectional household survey data and a difference-in-differences identification strategy. For health outcomes, we use the Demographic and Health Surveys, specifically three waves of georeferenced data from 1999, 2010 and 2015, with which we estimate effects on short-run health symptoms, such as diarrhea and fever, for children aged 0-5 years. For learning outcomes, we use data from the Uwezo surveys that provide standardised test scores for school children near annually 2011-2017.

We find that a 10 percentage point increase in WDP leads to a 30% increase in diarrhea incidence, but find no effects on other health outcomes, which suggests that the negative impact of stagnant water is not due to other confounding diseases, such as malaria. Consistent with this, we find that access to high-quality sanitation and improved water sources mitigates most of the effect. Effects are larger in warmer and more densely populated locations, suggesting that the disease burden is likely to increase with climate change and population growth. Lastly, we find no evidence that exposure to stagnant water increases awareness of how to mitigate waterborne diseases.

On learning, we find that exposure to a 10 percentage point increase in WDP over the past two months reduces average test scores by 7% of a standard deviation. This masks considerable heterogeneity, however: effect sizes are approximately twice as high in urban compared to rural environments, consistent with our findings for

diarrhea. The negative effect on learning is robust to heterogeneous and dynamic treatment effects (de Chaisemartin and D'Haultfoeuille, 2022), and is not explained by other confounding factors such as malaria, the disruptive effects of floods, or child labour.

Lastly, using the latest climate projection data for East Africa (Ayugi et al., 2021), we estimate that 2°C of global warming may lead to a three-fold increase in the combined severity and frequency of stagnant water shocks, and consequently, waterborne disease outbreaks.

Our findings have several policy implications. First, stagnant water can be prevented by improved drainage and urban planning. Second, since awareness is low, stagnant water shocks may be mitigated by short-range forecasts, information campaigns, and targeted provision of medical supplies. Third, the methodology developed in this chapter can be used to target vulnerable areas for water- and sanitation investments.

This chapter contributes to the measurement of risk factors of waterborne diseases, complementing observational methods that rely on low-frequency satellite data (Pekel et al., 2016). By relying on stagnant water that is only partly determined by variation in rainfall, we are able to disentangle the effects of stagnant water from potentially confounding effects of weather, such as the impact of rainfall shocks (Sarsons, 2015; Mellon, 2022).

We further contribute to a large literature on early-life shocks and children's human capital (Maccini and Yang, 2009; Shah and Steinberg, 2017; Rosales-Rueda, 2018; Bleakley, 2007; Miguel and Kremer, 2004b), focusing on waterborne diseases, the second most debilitating type of disease in low-income countries. Moreover, we highlight the important role of sanitation quality in mitigating this risk, in contrast to recent RCTs which show at best mixed evidence for a positive effect of sanitation on health (Schmidt, 2015). This discrepancy may occur because the benefits of sanitation depend on the particular location's vulnerability to stagnant water. Furthermore, we contribute to a growing literature on climate change and public health (Carleton et al., 2022). Lastly, given the importance of cognitive skills for economic growth (Hanushek and Woessmann, 2012), this chapter contributes to a broad literature on the geographic determinants of development.[9]

Chapter II: Adapting to an Unstable Climate: Coping Strategies of Low-Income Rural Households

Rural households in low-income countries represent some of the world's most financially vulnerable individuals. Most of these households rely on rainfed agriculture (Bruinsma, 2017), which makes them exceptionally vulnerable to climate shocks such as droughts, and by extension climate change, which is expected to dramatically in-

[9] See the previous section "Geography, climate, and development" for a discussion of some of this literature.

crease rainfall volatility (Wasko et al., 2021). Poor rural households also tend to be financially excluded, with little access to formal banking, credit or insurance, to help smooth consumption during income shocks. Yet, we still know little about how exposure to climate uncertainty affects households' financial coping mechanisms, such as precautionary saving. For example, Paxson (1992) finds no effect of one climate uncertainty measure – rainfall variability – on precautionary saving, counter to her hypothesis climate uncertainty should encourage precautionary saving.

In this chapter, I introduce a novel measure of climate uncertainty – *climate instability* – that captures year-to-year shifts in climate conditions and show that this is an important predictor of households' financial coping strategies. First, I derive a model of consumption smoothing where income is derived from agricultural production. Because agricultural production depends on the climate, and future climate is uncertain, households must subjectively estimate the risk of a future income shock when deciding how much to save today. I argue that climate instability is better rooted in the behavioral literature on how exposure to recent events shape individual perceptions than alternative measures such as rainfall variability (Tversky and Kahneman, 1973; Bordalo et al., 2022).

In my main empirical analysis, I rely on large-scale household finance survey from the FinScope National Surveys for the main outcomes: whether a household saves, uses credit, or has insurance. Since this data is mostly cross-sectional, I use short-term deviations from long-term means to estimate exposure to climate instability. To generate the climate instability variable, I use the Standardized Precipitation Evapotranspiration Index (SPEI), which combines temperature and precipitation data to measure plant water availability (Vicente-Serrano et al., 2010). This measure has shown to be more effective in predicting agricultural production than rainfall or temperature alone (Kubik and Maurel, 2016). To validate this measure as a proxy of income, I first show that variation in the SPEI is an important predictor of agricultural production. Climate instability itself does not affect production, and is thus unlikely to affect saving through income effects. Because these fluctuations are as good as randomly assigned, I argue that this allows me to estimate the causal effect of climate instability on financial decisions. For robustness, I complement with additional data that allows me to use specifications with district and household fixed effects to control for unobserved heterogeneity.

I find that exposure to climate instability leads to more saving and credit uptake: A one standard deviation increase in climate instability leads to a 7% increase in saving. This is driven specifically by rural households with low levels of education. Households adapt to climate instability by increasing their savings propensity and uptake of credit in "good" (wet) years, and dissave in "bad" (dry) years. I find that exposure to climate instability, through its positive effects on precautionary savings, ultimately reduces the risk of food shortages, suggesting that the increase in savings propensity from exposure to climate instability may be welfare-increasing. Furthermore, exposure to climate instability is predictive of future shocks, which suggests that the saving response is a rational adaptation.

The main contribution of this chapter is the introduction of climate instability as an important predictor of saving and credit uptake among poor rural households, which may help explain why no effect is seen for alternative measures such as rainfall variability (Paxson, 1992; Abay et al., 2022). Arguably, this has important implications for households' ability to adapt to future climate change. Second, the novel FinScope data contains a rich set of financial inclusion variables and enables me to look explicitly at a key *ex-ante* consumption smoothing strategy: precautionary saving. Similar to Udry (1995), I find that households use precautionary saving in anticipation of a negative income shock in the near future. Third, this is to the best of my knowledge the largest study to date on how poor rural households cope with climate uncertainty through financial means, with the data covering 29 countries, 42 survey waves, and 223,000 individuals, over the period 2006-2022. Previous work has instead relied on smaller samples and individual countries, such as national panels (Fafchamps et al., 1998; Kazianga and Udry, 2006; Cole et al., 2013), or samples drawn from a small number of villages (Alem and Colmer, 2022; Udry, 1995). By using a global sample with rich heterogeneity across climate regimes and levels of development, I show that this is a universal phenomenon among poor rural households and not driven by any particular location.

Chapter III: Traditional Norms and Parental Investment in Human Capital

Parental investment is a key driver of human capital formation in children (Cunha and Heckman, 2008; Doepke et al., 2019; Francesconi and Heckman, 2016). However, parental investments vary widely between families which results in large observed inequalities in children's outcomes, especially in low-income countries (Attanasio et al., 2022b; Grantham-McGregor et al., 2007), To better understand inequality in human capital, understanding what shapes parental investment is crucial. An emerging literature proposes that parental preferences and beliefs play a key role in parental investment decisions. Yet, the origins of these preferences and beliefs remain poorly understood (Attanasio et al., 2022b).

This chapter aims to address this limitation by studying the effect of cultural norms on parents' investment in their children's human capital. Specifically, we focus on kinship norms –matrilineal versus patrilineal systems. In matrilineal kinship systems, lineage is traced through mothers, whereas in patrilineal systems, it is traced through fathers. Kinship norms form the backbone of societal organization in many developing countries (Radcliffe-Brown and Forde, 2015), dictating responsibilities within families, the extent of cooperation among family members, and the management of resources and production.

The literature suggests that matrilineal kinship norms, in contrast to patrilineal norms, are characterized by conflicting allegiances within couples (Fox, 1983), lower spousal cooperation (Douglas, 2013; Gluckman, 1963; Lowes, 2022), higher divorce rates and more extramarital affairs among couples (Loper, 2019), and greater employ-

ment in agriculture with limited returns on education (Tene, 2021). These factors can be detrimental to investment in children.

We examine the effect of matrilineal culture on parental investment in the context of Tanzania. Tanzania is intersected by the "matrilineal belt", a region comprising matrilineal societies stretching across south-central Africa. This implies that individuals from both matrilineal and patrilineal societies live in close proximity, often on opposite sides of the matrilineal belt border. This makes Tanzania an ideal setting for studying the effects of matrilineality on parental investment, allowing us to use the variation in kinship systems at this border in a fuzzy spatial regression discontinuity (RD) setup.

Our main analysis uses data from the Uwezo survey which collects detailed information on parental investment behavior and school-age children's education via large-scale household surveys. The data contain unique information both on monetary investment, such as sending children to private school, as well as non-monetary investment, such as checking children's homework. Another key feature is that all children in surveyed households are assessed using standardized tests, allowing us to estimate effects on learning.

To identify kinship norms, we use information on the language spoken in the household. We use the crosswalk by Giuliano and Nunn (2018) to assign each individual to an ethnicity as reported in the *Ethnographic Atlas* (Murdock, 1967). The *Atlas* contains information on traditional cultural practices, including kinship norms, allowing us to create an indicator for matrilineality. Employing a fuzzy spatial RD design, we instrument matrilineality with the indicator of residency on the matrilineal side of the border. Our main identifying assumption is that the likelihood of belonging to a matrilineal group jumps at the border, while all other determinants are continuous. We present evidence in favor of this assumption, showing that a range of geographic and cultural characteristics are balanced.

We find that matrilineal kinship norms reduce parental investment in children's education. This negative effect is consistent across all six measures of investment and is quantitatively important. This translates into lower levels of learning among matrilineal children, as reflected by their lower test scores. Our results are robust to accounting for households' socio-economic characteristics, controlling for geographic and ethnic factors, testing various bandwidth ranges, employing different specifications of the RD polynomial, and addressing spatial correlation.

Exploring mechanisms, we find that matrilineal couples exhibit more conflict, less cooperation, more extramarital affairs, divorce, and stepchildren, consistent with the literature (Lowes, 2022; Loper, 2019). Since these factors arguably affect parental investment capabilities this could partially explain the lower levels of educational investment we find. Matrilineal mothers in Tanzania also have lower educational attainment, a higher likelihood of employment outside the home, and a greater propensity to work in farming, consistent with Lowes (2022) and Tene (2021). Consequently, mothers with limited human capital may be in a disadvantageous position to invest

in their children, having less available time for their children, and fewer incentives to invest in education due to lower perceived returns.

Lastly, we evaluate the impact of a nation-building reform in the 1970s designed in part to challenge ethnic norms. Our findings reveal that this policy experiment, consisting of large-scale villagization across rural Tanzania, effectively did not counteract the influence of traditional norms.

This chapter relates to a literature on the role of parental influence in human capital development (Attanasio et al., 2020b,a, 2022b,a; Carneiro et al., 2021; Cunha and Heckman, 2008; Dahl and Lochner, 2012; Doepke et al., 2019; Francesconi and Heckman, 2016). This literature places significant emphasis on preferences and beliefs as key drivers behind investment decisions (Attanasio et al., 2022b,a). We contribute by demonstrating how cultural norms play a crucial role in shaping parental investment. A parallel literature in development economics examines the importance of culture for human capital formation (Ashraf et al., 2020; Bau, 2021; Collins, 2022; Figlio et al., 2019; La Ferrara and Milazzo, 2017). We contribute by documenting the relationship between cultural norms and the actions parents take when investing in their children's human capital. Moreover, we are able to capture effects on children's learning, an improvement over traditional measures such as years of schooling, which is only weakly related to learning in Sub-Saharan Africa (World Bank, 2017). Finally, this chapter relates to a broad literature exploring the relationship between traditional norms and various socio-economic outcomes (Alesina et al., 2013b; Becker, 2021; Gneezy et al., 2009; Jayachandran and Pande, 2017; La Ferrara, 2007; Lowes, 2022; Moscona et al., 2020; Rossi, 2019).

Chapter IV: Heterogeneous Effects of the Slave Trade on Mistrust in Africa

Trust is recognized as a key driver of economic development.[10] In a highly influential study, Nunn and Wantchekon (2011) find that the European slave trade had a negative legacy on African development by creating a culture of mistrust in Africa. Individuals belonging to ethnicities heavily impacted by the slave trade have lower levels of trust today for their relatives, neighbors, local government council, members of their own ethnic group, and individuals from other ethnic groups (Nunn and Wantchekon, 2011). We revisit the relationship between the slave trade and trust, and identify an important role of indigenous slavery in moderating the effect of the slave trade on trust.

Historical literature suggests that indigenous slavery systems played a role in facilitating export slavery, such as the Atlantic slave trade, and that the growth of the Atlantic slave trade also amplified indigenous slavery practices (Klein, 1978; Lovejoy, 2011, p. 21). Similar to export slavery (Nunn, 2008), indigenous slavery has also had a substantial negative effect on African development (Bezemer et al., 2014).

[10] E.g. Algan and Cahuc (2010); Greif (1993); Guiso et al. (2006); Tabellini (2010).

This warrants further examination of the interaction between ancestral slavery and the European slave trade. The deterioration in trust can be attributed to the fact that, as the slave trade progressed, it became increasingly common for individuals to be sold into slavery by those closest to them, including neighbors, friends, and even family members (Hair, 1965; Koelle et al., 1854; Nunn and Wantchekon, 2011; Piot, 1996), leading to positive selection pressure on a heuristic of mistrust. This mechanism may be compounded by local preexisting slavery practices that facilitated the sale of one's own relatives, friends, and neighbors to slave traders. Consequently, the Atlantic slave trade might have had differential effects depending on the extent of local slavery practices.

Employing individual trust outcomes from the Afrobarometer Survey and an ancestral slavery measure from the Ethnographic Atlas of Murdock (1965), our analysis reveals that the negative correlation between the slave trade and present-day mistrust is entirely driven by the interaction of the slave trade and ancestral slavery measures. Present-day mistrust emerges as a consequence of the slave trade solely within societies with ancestral slavery. Instead, in societies lacking ancestral slavery, the slave trade does not correlate with lower trust.

These findings align with two plausible interpretations. One perspective suggests that the slave trade might have precipitated the development of local indigenous slavery, subsequently leading to a decline in trust. Alternatively, mistrust may have surfaced as individuals turned against each other in the aftermath of the slave trade's impact, particularly in societies where slavery was prevalent. To shed more light on the direction of causality, we analyze heterogeneity by predetermined historical factors that are associated with indigenous slavery. First, we probe the role of the trans-Saharan trade routes, which facilitated slave trade more than a millennium before the Atlantic slave trade (Segal, 2002, p. 56). We find that the adverse impact of the slave trade on trust is observed only among ethnicities most exposed to the pre-existing ancient slave trade routes near the trans-Saharan trade routes. Second, we evaluate how malaria suitability drives the main correlations. Reilly (2015) argues that demand for malaria-resistant labor during the trans-Saharan trade was high due to endemic malaria in fertile wetlands on the Arabian Peninsula. We find that malaria suitability predicts ancestral slavery and also drives much of the negative effect of the slave trade on trust. Lastly, historical accounts reveal that chronic labor demand and centralized states were important drivers of African slavery prior to the Atlantic slave trade (Fenske, 2013, Klein, 2010, p. 8). We use share of cropland in 1500 CE and *cereal advantage* – the caloric productivity advantage of cereal crops over root crops – shown to predict early centralization (Mayshar et al., 2022). Again, we find that the effect on mistrust is greater for ethnicities who faced historically favorable conditions for indigenous slavery.

Lastly, we empirically assess the proposed mechanism in Nunn and Wantchekon (2011), that the risk of being kidnapped into slavery explains observed mistrust today. Using novel data from The Trans-Atlantic Slave Trade Database (2019) on the number of slave children exported at the port-year-voyage level, we find that as demand for African slave labor rose following the Atlantic slave trade, there was an increase

in the child slave ratio. However, this increase is mostly seen in the areas most exposed to preexisting slave markets, as measured by their proximity to Saharan trade nodes. This suggests that kidnapping may have become a more common manner of enslavement in these areas, thus shedding more light on the mechanism linking the Atlantic slave trade and indigenous slavery to mistrust today.

To our knowledge, this is the first systematic exploration of the influence of the complementarity between ancestral slavery and the European slave trade on the culture of mistrust in Africa. The existing literature on slavery has explored its effects on long-run development in Africa (Nunn, 2008; Whatley, 2022; Bezemer et al., 2014), industrialization in Britain (Eltis and Engerman, 2000), and productivity across U.S. states (Mitchener and McLean, 2003), among others. We add to this literature by shedding light on the complementarity between indigenous slavery and the slave trade. Lastly, we contribute to a recent literature focusing on replicability in economics (Brodeur et al., 2023; Duvendack et al., 2017; Hamermesh, 2017; List, 2023; Vilhuber, 2020).

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