Three essays in applied microeconomics with policy implications

by

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B.A., University of Ghana, 2012
MSc., University College London, 2014

AN ABSTRACT OF A DISSERTATION

submitted in partial fulfillment of the requirements for the degree

DOCTOR OF PHILOSOPHY

Department of Economics
College of Arts and Sciences

KANSAS STATE UNIVERSITY
Manhattan, Kansas

2024

Abstract

In this dissertation, I investigate three distinct topics in applied microeconomics that focus on human behavior and public policy.

In my first essay, I examine how colonial medical campaigns organized in Cameroon in West Africa impact COVID-19 vaccine hesitancy in neighboring Nigeria. Specifically, I study how distance from historical medical campaign sites in Cameroon affects the likelihood that Nigerians today would willingly accept a free, safe COVID-19 vaccine. I find that a 1000-kilometer increase in distance from colonial medical campaign sites is correlated with a 15.8 percentage point increase in the likelihood that Nigerians will accept a free safe vaccine. Examining potential transmission mechanisms reveals that my result can partially be explained by Nigerians' mistrust in their government, traditional, and religious authorities and institutions. This finding establishes persistent long-run spillover effects of colonial medical campaigns into neighboring countries.

My second essay examines how Project Hope, a maternal healthcare intervention in Cross Rivers State, Nigeria impacts the likelihood of ever attending antenatal care, attending antenatal care before 12 weeks' gestation and receiving blood pressure checks during pregnancy. Using data from the Nigerian Demographic and Health survey, I conduct a difference-in-differences analysis to estimate the before and after effects of Project Hope. I find that while Project Hope increases the likelihood of early antenatal care attendance before 12 weeks' gestation by 19.2 percentage points, it does not significantly impact the likelihood of receiving a blood pressure check or the likelihood of ever attending antenatal care. My findings establish that maternal healthcare interventions reduce barriers to accessing critical healthcare services during pregnancy and may improve outcomes for mothers and their babies.

My third essay isolates the effects of English language ability on female labor force participation in the United States using different samples of childhood female immigrants including those who are now married women and mothers. I use an instrumental variables model that interacts coming from a non-English speaking country with arriving in the US at a young age to identify the effect of English language proficiency on immigrants' labor force participation. Speaking English well leads to a 21-percentage point increase in the likelihood of future labor force participation for female childhood immigrants to the US, all else equal. My results hold steady for different categories of female immigrants and are largest for those women with young children at home. I also show that English language ability may be acting through increasing educational attainment to affect labor force participation for female immigrants.

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Dedication

To my dear husband, Sherif, and children- Menaal, Mehar-Jamal, and Kinal-Zayn and my parents Marjorie Martinson, Angela Martinson, and Ibrahim Adam Issaka:

Without your love and support, I wouldn’t be a Ph.D. holder today!

Thank you!

Chapter 1 - Historical spillovers from colonization to freedom: evidence from Nigeria's COVID-19 vaccination exercise

1.1 Introduction

Sub-Saharan Africa bears a significant portion of the global disease burden. According to the World Health Organization (WHO), malaria, HIV/AIDS, and tuberculosis claim about 3 million lives in that region each year. Childhood diseases including measles, hookworm, and schistosomiasis also claim hundreds of thousands of additional lives.[1] Despite government efforts to reduce the disease burden in the sub-region through vaccination, medical mistrust and vaccine hesitancy pose great threats to the eradication of these diseases. During the Ebola outbreak in West Africa in 2014, it was difficult for governments to contain the virus because people were not keen on taking the vaccines for prevention.[2] The peoples' belief in misinformation and lack of trust in public institutions frustrated government efforts in stemming the spread of the virus. As of July 2022, sub-Saharan Africa was behind the rest of the world in COVID-19 vaccination rates with just about 24.4 percent of the population being fully vaccinated.[3]

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[1] https://www.niaid.nih.gov/research/niaid-research-sub-saharan-africa#:~:text=The%20World%20Health%20Organization%20(WHO,of%20deaths%20and%20widespread%20suffering.

[2] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6936462/

[3] https://www.mckinsey.com/industries/healthcare/our-insights/a-data-driven-approach-to-addressing-covid-19-vaccine-uptake-in-africa

In the colonial era, Africa was plagued by several illnesses which posed a threat to human life on the continent including yaws, sleeping sickness, malaria, syphilis, and leprosy. Between the 1920s and the 1950s, the French colonial government set out to eradicate these ailments in its colonies (Cameroon and Central African Republic) by undertaking nationwide vaccine and treatment campaigns. As part of their strategy, they forced African patients to receive preventive vaccines and treatments sometimes at gunpoint. Many needles used in administering the vaccines were reused, increasing the chances of spreading infection. Additionally, the medications had some dubious side effects including gangrene, blindness, and death. For many colonies, the French medical campaigns constituted their first experience with the Western medical system and protocols.

I investigate the long-run, spillover effects of these medical campaigns on current vaccine hesitancy rates in neighboring areas of West Africa. Specifically, I measure the distance between French medical campaign sites in Cameroon and an individual's residence in neighboring country Nigeria and then estimate the impact of that distance on the individual's likelihood of COVID-19 vaccine acceptance. My main outcome variable is an individual's reported willingness to accept a free and safe COVID-19 vaccine provided by the government. These vaccines are effective in helping reduce disease, death, and inequality (Andre et al. 2007). Despite several international initiatives to make vaccines more accessible, uptake remains low. As at February 18, 2023, only 38.4% of the Nigerian population had received at least one dose of the COVID-19 vaccine[4], well below the levels required to achieve herd immunity[5]. My study hypothesizes that vaccine hesitancy reduces as distance from colonial campaign towns increases.

My analysis combines data from the World Bank's COVID-19 National Longitudinal Phone Survey, along with relevant Afrobarometer surveys, and location data from latlong.org, to create a novel dataset. I find a significant positive relationship between distance from colonial medical campaign sites and vaccine acceptance. A 1000-kilometer increase in distance from colonial medical campaign sites increases the likelihood of accepting the COVID-19 vaccine by 15.8 percentage points. Identification of my model relies on the assumption that individuals who are more or less vaccine hesitant do not select into cities in Nigeria based on proximity to the medical campaign sites. To support this assumption, I conduct a formal test of selection bias using the methods described in Oster (2019).

There are several reasons to suspect that colonial medical policies might have lingering effects as well as spillover effects. In Boateng-Ade's (2022) study of the embedded roots of colonialism in the current state of Ghana's healthcare system, she finds that Ghana's current dual healthcare system is partly due to colonial influences. Aikins (2013), Agwu et al. (2018), and Pheage (2016–2017) also find similar colonial influences on healthcare provision and access across Africa. Although Ethiopia and Liberia were never colonized, they experienced spillover effects from colonization. Both countries have similar education, religious, and institutional structures as their neighboring countries that were colonized.[6]

[4] https://coronavirus.jhu.edu/region/nigeria

[5] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9144560/

[6] https://africanarguments.org/2017/06/ethiopia-was-colonised/

I investigate potential mechanisms to examine whether mistrust in government, religious, and traditional authorities and institutions is driving the impact on vaccine acceptance. To do this, I construct a trust score that adds up and averages survey respondents' levels of trust in various authorities and institutions. I find a positive relationship between my computed trust score and vaccine acceptance and between my trust score and distance to colonial medical campaign sites. This result suggests that distance increases vaccine acceptance by increasing trust.

My study contributes to the literature on colonial institutions and the roles that they have played in modern African development. Acemoglu et al. (2001) found that colonies where Europeans faced lower death rates have better institutions and more economic development as compared with places with higher mortality rates. According to this study, in the colonies where European settlers could not stay, they created 'extractive' societies responsible for volatile economic growth in those colonies today. On the other hand, in colonies that were more favorable for European settlement, the colonial masters settled en masse and reproduced their institutions in these colonies contributing to their more advanced and sustained development today. North (2006) also posited that understanding the cultural background of countries is necessary for explaining differences in institutions and development between rich countries and poor countries. La Porta et al (1998), Djankov et al (2003) and Glaeser and Shleifer (2003) also found that legal institutions that prevailed during the colonial era continue to have a profound impact on African development today. For instance, colonies that experienced the British legal system are more developed today as compared with those that experienced the French legal system. These studies provide evidence that poor countries today may have been shaped by their colonial experiences, systems, and institutions. What is not clear is the influence of Africa's colonial past on current African attitudes and perceptions both about their local institutions and Western institutions. My research attempts to fill in this piece of the puzzle.

Additionally, my study is related to the literature on the historical impacts of colonization on vaccine hesitancy in Africa. Keller (2006) documents some colonial events including medical campaigns that have created lasting, deep-seated issues of medical mistrust in Africa. Lowes and Monterro (2021) investigate the impacts of French colonial medical campaigns on vaccination rates and medical mistrust in five Central African countries. Their paper suggests that vaccination rates and trust in medicine decrease with increases in colonial medical campaign visits. However, neither of these studies consider evidence from the COVID-19 pandemic nor the spillover effects of colonial medical campaigns into other countries. To date, there is limited evidence on how colonial perspectives are shaping people's acceptance or rejection of the COVID-19 vaccine. My research fills this gap and establishes persistent spillover effects of colonial medical campaigns into neighboring countries. Although Nigeria has no history of colonial medical campaigns, my study shows that it is experiencing spillover effects from policies implemented in neighboring Cameroon during the colonial era. To the best of my knowledge, my study is the first one to explore this neighboring country 'penalty' as a result of colonial medical campaigns.

The rest of my study is organized as follows: In Section 2, I provide some background on Africa's experience with the Covid-19 pandemic with emphasis on the evolution of COVID-19 in Nigeria. Additionally, I provide some historical context of colonial medical campaigns in Cameroon. In Section 3, I describe my data and the variables I use for my analysis with a focus on my outcome variable of interest. I also explain the methodology used for my empirical analysis. I also provide some insights into threats to the validity of my research and explain how

I address them. Section 4 outlines my results and Section 5 concludes my analysis and provides some policy recommendations based on my results.

1.2 Background

1.2.1 COVID-19 in Nigeria

On February 27th, 2020, the first case of COVID-19 was confirmed in Ogun state, Nigeria. An Italian man had contracted it during his travels and had imported it into the country while traveling from Milan to Lagos. Since the importation of the disease, it spread rapidly throughout the country with several states alternating the unenviable epicenter title. By December 2020, 35 out of the 36 states in Nigeria and the Federal Capital Territory had all reported cases of the virus. The case count continued to rise. According to the World Health Organization, between March 2020 and December 2022, Nigeria reported 266,675 cases and 3,155 deaths.

Like the rest of the countries in Africa, Nigeria experienced a relatively lower incidence of COVID-19 than the rest of the world. It realized relatively less morbidity and fewer deaths from the pandemic. One of the attributes of Nigeria responsible for the slow progression of the disease is its youthful population. With only 3.1% of the population being classified as elderly with 6.4 million being above 65 years out of a population of 213.4 million people (World Bank, 2021), Nigeria was less susceptible to the age risk (Rabi et al., 2020). Additionally, the government instituted partial lockdowns, stay at home orders, and provided some economic relief packages (The Economic Stimulus Bill, 2020) to the most vulnerable to help cushion citizens and protect them from the vagaries of the disease.

Despite government efforts to reduce the spread of the virus, COVID-19 continued to threaten Nigeria's already weak public healthcare system. In 2019, the country had already been rated poorly by the World Health Organization and the Global Health Security Index in 2019 for its response to disease outbreaks. In Nigeria, the doctor- patient ratio is 1: 9,083 (Nigeria Medical Association, 2022), far below the World Health Organization recommendation of 2.5 medical staff to 1,000 people. There is also low government spending on health. In 2020 for example, the government spent only 3.38% of its budget on health (World Health Organization Global Health Expenditure database). With such low budget spending on health, Nigeria's response to the vaccine spread has been slow.

Additionally, Nigeria is plagued with low vaccination rates. According to Ojo et al (2023), as of February 2023, only 30.5% of the Nigerian population was fully vaccinated against COVID-19[7]. With research emerging to show that vaccination is effective for combatting the disease, the low vaccination rates may pose a threat to the government's efforts and rather promote disease spread and mortality.

1.2.2 History of Colonial Medical Campaigns in Africa

In the 19th century, human African trypanosomiases (HAT), a lethal parasitic disease, plagued Africa. Left untreated, HAT could easily cause multiple human organs to shut down at the same time and further reduce the population of Africa which was already sparsely populated at the time. As HAT's spread in Africa reduced the amount of readily available labor for foreign plantations, most colonial governments conducted medical campaigns that were heavily focused on preventing and treating trypanosomiases (sleeping sickness). These governments included the Belgian and French governments.

[7] Ojo, Temitope Olumuyiwa, et al. "Determinants of COVID-19 vaccine uptake among Nigerians: evidence from a cross-sectional national survey." *Archives of Public Health* 81.1 (2023): 1-7.

The French colonial medical campaigns in Cameroon began in 1921. The campaigns involved sending out medical outreach teams including one French doctor, several African nurses, and porters who helped to convey medical equipment to the treatment sites where HAT was most dominant. To treat HAT in infected patients and even those without symptoms, the lethal drug atoxyl was used. Atoxyl was both effective and dangerous. When used to treat a patient in the first stage of HAT, it was effective in eliminating the disease parasites from the patient's bloodstream. However, when used in the second stage, it could cause multiple organ failure and eventually kill the patient. Additionally, the dosage of atoxyl required to bring relief from HAT was almost equal to the amount required to kill the patient. In about 20% of cases, atoxyl caused blindness in patients. Despite these dangers, the outreach teams continued to use atoxyl because it was cost-effective, well-suited to the tropical climate, and easier to administer than its close competitors.

After a few years, pentamidine was introduced as a preventive vaccine for HAT. The medical outreach teams injected this medication into the arms of the villagers every six months to offer continuous protection against the disease. The medication however did not come without serious side effects. The dangers of using pentamidine included gangrene and death, making the drug very unsafe for European use. Over time, it was discovered that pentamidine did not effectively prevent HAT and worked only to reduce disease parasites in the blood over the short term.

The unsanitary practices employed during the colonial medical campaigns caused further medical complications for the villagers in the colonies in those days. For example, Strickland (2010) found that while treating sleeping sickness in the colonial era, medical outreach teams indirectly promoted the spread of other diseases including the hepatitis C virus (HCV), the human immunodeficiency virus (HIV), and the human T lymphotropic virus (HTLV)—1. His study was a follow up to a study done by Pepin et al in 2010 that found antibodies to the various ailments in the bloodstreams of elderly residents in villages in Cameroon over 60 years old.

The brutal nature of these colonial campaigns did not augur well for building trust in Western medicine. There are several studies that point out to the negative effects of past western medical campaigns on the acceptance of western medicine in Africa. For instance, a study conducted by Feldman-Savelsberg, Ndonko, and Schmidt-Ehry (2000) found that recollections of past occurrences and the passing down of information from one generation to another contributed significantly to the abortion of a campaign to vaccinate children in Cameroon. Additionally, a study by Archibong and Annan (2023) established that Pfizer vaccine trials for meningitis conducted in the Muslim communities in Nigeria in the 1990s had a negative impact on Muslim mothers' compliance with childhood vaccine schedules for their children in the 2000s.

1.2.3 Colonialism in Nigeria & Cameroon

Great Britain colonized Nigeria in the 18th century. During this time, the British colonial masters left local government mostly in the hands of traditional authorities, with very little interference. The British government also respected Nigerian customs and traditions, although it mostly did not understand them. Unlike the French, The British did not carry out colonial medical campaigns in their colonies. After a long period of colonial rule, Nigeria finally gained independence on 1st October 1960 and is now a democratic federal state.

Cameroon at different times in the past has been colonized by the Germans, French, and British. In 1914, the British and French governments invaded Cameroon and partitioned the country amongst themselves. The French portion was geographically larger than the British portion and called Cameroon with its capital being Yaoundé. The British portion comprised a strip bordering Nigeria from the sea to the area around Lake Chad and the colonial masters ruled their territory as part of their Nigerian colony and called it Cameroons.

While the French style of governance involved treating Cameroon as one of the 'provinces' in France (assimilation), the British style of governance involved indirect rule where they ruled Cameroons indirectly through local chiefs, preserving already established traditional norms and customs. Because of the differences in style of governance, French Cameroon experienced colonial medical campaigns while the British Cameroons did not experience colonial medical campaigns.

Though Cameroon attained independence on 1st January 1960, the country remained divided between Nigeria and Cameroon. A plebiscite was subsequently held in 1961 which resulted in Northern Cameroons choosing to join Nigeria while Southern Cameroonians voted in favor of uniting with Cameroon. Cameroon is currently a federal democratic state.

Figure 1.1. ***Map of Africa showing Nigeria and Cameroon.***

Note: Nigeria is found on the Western border of Cameroon and is shaded in deep blue
Source: Author's drawing using Stata SE 17

1.3.0 Data and Methods

1.3.1 Data

1.3.1.1. World Bank COVID-19 National Longitudinal Phone Survey for Nigeria 2020-2021

During the COVID-19 pandemic when in-person interviews could no longer be conducted, the World Bank instituted the National Longitudinal Phone survey to collect household-level data for over 40 countries on the evolving COVID-19 situation. As part of its efforts, the Bank collected data on the social and economic impacts of the pandemic across several countries. This data encompassed topics such as access to social safety nets, household coping mechanisms, food security, education, employment, and household livelihood/ income loss.

Using this World Bank data, I extract Nigeria's COVID-19 National longitudinal phone survey conducted between 2020 and 2021 for my analysis. Some of the areas pertinent to my analysis include individual and government-imposed preventive measures against the virus, access to healthcare before and after the onset of the pandemic, and employment and income levels before and after COVID-19. My World Bank subsample consists of 1,712 households and 11,301 individuals interviewed over 9 survey rounds. In each household, one respondent was chosen to provide responses to the questions asked for each member of the household.

To construct my main outcome variable, I extract people's responses to the question "Would you take a free safe vaccine when one becomes available?". For ease of interpretation, I then condense the multiple responses offered to this question into 'No' and 'Yes.' All those who answer 'Not sure' 'It depends' are initially coded as 'No' respondents for my study. However, I conduct a robustness check (**Table A.3**) where I recode them as 'Yes' and show that my results do not change significantly. The World Bank dataset also provides data on each surveyed individual's gender, location (city and state), education level, and employment status.

1.3.1.2. Afrobarometer

The Afrobarometer survey gauges the social, political, and economic climate in 36 African countries by asking randomly selected citizens questions including about how much they trust their Presidents, Members of Parliament, and religious leaders. The survey is conducted every three years, on average, and includes questions such as "How would you rate the country's current economic condition?” “How would you rate the country’s current economic condition now as compared with twelve months ago?” “How would you rate your own present living condition?” “In this country, how free are you to say what you think?” “How much do you trust the President?” The surveys are targeted at citizens within the African countries covered and usually capture a representative sample of between 1,200 to 2,400 citizens. According to the survey website, it has so far covered 75% of Africa’s adult population. So far, the Afrobarometer has conducted 8 surveys in Nigeria beginning in 2000. My study focuses on survey rounds 6 and 7, the most recently available surveys during my study.

My second outcome variable gauges how much Nigerian citizens trust their governmental, traditional, and religious leaders. To construct this variable, I extract all questions from the Afrobarometer which ask about how much citizens trust their leaders at various levels on a scale of 0 to 3. Using this scale, 0 means ‘not at all,’ and 3 means ‘a lot.’ I sum up the responses for each individual and divide that total by 11, which is the total number of trust questions asked.

1.3.1.3. Latlong.net

Latlong.net is an online resource that provides geographical coordinates of places and towns in latitude and longitude. Entering a city’s name returns both its longitude and latitude measurements, and a map showing its geographical location. Using latlong.net, I obtain geographical coordinates for all cities in Nigeria, and the colonial medical campaign cities in Cameroon. With the geographical coordinates, I then compute the distances from each city in Nigeria to the nearest colonial medical campaign city in Cameroon using the nearest neighbor technique[8]. I compute all distances in kilometers, as that is the standard unit of measuring distance in Africa.

Table 1.1. ***Sample statistics***

	Observations	Mean	Std. deviation	Minimum	Maximum
Vaccine acceptance	11301	0.8848	0.3193	0.0000	1.0000
Distance (1000 km)	11301	0.5442	0.2058	0.1603	1.0612
Age	11301	22.9600	18.9814	0.0000	100.0000
Basic education	11301	0.0940	0.2918	0.0000	1.0000
Secondary education	11301	0.0120	0.1090	0.0000	1.0000
Tertiary education	11301	0.0035	0.0594	0.0000	1.0000
Employed	11301	0.4562	0.4981	0.0000	1.0000
Male	11301	0.5034	0.5000	0.0000	1.0000

Table 1.1 presents some summary statistics for my estimation sample. My sample includes about 11,300 Nigerians living in 362 cities across 37 states. On average, 88% of Nigerians in my sample would accept a free safe COVID-19 vaccine. Nigerians captured in my sample present low levels of education with only about 1% of survey participants with tertiary education. In the appendix (Table C), I present some summary statistics for data from Afrobarometer.

1.3.2. Methods

I estimate a linear probability model to isolate the impacts of colonial medical campaigns on COVID-19 acceptance. The ordinary least squares equation is:

$$y_{ict} = \beta_1 dist_c + X'_{it}\gamma + \tau_j + \alpha_t + \epsilon_{it}$$

[8] Nearest neighbor matching involves running through the list of treated units and selecting the closest eligible control unit to be paired with each treated unit.

where y_{ict} = vaccine acceptance for individual i, living in city c during survey round t which is equal to 1 if the individual reports being willing to accept a free COVID-19 vaccine and 0 otherwise. $Dist_c$ measures the distance from city c in Nigeria to the nearest colonial medical campaign site in Cameroon in kilometers. X_{it} represents a vector of individual characteristics including age, gender, employment, and educational attainment as measured by the highest level of education attained. τ_j and α_t are state and survey year-fixed effects respectively. In my analysis, standard errors are clustered at the city level. All regressions are weighted using World Bank survey weights.

It is reasonable to assume that cities closer to urban areas have access to better healthcare facilities and are within shorter distances than the cities in rural areas where facilities are not as accessible. For this reason, differential access to healthcare between states in Nigeria may yield biased estimates of COVID-19 vaccine acceptance. State fixed effects net out any time-invariant benefits or costs of proximity that may affect access to healthcare in my sample and which may also impact the interpretation of my results. I also include time-fixed effects to account for factors such as concurrent events that might affect people's likelihood of accepting a free vaccine.

I expect to find that people in Nigerian cities living further away from the colonial medical campaign sites in Cameroon are more likely to accept a free COVID-19 vaccine. This is based on the reasoning that such people are less exposed to information about the medical campaigns and will as such be more trusting of Western medicine.

Causal identification of β_1 relies on the assumption that people do not self-select into cities in Nigeria based on the city's proximity to or distance from colonial medical campaign sites in Cameroon. If this assumption is faulty, then my analyses will produce biased estimates.

To address this concern, I estimate the test for selection on unobservables from Oster (2019) to provide evidence against selection bias. I discuss this test and the results in detail in section 1.4.4.

1.4. Results

1.4.1 Main specification (OLS results): Distance increases vaccine acceptance

Table 1.2 presents my main specification OLS estimates of how distance from colonial medical campaign towns affects the likelihood that Nigerians will accept a free, safe coronavirus vaccine. My results from column one suggest that a 1000-kilometer increase in distance is correlated with a 17.23 percentage point increase in the likelihood of accepting a free safe vaccine. Columns two to four include fixed effects and some traditional controls such as age, gender, employment status, and educational attainment added incrementally to the model. Including all controls in my model does not significantly change my point estimate. This reinforces my finding that distance has a significant positive effect on the likelihood that Nigerians will accept a free safe coronavirus vaccine. A 1000-kilometer increase in distance from colonial medical campaign sites increases the probability of vaccine acceptance by 15.8 percentage points. Because Nigeria did not experience colonial medical campaigns, these results can best be described as a spillover effect of colonialism from Cameroon.

Table 1.2. ***Results from main specification: How distance impacts COVID-19 vaccine acceptance***

Dependent Variable: Vaccine acceptance				
	1	2	3	4
Distance	0.1723***	0.1646***	0.1583***	0.1580***
	(0.0150)	(0.0149)	(0.0309)	(0.0310)
Age		-0.0007***	-0.0001	-0.0001
		(0.0002)	(0.0002)	(0.0002)
Male		-0.0069	-0.0059	-0.0061
		(0.0060)	(0.0058)	(0.0058)
Basic education		-0.0046	0.0026	0.0021
		(0.0103)	(0.0100)	(0.0101)
Secondary education		-0.0453	-0.0140	-0.0143
		(0.0315)	(0.0298)	(0.0298)
Employed		-0.0172**	-0.0000	0.0006
		(0.0060)	(0.0058)	(0.0060)
Region FE	No	No	Yes	Yes
Time FE	No	No	No	Yes
Observations	11305	11301	11301	11301
Adjusted R^2	0.012	0.014	0.087	0.086
AIC	6128.5378	6112.1957	5285.8693	5293.3104

Notes: This regression is estimated using OLS. Standard errors (in brackets) are clustered at the city level. The dependent variable is people's willingness to accept a free COVID-19 vaccine. This is coded as 1 if people say "YES" and 0 otherwise. *** Means significant at 1 percent level, ** means significant at the 5 percent level, and * means significant at the 10 percent level.

1.4.2 Probit results: Distance affects vaccine uptake

A nonlinear model may be preferred over linear probability models when the dependent variable is binary. This is because the linear probability model can easily produce fitted values of the dependent variable that lie outside the probability range from 0 to 1. For this reason, I estimate a probit model to test the robustness of my main estimates. Table 1.3 shows the average marginal effects estimated from the probit model, which strongly reinforce my OLS results. The average marginal effect of a 1000-kilometer increase in distance from colonial medical campaigns is a 16.21 percentage point increase in vaccine acceptance in my full specification, other things being equal.

Table 1.3. ***Probit estimation***

Dependent Variable:	Vaccine Acceptance			
Distance	0.1746***	0.1656***	0.1621***	0.1621***
	(0.0157)	(0.0157)	(0.0284)	(0.0284)
Age		-0.0006***	-0.0001	-0.0001
		(0.0002)	(0.0002)	(0.0002)
Male		-0.0073	-0.0056	-0.0056
		(0.0060)	(0.0057)	(0.0057)
Basic education		-0.0051	0.0024	0.0023
		(0.0107)	(0.0104)	(0.0104)
Secondary education		-0.0401	-0.0100	-0.0103
		(0.0250)	(0.0239)	(0.0239)
Employed		-0.0157**	-0.0015	-0.0014
		(0.0060)	(0.0058)	(0.0059)
Region FE	No	No	Yes	Yes
Time FE	No	No	No	Yes
Observations	11301	11301	11222	11222

Notes: This regression is estimated using probit. Standard errors (in brackets) are clustered at the city level. The dependent variable is people's willingness to accept a free COVID-19 vaccine. This is coded as 1 if people say "YES" and 0 otherwise. *** Means significant at 1 percent level, ** means significant at the 5 percent level, and * means significant at the 10 percent level.

1.4.4 Test for Selection on Unobservables

I next consider the β statistic proposed in Oster (2019). If unobservables are as correlated with vaccine acceptance as the observables in my model, then β will represent the coefficient for vaccine acceptance. According to Oster (2019), it must be the case that zero does not belong to the interval between the estimated coefficient for COVID-19 vaccine acceptance and β to rule out the null hypothesis that my results are driven exclusively by unobservables.

Oster's β statistic in this model is 2.057 *(Appendix Table A.2)*. Assuming that both the unobservables and observables are equally correlated with vaccine acceptance and that these correlations have the same sign, the estimated coefficient for vaccine acceptance, if one were able to control for all unobservables would be $\beta = 2.057$. Since the interval between the actual coefficient estimate from the full specification (0.158) and β excludes zero it is unlikely that omitted variables can explain away my main results.

1.4.5 Examining transmission mechanisms: The role of the trust score

So far, I have found significant positive effects of distance from colonial medical campaign sites in Cameroon to all towns in Nigeria. My results show that the greater the distance in Nigeria is from the colonial medical campaign sites in Cameroon, the more likely Nigerians are to accept a free COVID-19 vaccine. My results are consistent with prior findings in the literature that show that colonial medical campaigns reduce trust in medicine and negatively impact vaccination programs in developing countries (Lowes and Monterro 2021, Badur et. Al, 2020, Turshen 1977).

To test the hypothesis on the role of distance from colonial medical campaign sites affecting people's trust in their institutions and authorities and subsequently influencing medical mistrust, I use data from the Afrobarometer survey rounds 6 and 7 which asked respondents how much they trust their institutions, religious and traditional leaders, and government officials. Past research (Nunn and Wantchekon 2011) has established that peoples' trust in their institutions and authorities today are a result of long-term historical events such as the transatlantic slave trade that took place between the 16th century and the 18th century. As a result, it is reasonable to infer that historical experiences may still be relevant for understanding people's trust in their traditional, religious, and government authorities and institutions today.

To test for this potential mechanism, I investigate whether people's trust in their institutions and authorities in Nigeria increases with distance from colonial medical campaign sites in Cameroon. My specification for the trust score takes the same form as my vaccine acceptance specification but with trust score as the outcome of interest.

Table 1.4. ***Trust score estimation***

Dependent variable:	Trust Score			
Distance	0.3299***	0.3300***	0.1906***	0.1887***
	(0.0161)	(0.0166)	(0.0139)	(0.0140)
Age		-0.0012***	-0.0003	-0.0003
		(0.0002)	(0.0002)	(0.0002)
Male		0.0041	-0.0005	-0.0007
		(0.0080)	(0.0057)	(0.0057)
Basic education		-0.0188	-0.0089	-0.0098
		(0.0159)	(0.0116)	(0.0117)
Secondary education		0.0314	0.0366	0.0360
		(0.0414)	(0.0303)	(0.0306)
Employed		0.0389***	0.0044	0.0057
		(0.0080)	(0.0063)	(0.0067)
Region FE	No	No	Yes	Yes
Time FE	No	No	No	Yes
Observations	3887	3670	3670	3670
Adjusted R^2	0.078	0.093	0.535	0.536
AIC	29.1885	-20.5027	-2442.7353	-2440.6025

Notes: This regression is estimated using OLS. Standard errors (in brackets) are clustered at the city level. The dependent variable is people's trust in their traditional, religious, and governmental authorities and institutions. This is computed as an average score out of eleven questions on trust asked in the Afrobarometer survey rounds 6 and 7. *** Means significant at the 1 percent level, ** means significant at the 5 percent level, and * means significant at the 10 percent level.

The results in Table 1.5 show a strong positive relationship between distance and the computed trust score. I find that a 1000 km increase in distance is correlated with a 33-percentage point and a 19-percentage point increase in the trust score in my base model and the model with my full set of controls respectively. Based on these results, distance from colonial medical campaign sites increases trust which in turn increases the likelihood that Nigerians will be willing to accept a free, safe COVID-19 vaccine.

1.5. Conclusion

Historical events, particularly those related to colonialism, continue to affect behaviors and attitudes even in the 21st century. My results show significant effects of the French colonial medical campaigns organized in Cameroon on COVID-19 vaccine hesitancy in neighboring Nigeria today. Inhabitants of cities in Nigeria closer to colonial medical campaign sites in Cameroon are less likely to accept a free, safe COVID-19 vaccine than those in cities further away from colonial medical campaign sites. My findings are driven by inhabitants living further away from the CMCs being more trusting of their traditional, religious, and governmental authorities and organizations than those living closer to the CMCs.

My results show that trust is an important factor in affecting vaccine acceptance. Research evidence abounds to the effect that building public trust is essential to successfully carrying out vaccination drives to curb various disease outbreaks across the world. Finally, not only is history important for understanding human behavior today- government policies can sometimes have unintended consequences for neighboring countries. In future, governments seeking to carry out successful vaccination drives at the onset of epidemics may consider more transparent, ethical, and inclusive approaches to building public confidence well in advance of the planned drives. These efforts may help improve vaccine uptake and reduce the dire consequences of low vaccination rates.

Chapter 2 - The impact of maternal healthcare intervention on prenatal outcomes in Nigeria

2.1. Introduction

According to the World Health Organization, Nigeria accounts for 20% of global maternal deaths. 1 in 22 Nigerian women die during pregnancy, childbirth, and in the postpartum period as compared with 1 in 4,900 women in developed countries[9]. Current evidence suggests that high levels of maternal deaths in Nigeria are linked to three delays: delays in deciding to seek care at the point of need, delays in identifying and getting to a medical center to seek help, and delays in receiving care at the healthcare facility[10]. Additionally, preeclampsia, a potentially fatal pregnancy complication caused by elevated blood pressure levels during pregnancy, has been marked as a significant contributor to the high level of maternal deaths in Nigeria. It is often detected in routine antenatal care visits during pregnancy[11].

To address these challenges, some state governments have partnered with nonprofit organizations to institute maternal healthcare interventions. These differ greatly by type, duration, and target group. Some interventions aim to promote antenatal care attendance, while others emphasize skilled birth attendance, and others emphasize postpartum care. The literature suggests that all interventions that target various aspects and stages of pregnancy are equally

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[9] https://www.thisdaylive.com/index.php/2022/09/08/maternal-mortality-in-nigeria-2/#:~:text=Latest%20statistics%20from%20the%20World,in%204900%20in%20developed%20countries.

[10] https://pubmed.ncbi.nlm.nih.gov/9579750/#:~:text=The%20%22Three%20Delays%22%20model%20proposes,when%20a%20facility%20is%20reached.

[11] https://www.acog.org/womens-health/faqs/preeclampsia-and-high-blood-pressure-during-pregnancy

important and may improve outcomes for mothers and their children. By initiating antenatal visits before 12 weeks' gestation for example, mothers are able to receive more information about their pregnancy stages and expected symptoms and are enlightened on potential dangers during pregnancy in order to avoid adverse outcomes such as stillbirths and perinatal deaths.[12] During antenatal visits, women regularly receive blood pressure checks to test for potential problems. The blood pressure checks received during pregnancy increase the prospects of having a safe pregnancy period because healthcare professionals are able to quickly diagnose and treat complications that may otherwise not be visible from a physical inspection.

My research studies the effect of one such intervention called Project Hope on the likelihood of ever attending antenatal care, early antenatal care attendance (before 12 weeks gestation[13]), and blood pressure checks in Cross Rivers state, Nigeria, and compares these outcomes with a similar state, Abia state, which did not receive the intervention. Project Hope is the only maternal health care intervention in Cross Rivers State, Nigeria so far, as well as the only intervention in Nigeria that addresses all three delays and all three interactions between the individual, the community, and the healthcare system. By targeting all three delays, Project Hope provides evidence for a multi-pronged approach to reducing maternal deaths in Nigeria. My study helps address the dearth of literature on the impacts of maternal healthcare interventions

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12 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10603512/#:~:text=Delay%20in%20ANC%20initiation%20and,transmitted%20disease%2C%20anaemia%20and%20medical

13 https://www.who.int/news/item/07-11-2016-new-guidelines-on-antenatal-care-for-a-positive-pregnancy-experience

targeting all three delays and those involving interactions between the individual, community, and healthcare system.

Using data from the Nigerian Demographic and Health Survey, I implement a difference-in-differences identification strategy to isolate the treatment effects of Project Hope. My identifying assumption is that, in the absence of the treatment, both Cross Rivers state and Abia state would observe similar trends in the likelihood of early antenatal care attendance and the likelihood of receiving blood pressure checks. I present evidence to show that the likelihood of early antenatal care attendance and the likelihood of receiving blood pressure checks for both Cross Rivers State and Abia state demonstrate similar uptake patterns before Project Hope's inception. Event study analysis also shows that there are no statistically significant differences between the two states in early antenatal care attendance prior to Project Hope.

I find that, while Project Hope has no discernible effect on the probability of antenatal care attendance overall and the probability of receiving a blood pressure check, the intervention did significantly increase the likelihood of attending antenatal care before 12 weeks of pregnancy[14] by 19.2 percentage points.

These results are largely consistent with findings from prior studies, showing the efficacy of maternal healthcare interventions in improving in maternal health outcomes. Luo (2013) conducted a randomized controlled trial to evaluate the effects of a maternal healthcare intervention in China on antenatal visits. His results showed that healthcare education through text messaging significantly increased the number of women who initiated early antenatal care

[14] https://www.who.int/news/item/07-11-2016-new-guidelines-on-antenatal-care-for-a-positive-pregnancy-experience

attendance and attended 4 or more antenatal visits. Similarly, Ekirapa Kiracho Elizabeth, et al. (2021) found a positive impact of community mobilization and empowerment and health provider capacity development on early initiation of antenatal care in rural Uganda.

Several studies have pointed to the importance of investments in healthcare for human capital development. Bleakley (2010) found that better healthcare results in increased incomes over one's lifetime, which then leads to further investments in better healthcare. Essentially, when people have access to better healthcare, they become more productive, earn higher incomes, and demand better healthcare services from their governments. This prompts governments to increase healthcare spending to improve long-term health. This means that health itself is a form of human capital that helps in the formation of even more health capital.

Despite the importance of maternal healthcare interventions for building health capital, it remains a topic of great debate in economics and public finance. This is because while some economists argue that imposing user fees[15] for maternal healthcare services helps to improve service delivery and reduce unnecessary use (El-Shal, Cubi-Molla, and Jofrey-Bonnet, 2021), other economists believe that user fees serve as a barrier to accessing critical healthcare that can help to save lives and improve health outcomes (Kremer and Holla 2009). My research provides evidence to show that maternal healthcare interventions encourage mothers to increase uptake of essential maternal healthcare services which could potentially lead to improved pregnancy outcomes and better health overall.

[15] User fees are system fees for using maternal healthcare services and facilities that help these healthcare centers recover the costs of providing services. An example of a user fee would be a charge for a laboratory test or an ultrasound scan.

My work is closely related to several studies that estimate the effects of a single maternal healthcare intervention on one of the three delays (Obare et al., 2013, Regan, Mathilda, et al., 2023, Sibley et al., 2014, and Pallangyo et al., 2017). For example, Ekirapa Kiracho Elizabeth, et al. (2021) studied the effects of community mobilization and health care provider capacity development on early initiation of antenatal care in three rural Ugandan districts. However, unlike these previous papers, I study an intervention that targets all three delays identified in the medical literature. Project Hope enables me to study how a series of targeted interventions involving interactions between the individual, the community, and the healthcare system affect early maternal healthcare uptake and the likelihood of receiving a blood pressure check during pregnancy.

The rest of my study is organized as follows: In section 2, I provide some background information about maternal healthcare in Africa and highlight some scholarly works that explain the various levels of interventions. In section 3, I provide an overview of the maternal healthcare situation in Nigeria with emphasis on factors that influence maternal and neonatal mortality. I also provide some background on my treatment and control states. In Section 4, I describe my data and the variables I use for my analysis with a focus on my outcome variables of interest. I also explain the difference-in-differences methodology used for my empirical analysis. This section also provides some insights into threats to the validity of my research and explains how I address them. Section 5 outlines my results and section 6 concludes my analysis.

2.2. Literature Review

2.2.1 Maternal Healthcare interventions in Africa

Maternal healthcare interventions in Africa have had mixed results. There is little understanding of why antenatal care is important, what constitutes an obstetric emergency, and when to seek help. More generally, while some interventions have been successful, others have produced the opposite effect. In 1994, Thaddeus and Maine advanced "three delays" as a conceptual framework to help elucidate some barriers to maternal healthcare which contribute to the high rates of maternal mortality in Africa. According to their study, these three delays include delays in making a decision to seek care, delays in arriving at a healthcare facility, and delays in receiving quality care at the point of care. Most maternal healthcare interventions across Africa have aimed to reduce at least one of these three delays. The interventions have thus been fragmented into the individual, community, and facility levels of life-preserving care received during pregnancy.

2.2.2. Community level healthcare interventions

Emaway Altaye et al. (2018) evaluated an intervention in rural Ethiopia that involved prenatal education on nutrition, the importance of receiving antenatal care, and the need to start saving money for childbirth to purchase baby essentials and pay for the costs of delivery. The intervention also used local community volunteers to create awareness among pregnant women and decision-makers in their homes about what constitutes an obstetric emergency, how to act in such situations, and how to get to the nearest healthcare center to seek treatment. Emaway Altaye et al. (2018) showed that 63% of the women who received the intervention delivered in health facilities as compared with 56% of the women who formed the control group. Studies in Tanzania (Regan et al, 2023) and Uganda (Mbonye et al, 2008) of similar interventions found comparable positive effects.

2.2.3. Interventions targeting the healthcare system

While some healthcare interventions have focused on the community, others have targeted the healthcare system. Sibley et al. (2014) studied the impacts of a Community Maternal and Newborn Health (CMNH) training program in rural healthcare facilities in Ethiopia. They found that after the training program, there were more women receiving antenatal care and more mothers and children receiving postpartum and newborn care respectively. Additionally, the program made community healthcare workers more efficient, leading to a reduction in home and traditional-based births and reductions in perinatal mortality. Pallangyo et al. (2017) obtained similar results from their qualitative study on healthcare interventions in Tanzania.

2.2.4. Interventions that target both the community and the healthcare system

Some countries have also combined community level and health facility interventions in their approach. In Zambia, offering expectant mothers kits containing baby essentials such as blankets, diapers, and clothes during antenatal care was found to increase the likelihood of giving birth in a health facility (Turan et al. 2018) as compared with those who did not receive the baby kits Altaye et al. (2018), and Sangho, Doumbla, Keita et al., (2010) also found that combining individual level interventions with those that strengthen the healthcare system increased the levels of facility based deliveries in Lesotho and Ethiopia respectively.

2.2.5. Interventions that have had negative impacts

Not all healthcare interventions to improve maternal outcomes were successful. Some studies reported that in some countries such as Uganda, healthcare initiatives produced the opposite effect and reduced postpartum care uptake (Massavon et al. 2017). Wilunda et al. (2017) also found that community healthcare strengthening programs launched in rural Ethiopia did not significantly impact postpartum healthcare patronage. Additionally, a study conducted on maternal healthcare satisfaction after various computerized decision support systems and performance based initiatives interventions in the Upper East Region of Ghana found that mean overall satisfaction with maternal healthcare declined slightly in treatment areas as compared with the control areas. Also, the difference-in-difference estimates for healthcare provider availability and technical performance of healthcare facilities were not significant (Aninanya, Otupiri, and Howard, 2021).

These studies mentioned above all target either one or at most two of the delays identified in the literature. Additionally, the interventions studied were focused on either the individual, the community, or the healthcare system or a mixture of two of these interactions. I contribute to the literature on maternal healthcare interventions by examining the impact of an intervention that targets all three delays identified in the literature and the interactions between the individual, the community, and the healthcare system.

2.3. Background - Maternal Healthcare in Nigeria

According to the medical literature, the major causes of maternal mortality in Nigeria are preeclampsia, sepsis, and hemorrhage[16]. Though these conditions can be detected and treated early to save lives of mothers and their babies, there is also low uptake of maternal healthcare services in Nigeria. For instance, a study by Okonofua et al (2018) found that long distances to healthcare centers, expensive care, and low quality of care received at primary healthcare centers reduce uptake of maternal medical services.

Due to these challenges, some state governments in Nigeria have partnered with nonprofit organizations to institute various healthcare interventions. These interventions take various forms. In Anambra and Kano states for example, state governments have entirely removed user fees for maternal healthcare services, while in Ondo state, user fees have been

[16] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9036837/#:~:text=The%20leading%20causes%20of%20direct,Joinpoint%20estimates%20showed%20a%20statistically

removed for specific maternal healthcare services. In Cross Rivers State, the state government partnered with the Saving Mothers Giving Life Initiative to institute an intervention called Project Hope to safeguard the lives of pregnant women and their children. Project Hope commenced in Cross Rivers State in 2015 with the sole aim of strengthening district healthcare provision to reduce maternal and neonatal mortality.

2.3.1. Cross Rivers State

Cross Rivers State is in the South-south geopolitical zone of Nigeria. Its capital town is Calabar. It has a total land area of 7,782 miles and a population of 3.73 million residents as captured by the 2016 census.[17] The population is predominantly rural. About 25% dwell in the urban areas while 75% live in the rural areas. Cross Rivers state serves as the treatment group for my analysis as it received the maternal healthcare intervention from 2015 to 2019. During this period, there was no other maternal healthcare intervention in place in Cross Rivers State.

In Cross Rivers state, variation in the quality of healthcare, and the unequal distribution of healthcare facilities are major contributors to the high maternal mortality rate of 876 deaths per 100,000 live births.[18] Among mothers to be and other residents, there is a general apathy towards the healthcare system. There is very little contact between community health workers, formal healthcare centers, and the community. This makes it difficult to share information and also provide assistance at various levels of care. Additionally, the poor road networks and unequal distribution of life saving healthcare service provision make goals for maternal and

[17] https://en.wikipedia.org/wiki/Cross_River_State

[18] https://www.pathfinder.org/wp-content/uploads/2019/07/A-Whole-System-Approach-to-Saving-Mothers-in-CRS-Nigeria_Final_July2019.pdf

neonatal health outcomes far from reach. There is also poor record keeping, limited conduction of maternal and neonatal death audits, and great variation in the availability of life saving medication.

2.3.2. Abia State

Abia state is in the South-eastern geopolitical zone of Nigeria. It is located on the western border of Cross Rivers State as shown in Fig 1. Its capital city is Umuahia. It has a total land area of 2,440 square miles and a population of 3.72 million residents as at the time of the 2016 census.[19] About 70% of the population dwell in the rural areas while 30% dwell in the urban centers.[20] Abia state serves as the control group for my study because it had no maternal healthcare intervention in place from 2015 to 2019 and it’s located right next to Cross Rivers state. It is similar to Cross Rivers state in population, healthcare provision, and public healthcare uptake. Figure 1 shows the geographical locations of Cross Rivers State and Abia state.

Close to 70% of the 1,100 healthcare centers in Abia state do not offer essential obstetric care.[21] Many public healthcare centers are not adequately prepared to cope with obstetric emergencies. Additionally, the essential obstetric service healthcare centers are concentrated in the urban areas.

Like Cross Rivers state, Abia state faces similar challenges in maternal healthcare access and provision. The state is plagued with poor road networks, very limited contact between

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[19] https://en.wikipedia.org/wiki/Abia_State

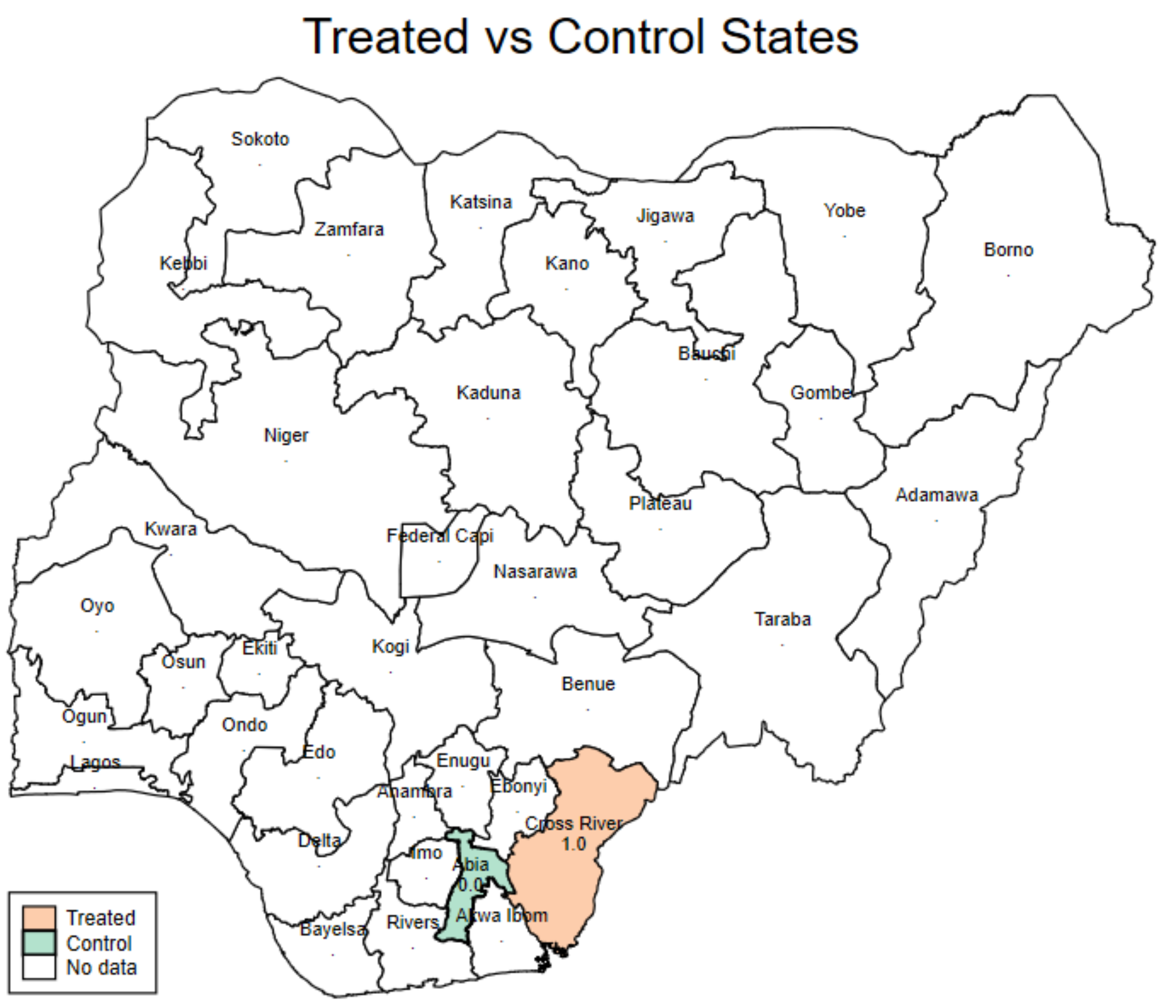
[20] https://www.fhi360.org/sites/default/files/media/documents/Abia%20State%20Op%20Plan.pdf

[21] file:///C:/Users/Aisha/Downloads/1067-6537-2-PB.pdf

residents and the healthcare system, and poor outreach from the healthcare system and its workers to the community inhabitants. Additionally, there is limited record keeping on maternal and neonatal deaths, and great differences in the availability of life saving drugs and medical treatments.

Since Nigeria is so geographically, politically, and culturally diverse, I do not include other states as they differ significantly on dimensions considered in my research. Additionally, various federal states in Nigeria run different maternal health programs that could impact my results hence their exclusion from my analysis.

Figure 2.1. ***Map of Nigeria Showing Treatment and Control States.***



Source: Author’s graph plotted in Stata 17.0

2.2.3. Project Hope

This project was introduced in Cross Rivers State, Nigeria in 2015 as a partnership between the Federal Government and Saving Mothers Giving Life (SMGL) initiative to help address Thaddeus and Maine's (1994) three delays that negatively impact maternal health. These include delays in taking a decision to seek care, delays in arriving at a healthcare facility, and delays in receiving quality care at the point of care.[22] The project adopted a "whole system approach" which engaged the individual and the community in addition to the healthcare system in Cross Rivers State to empower women to seek care and to make available needed resources to facilitate positive birth outcomes for mothers and their babies.

A key objective of Project Hope was to reduce maternal mortality by 25% and neonatal mortality by 35% by 2019. In order to achieve this objective, the project clustered public and private healthcare facilities into 10 clusters spanning all the 18 Local Government Areas in Cross Rivers State. It ensured that the cluster networks incorporated at least 4 basic Emergency Obstetric and Newborn Care Centers (EmONC) and 1 comprehensive EmONC center per 500,000 people. The project created shared networks where patient information was available across the healthcare centers to facilitate access to quality care and seamless referrals whenever there was the need.

To shore up demand for maternal healthcare services, Project Hope initiated some interventions at the community and individual levels including some technological interventions. Through the project, community based organizations trained educated community health volunteers to conduct home visits during pregnancy and after childbirth to create awareness

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[22] https://pubmed.ncbi.nlm.nih.gov/8042057/

about safe practices during pregnancy, childbirth, and after childbirth. They also counseled families on safe contraceptive use after childbirth. The initiative also trained Traditional Birth Attendants to serve as focal people to refer and escort pregnant women to the healthcare centers. Also, it adapted Hello Mama content from Johnson & Johnson's "baby center" to the Nigerian context and frequently sent out text messages to expectant mothers specific to their pregnancy trimesters.

Access to healthcare was pivotal to the success of Project Hope. The project was focused on making sure that pregnant women receive the needed care in a timely manner. To improve access, between 2015 and 2019, it scaled up 108 healthcare centers across the 18 Local Government Areas to ensure that they were equipped to provide relevant care. Additionally, the program trained community health extension workers to provide basic EmONC and family planning services at the primary healthcare level. The project also experimented with a digital health referral system in 2 clusters to facilitate quick referrals of complicated cases to more advanced healthcare centers. To ameliorate transportation problems, Project Hope initiated a transport voucher system. Here, pregnant women received emergency transport vouchers during their antenatal care visits containing phone numbers of networked drivers. These drivers were equipped with a list of health facilities within their vicinities where they could send their clients in case of emergency.

Project Hope also prioritized improving the quality of care that pregnant women and their children receive at the healthcare centers. In view of this, they used a top-down approach to train healthcare administrators at the state level, and then the staff at the various hospitals on EmONC, newborn care, post abortion care, postpartum care and family planning. They also liaised with professional organizations to provide training for specialist doctors throughout the state on

EmONC. Additionally, they got volunteer specialists to regularly organize clinics in 6 of the clusters to provide free specialist care and counselling on pregnancy, childbirth, family planning, breastfeeding, and immunization. In collaboration with professional organizations, they also created an application that helped monitor service standards in health centers. This application was equipped to monitor service standards using a checklist that captured prenatal care, postpartum care, and newborn care. With the application Project Hope reviewers could regularly assess the healthcare centers and devise mentorship plans for improving areas of weakness in service delivery.

2.4. Data and Methods

2.4.1. Data

For my analysis, I use repeated cross-sectional household data from the National Demographic and Health Surveys (NDHS) conducted in 2003, 2008, 2013, and 2018. This enables a before and after analysis of the healthcare intervention carried out in Cross Rivers state from 2015-2019. The NDHS is a nationally representative survey that provides current information on Nigeria's health and demographic indicators. Target groups for the survey typically include women between ages 15-49 and men between ages 15-59 in randomly selected households across the country. The survey collects data on marriage, fertility, family planning, maternal and infant nutrition, female genital mutilation, domestic violence, and HIV/AIDS. For the purposes of my study, my sample is restricted to women.

The NDHS is conducted every five years in almost every developing country in Africa. For my study, I use 2003, 2008, and 2013 as my pre-intervention years and 2018 as my post-intervention year. This is because, the data for the period 2019-2023 is still being collated and as such not yet available.

Outcome variables for my study are: likelihood that women attended antenatal care, likelihood that women attended antenatal care before 12 weeks' gestation, and likelihood that women received blood pressure checks. Thus my sample includes women who have ever been pregnant. In my study, I control for mother's age, employment, wealth index, and education level.

Table 1 presents some summary statistics for my analytical sample. My sample includes 1739 women who live in Cross Rivers State or Abia State. On average, 42% of the women in my sample attended antenatal care before 12 weeks' gestation, about 66% attended antenatal care during pregnancy, and about 64% received a blood pressure check during pregnancy. The average age observed in my sample is 31 years. Based on my summary statistics in Table 1, majority of the women in my sample have at least secondary education and belong to the middle-class wealth quintile or higher[23].

2.4.2. Methods

The difference-in-differences regression for antenatal care visits and blood pressure checks is:

$$Y_{ist} = \beta_1 Treat_s + \beta_2 Post_t + \beta_3 Treat * Post_t + X_i'\gamma + \tau_t + \epsilon_{ist} \ldots.(1)$$

Here, Y_{ist} represents my maternal outcomes of interest: likelihood of attending antenatal care before 12 weeks gestation, likelihood of ever attending antenatal care, or likelihood of receiving blood pressure checks during pregnancy. In my first set of analyses, Y_{ist} is coded as 1

[23] The wealth index is a composite measure of a household's cumulative living standard. The wealth index is calculated using data on a household's ownership of selected assets, such as televisions and bicycles; materials used for housing construction; and types of water access and sanitation facilities. It places individual households on a continuous scale of relative wealth. DHS separates all interviewed households into five wealth quintiles to compare the influence of wealth on various population, health and nutrition indicators.

if woman i, from state $s,$ surveyed in year t, attended antenatal care before 12 weeks gestation and 0 otherwise. The vector X_i includes maternal covariates that have a bearing on pregnancy outcomes including the mother's age, level of education, wealth index, and number of children ever born. $Treat_s$ is a binary variable that is coded as 1 if the pregnant woman lives in Cross Rivers State and 0 otherwise. The baseline (or untreated) years for analysis are 2003, 2008, and 2013. To test if Project Hope was beneficial to Cross Rivers state, I multiply $Post_t$ which is a dummy variable that is equal to 1 if the year is 2018, and 0 otherwise by $Treat_s$. The coefficient β_3 then identifies whether the treatment improved outcomes for inhabitants of Cross Rivers state as compared with those in the control group (Abia state) over the time period studied (2003 to 2018). My regression includes time fixed effects τ_t that control for unobservable changes over time that are common across states in Nigeria. I employ heteroskedasticity-robust standard errors for my analysis. All regressions are weighted using sample weights from the Demographic and Health Surveys.

To complement the results of my difference-in-differences analysis, I also estimate an event study model and compare outcomes before and after the intervention for Cross Rivers State and Abia state.

My event study model is:

$$Y_{ist} = \sum_{t=1}^{4} \theta_t D_t * Treat_s + \overline{X_i'}\bar{\gamma} + \epsilon_{ist} \ldots\ldots\ldots.(2)$$

For this event study, I use 2003 and 2008 as the pre-treatment years, 2013 as my base (omitted) year, and 2018 as the treatment year. I am interested in the estimates of θ_t both prior-to and after treatment. Statistically insignificant estimates before treatment suggest no differences exist between the treatment and control groups pre-intervention. Post-treatment, statistically significant estimates of θ_t suggest that the intervention has an impact on the prenatal care outcome variables.

2.4.3. Threats to Validity

2.4.3.1. Non-parallel trends between treatment and control

One major threat to internal validity in establishing a causal relationship in difference in difference analysis is the existence of non-parallel trends between treatment and control states (Roth et al., 2023). The parallel trends assumption requires that both treatment and control groups exhibit similar trends in the outcome of interest in the absence of the treatment (Angrist and Pischke, 2009).

To effectively isolate the effects of Project Hope, I use Abia state, a neighboring state with similar characteristics as my comparison group. Abia state, like Cross Rivers State, has about 3.72 million inhabitants. Similar to Cross Rivers State, about 70% of the population live in rural areas while 30% live in urban areas. Additionally, about 70% of the 1,100 healthcare centers in Abia state do not offer essential obstetric care.[24] The state is also plagued with poor road networks, poor maternal and neonatal death record keeping, and a general apathy towards healthcare uptake in general. Unlike Cross Rivers State, however, Abia state did not receive a maternal healthcare intervention during the period studied (2015-2019).

[24] file:///C:/Users/Aisha/Downloads/1067-6537-2-PB.pdf

Table 2.1. ***Sample statistics***

	Count	Mean	Standard deviation	Minimum	Maximum
Early Antenatal Care Attendance (before 12 weeks gestation)	1739	0.422	0.494	0.000	1.000
Blood Pressure Checks	1739	0.644	0.479	0.000	1.000
Ever attended Antenatal Care	1739	0.658	0.474	0.000	1.000
Poorest	1739	0.012	0.110	0.000	1.000
Poor	1739	0.057	0.231	0.000	1.000
Middle Class	1739	0.159	0.366	0.000	1.000
Rich	1739	0.297	0.457	0.000	1.000
Richer	1739	0.475	0.500	0.000	1.000
No education	1739	0.016	0.127	0.000	1.000
Primary Education	1739	0.128	0.334	0.000	1.000
Secondary Education	1739	0.593	0.491	0.000	1.000
Higher Education	1739	0.263	0.440	0.000	1.000
Age	1739	31.175	6.041	15.000	49.000
Treated	1739	0.317	0.466	0.000	1.000
Employed	1739	0.697	0.460	0.000	1.000
Post (year=2018)	1739	0.585	0.493	0.000	1.000
Treat*Post	1739	0.213	0.410	0.000	1.000

I provide evidence in favor of the parallel-trends assumption by plotting the unadjusted means of my outcome variables over time in both Abia and Cross Rivers state. If Abia and Cross Rivers exhibit dissimilar trends pre-intervention in the outcome variables, I cannot plausibly attribute any changes in these outcomes to Project Hope. This is because aside Project Hope, there may be some unobservable factors and external events at play in affecting prenatal care behaviors in Cross Rivers state.

Plots of the likelihood of ever attending antenatal care, early antenatal care attendance and blood pressure checks in figures 2.2 and 2.3 below from 2003 to 2018 show that both Cross Rivers state and Abia state exhibit similar trends in uptake prior to the treatment.

Figure 2.2. ***Likelihood of early antenatal care attendance (before 12 weeks' gestation) by state from 2003-2018.***

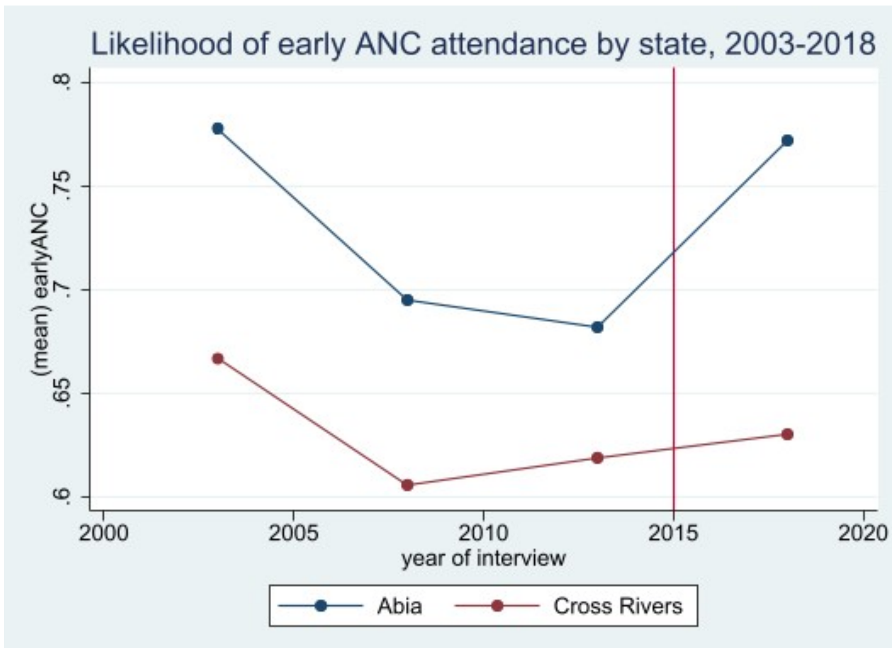
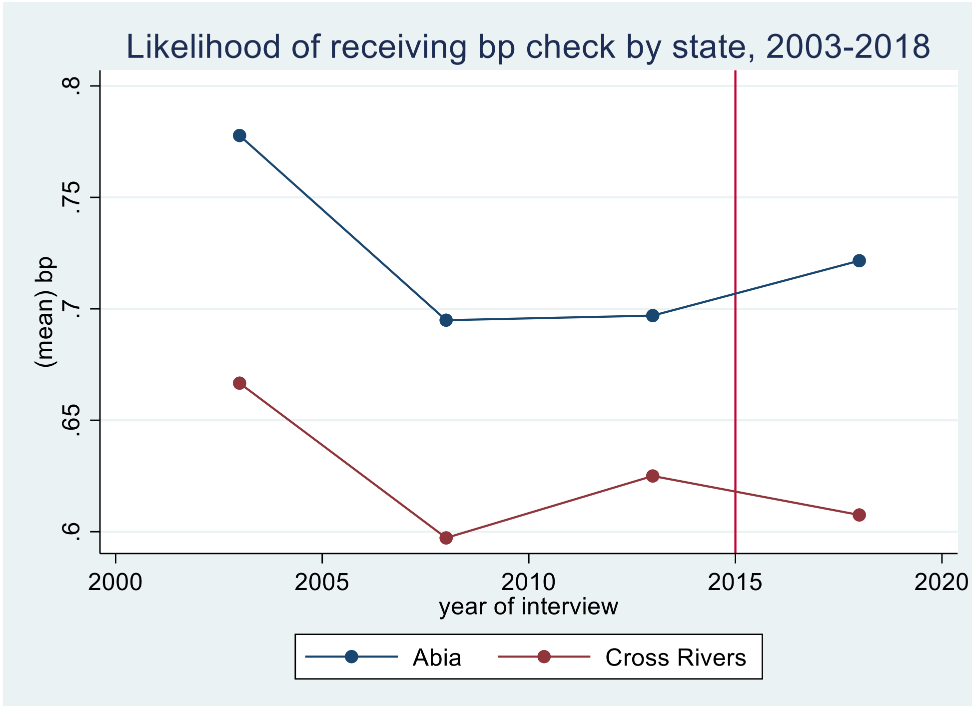


Figure 2.3. ***Likelihood of receiving Blood Pressure checks by state from 2003-2018.***



2.4.3.2. Possible endogeneity of fertility decisions

If women could anticipate the rollout of Project Hope and try to have more children as a result, my results would potentially suffer from sample selection bias. This would mean that some women who may have otherwise not wanted to have more children would alter their behaviors and become pregnant in the treatment period in order to benefit from the intervention.

I argue that this is unlikely to be the case in Nigeria. Social program benefits are not cast in stone because they depend on continuous flow of financial support which can be uncertain. Some social interventions which have started out as partnerships between federal governments and non-governmental organizations have stalled or been stopped after short periods of implementation because of lack of sustained funding. [25] As a result, even seemingly tenable assurances from government to provide funding well into the future to advance social interventions are unlikely to significantly impact fertility in Nigeria.

In order to test for the possibility of endogenous pregnancies, however, I follow Hoynes, Miller, and Simon (2015) and conduct a difference-in-differences analysis to compare number of births of my treatment and control states before and after the intervention. In the event that Project Hope caused more people to get pregnant, the number of births in Cross Rivers State would be higher than that in Abia state in 2018 which is the end year of my analysis.

I report my estimates in Table 2.2. My results show that the effects of Project Hope on the birth rates between treatment and control is not significant. Thus, Project Hope is unlikely to have influenced more women to want to have children in Cross Rivers state.

[25] https://cdn.odi.org/media/documents/7582.pdf

Table 2.2. ***Difference-in-differences estimation of the effects of Project Hope on a woman's total number of children ever born between 2003 and 2018***

	(1)
Dependent variable:	Total children ever born
Treat*Post	-0.151
	(0.189)
Age	0.164***
	(0.007)
Primary Education	-0.204
	(0.301)
Secondary Education	-1.061***
	(0.254)
Higher Education	-1.440***
	(0.270)
Employed	0.110
	(0.089)
Treated	-0.066
	(0.159)
Poorest	1.161**
	(0.358)
Poor	0.406*
	(0.212)
Middle Class	0.167
	(0.127)
Rich	-0.014
	(0.089)
Post (year=2018)	-0.918**
	(0.282)
Time FE	Yes
Observations	1739

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. Sample is all women who have been pregnant before during NDHS survey rounds in 2003, 2008, 2013, and 2018. In this specification, I include controls for three categories of educational attainment including primary education, secondary education and higher education and omit no education. I also include controls for four categories of the wealth index out of five.

2.5. Results

2.5.1. Difference-in-Differences Results

Table 2.3 presents results for my main specification from equation (1). Based on my results, Project Hope seems to be more important for the timing of antenatal care attendance than for attending antenatal care clinics at all during pregnancy. There is no significant effect of Project hope on the likelihood of attending antenatal care during pregnancy (Table 2.3 column 3). However, Project Hope increases the likelihood of early antenatal care attendance by 19.2 percentage points.

I do not find a significant effect of Project Hope on the likelihood of receiving a blood pressure check. This is expected because the literature has established that preeclampsia (detected by taking a pregnant woman's blood pressure reading) is often detected during the second half of pregnancy (August and Sibai 2017, Shahd A. and Long, 2023). As my results show that Project Hope only has a significant impact on the likelihood of attending *early* antenatal care, it is unlikely that this would lead to an increase in the likelihood of receiving a blood pressure check.

Based on my results, educational attainment significantly affects early antenatal care attendance and the likelihood of receiving a blood pressure check. For example, as compared with women who have no education, women who have at least primary education are about 20 percentage points more likely to initiate ANC attendance early. Women from the poorest households are less likely to initiate antenatal care before 12 weeks' gestation and less likely to receive blood pressure checks during pregnancy. This finding is in consonance with several studies that have found a negative correlation between household financial means and antenatal care attendance (Larson, 2007, Simkhada, Bibha, et al., 2008, Finlayson, Kenneth, and Soo Downe, 2013, Pandey and Karki, 2014, Rurangirwa, A.A., Mogren, I., Nyirazinyoye, L. et al., 2017). For women who already have children, the presence of a child reduces the likelihood of early ANC attendance by about 6 percentage points. This is in fact unsurprising as it is supported by a number of studies in the literature. According to Warri and George (2020), women with healthy babies at home tend to initiate antenatal care attendance very late in future pregnancies because they adopt a more relaxed approach.

Table 2.3. ***Results from general specification***

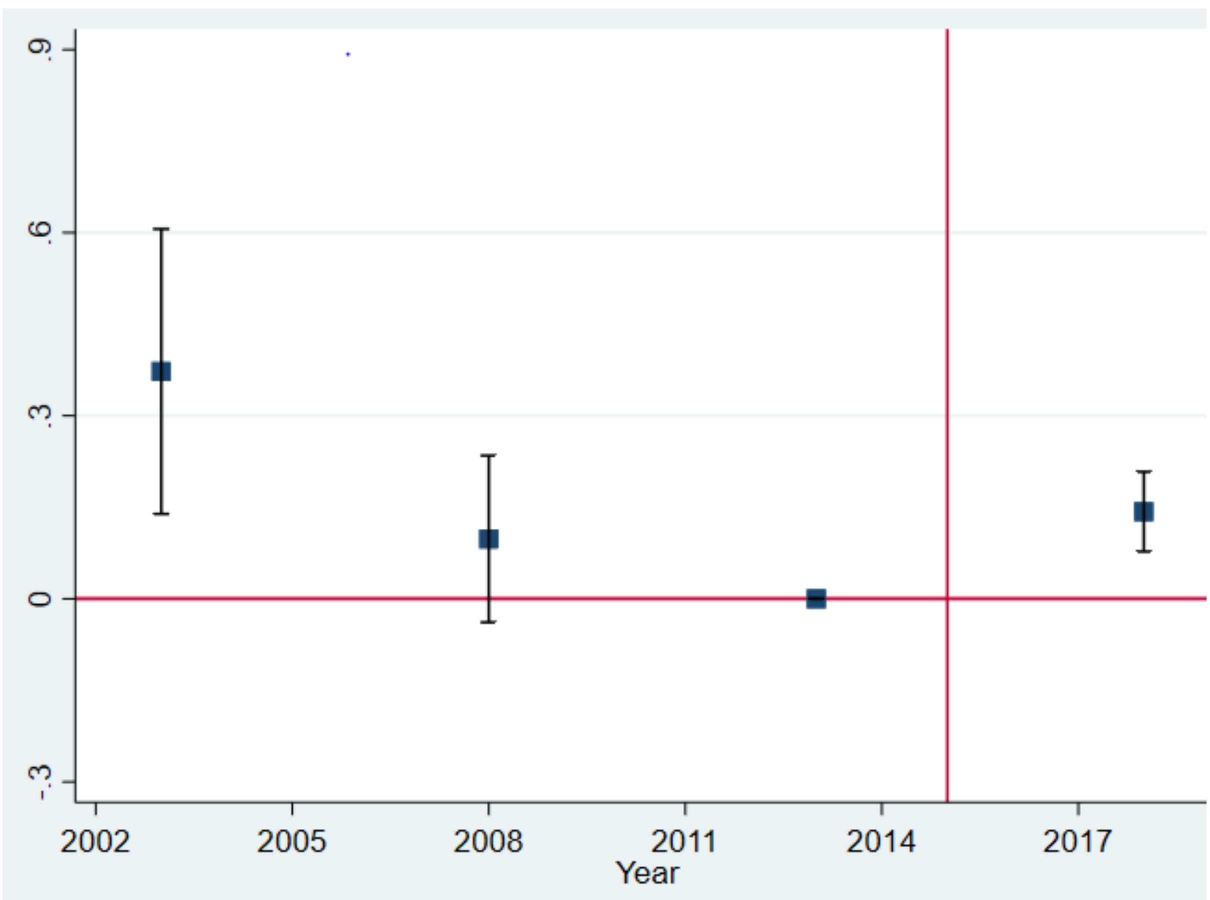
Dependent variable:	(1) Early ANC Attendance	(2) Blood Pressure	(3) Ever attended antenatal Care
Treat*Post	0.192**	0.019	0.024
	(0.060)	(0.057)	(0.057)
Age	0.014***	0.016***	0.016***
	(0.002)	(0.002)	(0.002)
Primary Education	0.195**	0.372***	0.272**
	(0.083)	(0.082)	(0.085)
Secondary Education	0.185**	0.364***	0.281***
	(0.074)	(0.073)	(0.076)
Higher Education	0.195**	0.291***	0.190**
	(0.079)	(0.079)	(0.082)
Employed	-0.005	-0.029	-0.054*
	(0.028)	(0.028)	(0.027)
Treated	-0.064	0.112**	0.121**
	(0.048)	(0.046)	(0.047)
Poorest	-0.226**	-0.389***	-0.295**
	(0.082)	(0.096)	(0.106)
Poor	-0.014	0.051	0.078
	(0.056)	(0.055)	(0.052)
Middle Class	0.081**	0.062*	0.060
	(0.038)	(0.036)	(0.036)
Rich	0.097**	0.040	0.070**
	(0.032)	(0.030)	(0.030)
Total children ever born	-0.063***	-0.058***	-0.060***
	(0.008)	(0.008)	(0.008)
Post (year=2018)	-0.054	-0.048	0.056
	(0.080)	(0.074)	(0.078)
Time FE	Yes	Yes	Yes
Observations	1739	1739	1739

Robust standard errors in parentheses *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Sample is all women who have been pregnant before during NDHS survey rounds in 2003, 2008, 2013, and 2018. Early Antenatal care attendance is captured as 1 if a woman attended antenatal care before 12 weeks' gestation and 0 otherwise. Blood pressure checks is coded as 1 if a woman received a blood pressure check during pregnancy and 0 otherwise. Ever attended antenatal care is coded as 1 if a woman attended an antenatal clinic during pregnancy and 0 otherwise. In this specification, I include controls for three categories of educational attainment including primary education, secondary education and higher education and omit no education. All specifications are difference-in-differences models and include time-fixed effects.

2.5.2. Event study plots

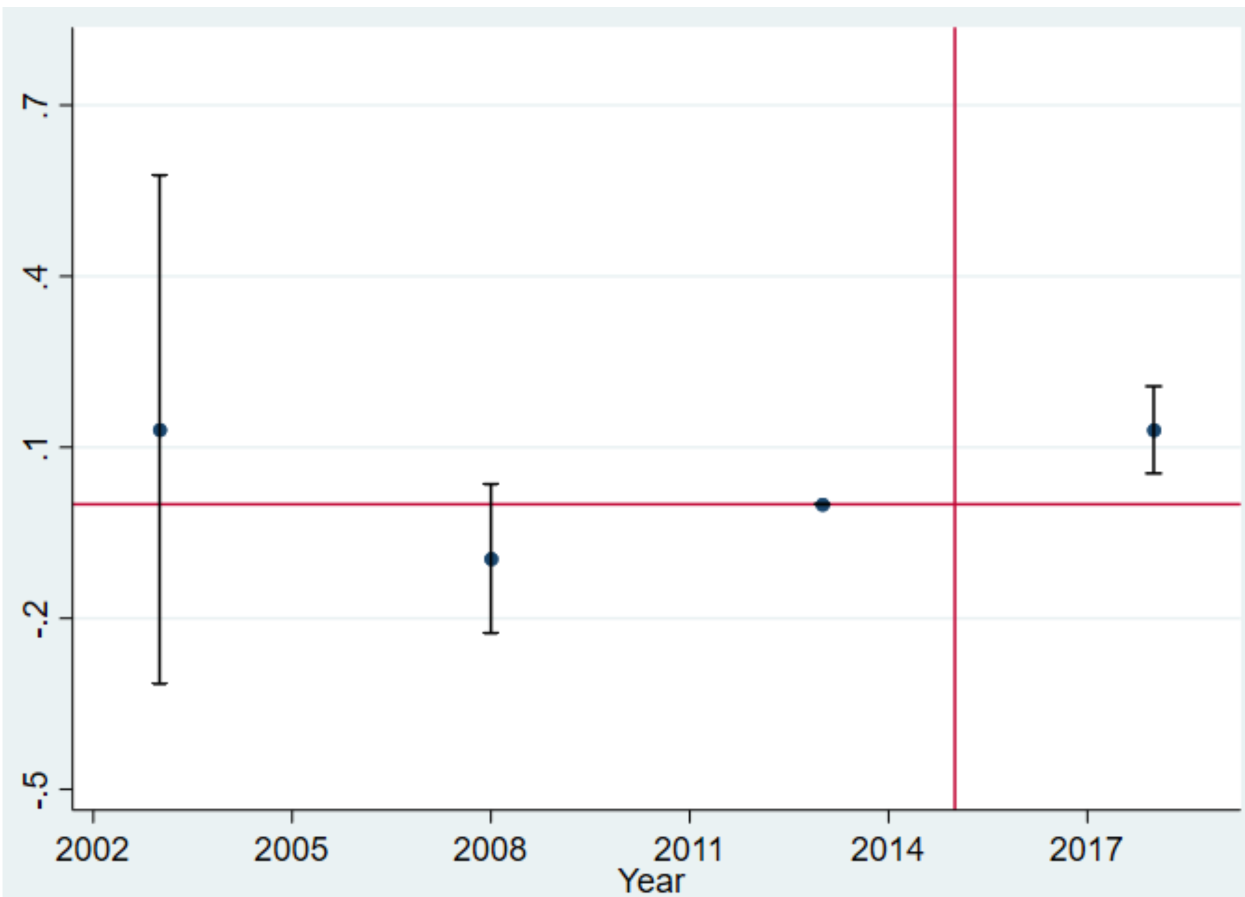
Figures 2.4, 2.5, and 2.6 show the estimates of θ_t in the event study specification given by equation (2). For the effects on early ANC visits, Figure 5 suggests no economical and statistical difference between treatment and control states prior to introducing Project Hope. This further supports the validity of the parallel trends assumption underlying my identification strategy. For the effects on blood pressure checks and ever attended ANC visits, I find a similar pattern with slight differences only in the earliest pre-treatment year, 2003. For the post-treatment period, I find statistically significant differences between treatment and control for all three of the outcome variables.

Figure 2.4. ***Event Study of the effects of Project Hope on Ever attended ANC visits.***



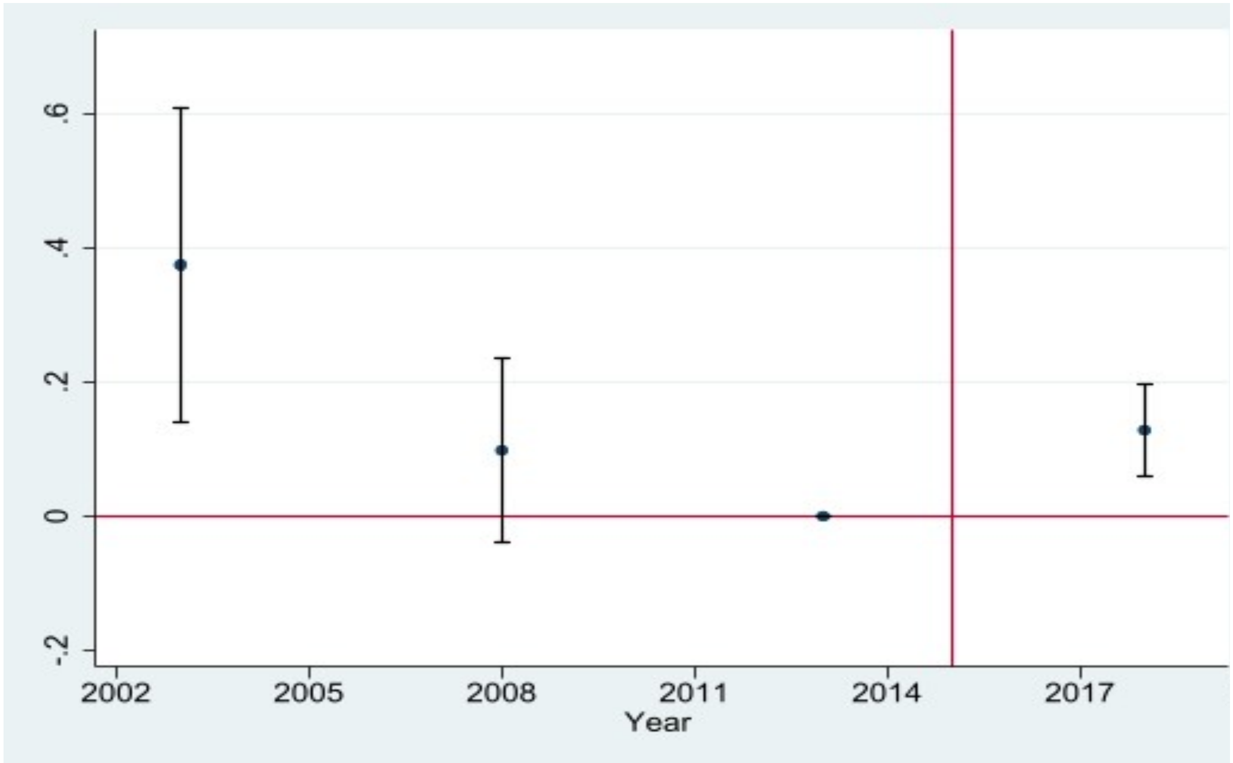
Notes: In each figure, I estimate two separate regressions. Each event study regression plot has its point estimates (circles) and 95% confidence intervals (error bars) as shown in each figure. I used data for the period before Project Hope (2003-2013) to estimate the pre-Project Hope coefficients with 2013 as my base year. In the second regression, I used all datasets (2003-2018) to generate the post-Project Hope estimate, using the pre-Project Hope period (2003-2013) as my reference point. My regressions include controls for three categories of educational attainment including primary education, secondary education and higher education and omit no education. I also account for wealth index, total number of children ever born, and age.

Figure 2.5. ***Event Study of the effects of Project Hope on Early ANC visits.***



Notes: In each figure, I estimate two separate regressions. Each event study regression plot has its point estimates (circles) and 95% confidence intervals (error bars) as shown in each figure. I used data for the period before Project Hope (2003-2013) to estimate the pre-Project Hope coefficients with 2013 as my base year. In the second regression, I used all datasets (2003-2018) to generate the post-Project Hope estimate, using the pre-Project Hope period (2003-2013) as my reference point. My regressions include controls for three categories of educational attainment including primary education, secondary education and higher education and omit no education. I also account for wealth index, total number of children ever born, and age.

Figure 2.6. ***Event Study of the effects of Project Hope on Blood pressure checks.***



Notes: In each figure, I estimate two separate regressions. Each event study regression plot has its point estimates (circles) and 95% confidence intervals (error bars) as shown in each figure. I used data for the period before Project Hope (2003-2013) to estimate the pre-Project Hope coefficients with 2013 as my base year. In the second regression, I used all datasets (2003-2018) to generate the post-Project Hope estimate, using the pre-Project Hope period (2003-2013) as my reference point. My regressions include controls for three categories of educational attainment including primary education, secondary education and higher education and omit no education. I also account for wealth index, total number of children ever born, and age.

2.5.3. Results from restricted sample of women with children 3 years old and below

The Demographic and Health Surveys are conducted every five years with questions on pregnancy mostly focused on pregnancies which occurred in the past five years. This means that for the 2018 questionnaire, women were asked about pregnancies which occurred between 2014-2018. Given that Project Hope spanned 2015 to 2019, the treated sample considered in my main analysis likely contained some women who had children in the year before treatment started.

Thus, I conduct a further robustness check to isolate women from Cross Rivers state who had children 3 years old and under at the time of the 2018 NDHS. I find that Project Hope continues to significantly influence the likelihood of early ANC attendance. Results in Table 2.4 show that Project Hope increases the likelihood of early ANC attendance by 24.5 percentage points ceteris paribus. This estimate is somewhat larger in magnitude than the corresponding result from Table 2.3, indicating that the presence of some ``untreated'' pregnancies in the treatment group was causing downward bias in my main results. As with the main results in Table 2.3, I do not find a significant impact of Project Hope on either the likelihood of ever attending antenatal care or on the likelihood of receiving a blood pressure check during pregnancy.

Table 2.4. *Results from sample with children 3 years old and under*

	(1) Early ANC Attendance	(2) Blood Pressure	(3) Ever attended antenatal Care
Treat*Post	0.245***	0.069	0.081
	(0.067)	(0.056)	(0.055)
Age	0.013***	0.016***	0.017***
	(0.002)	(0.002)	(0.002)
Primary Education	0.190**	0.363***	0.246**
	(0.091)	(0.088)	(0.087)
Secondary Education	0.189**	0.357***	0.258***
	(0.080)	(0.079)	(0.077)
Higher Education	0.200**	0.290***	0.172**
	(0.086)	(0.084)	(0.082)
Employed	-0.002	-0.030	-0.060**
	(0.032)	(0.028)	(0.028)
Treated	-0.073	0.111**	0.124**
	(0.054)	(0.045)	(0.046)
Poorest	-0.225**	-0.379**	-0.242*
	(0.108)	(0.123)	(0.127)
Poor	-0.069	0.018	0.047
	(0.063)	(0.056)	(0.052)
Middle Class	0.074*	0.061	0.055
	(0.043)	(0.037)	(0.037)
Rich	0.105**	0.046	0.078**
	(0.036)	(0.031)	(0.030)
Total children ever born	-0.057***	-0.049***	-0.050***
	(0.009)	(0.008)	(0.008)
Post (year=2018)	-0.031	-0.033	0.089
	(0.085)	(0.075)	(0.077)
Time FE	Yes	Yes	Yes
Observations	1396	1396	1396

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. Sample is all women who have been pregnant before during NDHS survey rounds in 2003, 2008, 2013, and 2018 and who have children 3 years old and younger as at the 2018 survey. Early Antenatal care attendance is captured as 1 if a woman attended antenatal care before 12 weeks' gestation and 0 otherwise. Blood pressure checks is coded as 1 if a woman received a blood pressure check during pregnancy and 0 otherwise. Ever attended antenatal care is coded as 1 if a woman attended an antenatal clinic during pregnancy and 0 otherwise. In this specification, I include controls for three categories of educational attainment including primary education, secondary education and higher education and omit no education. All specifications are difference-in-differences models and include time-fixed effects.

2.5. Conclusion

This study examines how Project Hope, a maternal healthcare intervention in Cross Rivers State, Nigeria which targets all three delays of maternal healthcare impacts the likelihood of attending antenatal care before 12 weeks' gestation, the likelihood of attending antenatal care at all, and the likelihood of receiving blood pressure checks during pregnancy. Although I find no significant impacts of Project Hope on the likelihood of attending antenatal care at all or getting a blood pressure check during pregnancy, I find that it increases the likelihood of early ANC attendance by 19.2 percentage points.

My results suggest that Project Hope was effective in increasing the likelihood of early attendance of antenatal care for women in Cross Rivers State. As a result of Project Hope, women were more likely to attend antenatal clinics before 12 weeks' gestation.

One limitation of my analysis is that I am not able to account for the entirety of the effects of Project Hope on my outcome variables of interest. Because the Demographic and Health Surveys (DHS) are collected every five years, the most recently available year is 2018. Thus, my results may best be interpreted as a lower bound measure of Project Hope's impacts on the likelihood of early antenatal care attendance and the likelihood of receiving blood pressure checks.

As long as there are barriers to accessing maternal healthcare in Nigeria, women will continue to die from pregnancy related causes. The literature has cited delays in deciding to seek care, report to the healthcare center, and receive care upon arrival as the principal causes of high maternal mortality in Nigeria. Thus, by removing barriers to accessing critical care during pregnancy and targeting all three delays, Project Hope can lead to improved maternal outcomes.

Chapter 3 - The Influence of English Language Proficiency on Immigrant's Labor Force Participation in the US

3.1. Introduction

Several studies have shown that English is an important marker of assimilation into the US economy (Carliner 2000, Bleakely 2007, Adserà, A., Pytliková, M. (2016)). As a result, immigrants who are proficient in English language upon arrival in the country are predicted to fare better than those with relatively lower levels of English language ability because they are better able to find jobs and establish critical relationships to thrive (Bleakley and Chin, 2004).

My study establishes the causal effects of English language ability on the likelihood that female immigrants to the US participate in the labor force. Specifically, I investigate the effects of speaking better English on the likelihood that female immigrants arriving to the US as children participate in the US labor force as adults within 16 to 30 years of their arrival.

Estimating the effect of English language proficiency on female immigrant labor force participation is challenging because it is likely that English language ability is endogenous. English language ability is correlated with several other factors that may also affect an immigrant's labor force participation in the US. For example, higher ability female immigrants are likely to learn English better and more quickly and are similarly more likely to succeed in the US labor force than their counterparts who are lower ability. As a result, using Ordinary Least Squares to estimate the effects of English language ability on labor force participation decisions is likely to yield biased estimates.

My identification strategy relies on an instrument, first proposed in Bleakley and Chin (2004), which interacts arriving in the US at a young age with arriving from a non-English speaking country. To make this clearer, consider two childhood immigrants to the US who arrive from Ghana (English speaking country) and Russia (non-English speaking country). Additionally, assume they arrive at parallel ages- 4 and 10 years around the same time. Upon arrival in the US, both the Ghanaians and the Russians have similar experiences with the exception of a new language for the Russians- English. In this case, any future differences between the 4-year-old Russian and the 10-year-old Russian can be attributed to age at arrival effects because one had earlier exposure to US culture, systems, and institutions than the other. However, since the Ghanaians have similar experiences as the Russians, they can be used to control for non-language effects of age at arrival. This means that when we partial out the future differences in labor force participation between the two Russians and the two Ghanaians and we net out the difference between the two, what will be left is the effect of English language proficiency.

I use data from the 2019 American Community Survey (ACS) for my study. My sample includes female immigrants who arrived in the US as children under the age of 18. I find a significant positive effect of English language ability on the likelihood that female immigrants to the US will participate in the labor force. I find that speaking English well increases the likelihood of future labor force participation by 21 percentage points. I find that this result is driven by women who are married and have children - a group who are likely to face additional barriers to labor force participation.

Two theorems in economics explain a woman's decision to participate in the labor force: The theory of the reservation wage, and the theory of human capital. A woman's reservation wage explains how much she prefers home production over market production. It may be influenced by how much her spouse earns, whether she has children, and whether there are available substitutes for household production. Thus, a woman with a higher reservation wage is more likely to prefer household production to working in the market place. The theory of human capital, on the other hand, posits that language, education, training, and experience all increase employability and may go on to affect labor force participation decisions. According to this theory, immigrants who speak the language of the host country, especially those who are highly educated, have more human capital than those who do not speak the host country language.

Although there is a lot of research on how English language helps male immigrants settle into life in the US and find jobs (Berman, Lang, and Siniver, 2003, Bleakley and Chin, 2004, Chiswick, Barry, and Miller, 2002, Kim, Jongsung, 2002), not much is known about how female immigrants may benefit from speaking English. The research on the relationship between language proficiency and labor market outcomes of immigrants has so far focused on men. Kossoudji (1988) found that English language deficiency is costlier for and reduces earnings for Hispanic male immigrants as compared with their East Asian counterparts. In Aldashev et al.'s (2008) investigation of how fluency in German affects labor market outcomes for male immigrants in Germany, they found that more fluent male immigrants have greater chances of landing white collar jobs than their counterparts who don't speak German as well. Miguel and Planas (2009) also established that Mexican male immigrants who don't speak good English find it more difficult to find professional or managerial jobs in the US. Other studies (Chiswick and Taengnoi 2007, Chiswick and Miller 2009) have also examined the impacts of English language proficiency on other labor market outcomes of male immigrants.

So far, these studies have established that English language is a crucial component of human capital that impacts various labor market outcomes of male immigrants across the world. However, less is known about how English language proficiency impacts female immigrant labor market outcomes in the host country, especially as it relates to their labor force participation in the host country. The factors affecting labor force participation for female immigrants also differ from men. For instance, unlike men, women are often 'tied movers' who move with their families to other countries to seek greener pastures (MacPherson and Stewart 1989, Ozden and Neaglu 2008). Additionally, cultural influences may induce even highly-educated female immigrants to pursue home production rather than market production (Bredtman and Otten 2022, Stranges 2022, Read 2004) which is not the case with male immigrants. Given these differences, it is crucial to understand how factors such as marriage and childbirth affect these decisions. Thus, my research attempts to fill this gap and provide a causal estimate of the impacts of English language ability on the likelihood of labor force participation for female immigrants to the US.

The rest of my study is organized as follows: In section 2, I explain my data and empirical strategy. In section 3, I present my results and then conclude in section 4.

3.2. Data

For this analysis, I use data from the Integrated Public Use Microdata Series (IPUMS). Specifically, the 2019 American Community Survey (ACS) census data, which includes information on age at arrival, English language proficiency, labor force status, and education level. I use data on female immigrants who arrived in the US as children (under age 18). Given the age restriction, this sample of immigrants have no direct control over their immigration decisions, as they moved to the US as minors. I define the age at arrival as [(current age) - 2019 - (year of immigration)].

My sample thus includes female childhood immigrants who arrived in the USA between 1989 and 2003, or those who have been residing in the US for 16 to 30 years. I do not include individuals who immigrated after 2003, because more recent immigrants could still be in school in 2019. I further restrict my sample to working-age individuals, between the ages of 25 and 49 in 2019. I define an 'immigrant' as an individual who was not born in the US and who has either naturalized in the country or remains a noncitizen. Except for those who failed to respond to the question on their immigrant status, all other women are considered natives and dropped from my sample.

I dissect the above sample into three distinct categories of female immigrants by country of birth: those from countries that have English as their official language, those from non-English speaking countries, and those from countries where English is the dominant and official language. The control group focuses on those from countries with English as both the official and dominant language while the treatment group consists of those from non-English speaking countries. Those from countries with English as the official, but not dominant language are dropped from my analysis because I cannot accurately measure their level of exposure to and understanding of the English language. For example, although Seychelles has English as one of its official languages, over 54% of the population speaks French. [26]

The main explanatory variable in my model is the SPEAKENG variable in the ACS, which indicates whether a respondent speaks only English at home, as well as how well they speak English if they speak a language other than English at home. Beyond the 1980 census, ACS provides self-reported information on each immigrant's level of English proficiency. I follow the ACS construction of this variable for my analyses. Using this method, an individual is

[26] https://frenchside.co.za/list-of-french-speaking-countries-in-africa/#:~:text=Seychelles%20is%20last%20on%20the,French%2C%20Seychellois%20Creole%20and%20English.

scored zero if they don't speak English, one if they don't speak English well, two if they speak English well, and three if they speak English very well.

Since my research focuses on labor force participation as the main dependent variable, I classify participation using the "labforce" variable in the ACS which measures if an individual is currently in the labor force.

3.3. Methodology

To examine whether lower English proficiency leads to lower labor force participation among immigrant women in the US, I estimate the following baseline model:

$$y_{it} = \beta P_{it} + X_{it}'\delta + \tau_c + \gamma_a + \phi_s + \epsilon_{it} \ldots (1)$$

where y_{it} = female immigrant i's labor force participation at survey year t; P_{it}= English Proficiency; X_{it}= controls for age, race, having young children at home under 5 years old and Hispanic origin; τ_c = country of birth fixed effects,γ_a = age at arrival fixed effects and ϕ_s = state fixed effects. I use the ACS sampling weights in my analysis and run regressions using standard errors clustered at the state level.

The culture in one's country of origin may impact an individual's ability to learn English Language and their willingness to participate in the labor market. Blau et al (2011) find that women from countries with high female labor force participation tend to participate more in the US labor force upon arrival than those from countries with relatively low rates of participation.

Furthermore, studies have shown that other source-country characteristics such as GDP may influence destination-country outcomes.[27] To control for these non-language, source-country influences, I include country of origin fixed effects.

However, even after controlling for country of origin, there may be additional omitted variables affecting both English language ability and labor force participation such as one's innate level of ability, necessitating the use of an instrumental variable approach.

3.3.1. Instrumental Variable Approach

Following Bleakley and Chin (2004), I use an instrument that interacts arriving in the USA as a child up to 11 years old with arriving from a non-English speaking country. This instrument's validity depends on two conditions: First, the instrument is correlated with a female immigrant's English Language proficiency. Given that my sample consists of childhood immigrants, these young arrivers can attend preparatory school in the USA and improve their English language ability over time and consequently become better suited for the labor market in the future. This is supported by the critical period hypothesis which posits that childhood immigrants arriving in the host country just before puberty can easily and quickly acquire the host country language almost up to the level of the natives (Lenneberg, 1967).

Second, it must be the case that the instrument can only affect the likelihood of labor force participation through English language ability. This means that there must be no direct

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[27] Blau, Kahn & Paps (2008) for instance found evidence for the intergenerational transmission of gender roles. They found that the mother's source-country characteristics significantly impacted second-generation women's labor supply. Also, Blau, Kahn & Paps (2011) found that married women from countries with high labor supply work more than those from countries with low labor supply upon arrival in the destination country while Harford (2009) found a negative relationship between source country GDP per capita and female immigrant participation in the US labor force.

relationship between labor force participation and the instrument conditional on additional controls. This implies that the spoken language in the immigrant's country of origin does not directly affect her labor force participation in the US after accounting for other factors.

In my example given in the introduction, the female immigrants from Ghana and Iran migrated to the US as children possibly in the company of their parents. As a result, I conclude that they had no control over their migration decisions at the time. Also, their innate abilities could not be influencing their migration decisions, as they migrated to the US as children. Finally, coming from a non-English speaking country was not their decision to make as that was determined at birth. As a result, my instrument is not correlated with any unobservable factors that could generate omitted variable bias. Given these premises, I posit that the instrument meets the exclusion restriction as it relies on the variation that is not explained by non-language variables from the source country.

I estimate the following first-stage regression:

$$P_{it} = \alpha_1 T_{it} + \alpha_2 X_{it} + \tau_c + \gamma_a + \phi_s + \mu_{it} \ldots (2)$$

where T_{it}= female immigrant i's interaction term that interacts age of arrival in the US, conditional on that age begin less than 11,[28] and an indicator for migrating from a non-English-speaking country. $\tau_c, \gamma_a, \phi_s, P_{it}$ and X_{it} are the same as in equation (1) above.

3.4. Results

3.4.1. Descriptive statistics

To begin my discussion of results, I present a general overview of my sample in Tables 1 and 2 below: There are 62,399 female immigrants in total, out of which 57,708 are from English-

[28] Age 11 is chosen to conform with the critical period hypothesis which posits that one's ability to learn a new language declines significantly after age 11.

speaking countries and 4,691 are from non-English-speaking countries. In highlighting some marked differences between immigrant source country types, I observe that immigrants from English-speaking countries have more years of schooling on average and are more active in the labor force than their non-English-speaking counterparts. Additionally, they arrive in the US much younger and speak better English than those from non-English speaking countries.

3.4.2. Effects of English language ability on labor force participation for general immigrant sample

Table 2, column 1 displays estimation results from the first stage equation. These results show a significant and large negative correlation between the instrument T_{it} and English language ability, P_{it} , suggesting that immigrants arriving in the US from non-English speaking countries at ages closer to 11 have poorer adult English language ability than those who arrive at even younger ages.

I estimate the effects of English language ability on labor force participation for the total sample of female immigrants in columns 2 and 3 of Table 3.1. Column 2 shows OLS results while column 3 shows results from the instrumental variable regression. The IV regression in column 3 for instance shows that speaking English well raises the likelihood of labor force participation by 21 percentage points as compared with not speaking English well. Zhen (2013) finds comparable results for male immigrants to the US. According to her results, those who speak English well earn about 17.7% more than those who do not speak as well. For the OLS estimates, speaking English well increases the likelihood of participating in the labor force by 14 percentage points, slightly lower than the IV estimate.

Table 3.1. ***Summary statistics***

	English speaking country		***Non-English speaking country***	
	Mean	Standard deviation	Mean	Standard deviation
Labor force status	0.851	0.356	0.685	0.464
Instrumental variable: arriving young * non-English-speaking country	0.000	0.000	2.214	2.274
Does not speak English	0.001	0.024	0.077	0.266
Does not speak English well	0.002	0.039	0.199	0.399
Speaks English well	0.013	0.113	0.218	0.413
Speaks English very well	0.985	0.122	0.506	0.500
Year of immigration	1995.090	4.179	1995.531	4.297
Age at arrival	10.620	4.767	11.399	4.728
Mother	0.564	0.496	0.743	0.437
White	0.327	0.469	0.599	0.489
Black	0.531	0.499	0.029	0.168
Asian/nonwhite	0.142	0.349	0.371	0.483
High School Diploma or higher	0.967	0.177	0.699	0.459
Age (in 2019)	34.530	5.516	34.869	5.491
Hispanic origin	0.009	0.097	0.766	0.424
Married with no children	0.111	0.314	0.087	0.282
Married with children	0.333	0.471	0.504	0.500
Unmarried with children	0.231	0.422	0.239	0.427
Unmarried without children	0.325	0.469	0.169	0.376
Observations	***4691***		***57708***	

The lower OLS estimate may be an indication of downward bias, as there could be measurement error from people's subjective assessment of their English language ability in the 2019 American Community Survey. This may also be due to the fact that OLS uses all the variation while the IV uses only the variation in language skills spurred on by the instrument. Additionally, there may be an omitted variable that is positively correlated with English language proficiency and negatively correlated with labor force participation (or vice versa) that causes downward bias in OLS estimates. For example, self-selecting into a Mexican enclave may make one less likely to be proficient in English, but more likely to participate in the labor force. This is because with Spanish as the dominant language within the enclave, it is difficult to learn an additional language. Additionally, local connections may make it easier to find a job within the enclave.

In appendix Table C, I estimate the effects of the ordinal measure of English language ability on the likelihood of labor force participation for my full sample. Here, English language ability is defined as an ordinal measure from 0 to 3 where 0 represents 'Does not speak English' and 3 means 'Speaks English very well.' The 2SLS estimates show that improving from not speaking English well to speaking English well increases the likelihood of labor force participation by 10.71 percentage points.

Table 3.2. ***Results for general sample, all female immigrants.***

Dependent variable:	English ability	Labor force participation	
	(1)	(2)	(3)
	First stage	OLS	2SLS
IV	-0.0671***		
	(0.0032)		
Speaks English Well		0.1407***	0.2105***
		(0.0092)	(0.0405)
Hispanic origin	-0.0827**	0.0258	0.0317
	(0.0245)	(0.0218)	(0.0211)
Child at home under 5	-0.0014	-0.1669***	-0.1669***
	(0.0046)	(0.0086)	(0.0083)
Country FE	Yes	Yes	Yes
Age at arrival FE	Yes	Yes	Yes
State FE	Yes	Yes	Yes
Observations	62399	62399	62399

Standard errors in parentheses clustered at state level.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
Notes: Weighted using IPUMS weights. All regressions include three categories of race (white, black, other) age at arrival, state, and country of birth fixed effects This is the sample of all female immigrants who arrived in the USA between 1989 and 2003 as captured in the 2019 ACS.

3.4.3. Effects of English language ability on labor force participation for immigrant mothers

Table 3.3 restricts the sample to immigrants who are now mothers. There is much evidence in the literature showing that women who have children at home face additional barriers to assimilation that makes it harder for them to work (Mincer 1962, Reimers 1985, Abraham and Hippie 2006).[29] According to Brown, Roberts, and Taylor (2011), women with children, especially those whose children are below the preschool age have higher reservation wages and as such higher costs of labor market entry. It may be the case that, among this group, reservation wages are too high to be affected by English language ability. On the other hand, it may be the case that these women are more on the margin in terms of their labor force decisions and thus, more susceptible to the effects of higher English language proficiency. My estimates show that the latter is more likely - English language ability has a strong positive influence on the likelihood of labor force participation for the sample of immigrant mothers.

The 2SLS estimate shows that speaking English well increases the likelihood of labor force participation by 18.65 percentage points for an immigrant mother. When I further restrict the sample to those with children under age 5 at home, I find an even larger, significant positive effect of English language ability on the likelihood of labor force participation (Table 3.4). When I evaluate the 2SLS estimate of the effect of English language as a percent change at the mean, I find a bigger effect of language proficiency on labor force participation for female immigrants who are now mothers with children under 5 years old at home than for female immigrants in the general sample and those who are now mothers. This shows that ceteris paribus, the biggest impact of English language ability on labor force participation is concentrated on the subsample of female immigrants with children under 5 years old.

[29] https://www.bls.gov/opub/ted/2022/labor-force-participation-of-mothers-and-fathers-little-changed-in-2021-remains-lower-than-in-2019.htm

Table 3.3. ***Results for sample of female immigrants who are now mothers***

Dependent variable:	English ability	Labor force participation	
	(1)	(2)	(3)
	First stage	OLS	2SLS
IV	-0.0647***		
	(0.0024)		
Speaks English Well		0.1390***	0.1865***
		(0.0083)	(0.0550)
Hispanic origin	-0.0769*	0.0223	0.0260
	(0.0338)	(0.0268)	(0.0264)
Child at home under 5	0.0232***	-0.1368***	-0.1379***
	(0.0045)	(0.0083)	(0.0080)
Country FE	Yes	Yes	Yes
Age at arrival FE	Yes	Yes	Yes
State FE	Yes	Yes	Yes
Observations	45458	45458	45458

Standard errors in parentheses clustered at state level.

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

Notes: Weighted using IPUMS weights. All regressions include three categories of race (white, black, other), age at arrival, state, and country of birth fixed effects. This is the sample of female immigrants who arrived in the USA between 1989 and 2003 and who had at least a child at home at the time of the 2019 ACS. The mean for this subsample using the 2SLS estimate is -0.71.

Table 3.4. ***Results for sample of female immigrants who are now mothers with children under age 5 at home***

Dependent variable:	English ability	Labor force participation	
	(1)	(2)	(3)
	First stage	OLS	2SLS
IV	-0.0764***		
	(0.0035)		
Speaks English Well		0.1587***	0.2414**
		(0.0143)	(0.0773)
Hispanic origin	-0.0875*	-0.0111	-0.0037
	(0.0394)	(0.0496)	(0.0514)
Country FE	Yes	Yes	Yes
Age at arrival FE	Yes	Yes	Yes
State FE	Yes	Yes	Yes
Observations	19046	19046	19046

Standard errors in parentheses clustered at the state level.

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

Notes: Weighted using IPUMS weights. All regressions include three categories of race (white, black, other), age at arrival, state, and country of birth fixed effects. This is the sample of female immigrants to the USA who arrived between 1989 and 2003 and who had a child at home under 5 years old at the time of the 2019 ACS. The mean for this subsample using the 2SLS estimate is -0.59.

3.4.3. Effects of English language ability on married and unmarried women with and without children

Tables 3.5 and 3.6 show the impacts of English language proficiency for restricted samples of married and unmarried women with and without children. For married women with children, the IV estimate shows that speaking English well increases the likelihood of labor force participation by 19.26 percentage points. For those without children, the effect is about 2.82 percentage points, and is not significant. This is expected because for married women without children, research has shown that it is much easier to participate in some form of economic activity with or without language ability than for those who have children (Hoffmann 2009, Mahoney 1961). We can thus reasonably conclude that married women without children may have lower opportunity costs of participating in the labor force than those who have children.

As compared with married women, the 2SLS estimates for unmarried women with and without children do not show a significant effect of speaking English well on labor force participation. This is consistent with prior findings which find that unmarried women have a lower reservation wage than their married counterparts (Ismayilov 2020, Mincer 1962, Schwartz, J. Brad, et al. 1990, Juhn and Potter 2006) and are as such more likely to participate in the labor force than their married counterparts.

Table 3.5. ***Effects on married women***

	Labor force participation			
	Married with kids		Married no kids	
	OLS	2SLS	OLS	2SLS
Speaks English Well	0.1631***	0.1926*	0.1476***	-0.0282
	(0.0115)	(0.0762)	(0.0250)	(0.1800)
Child at home under 5	-0.1219***	-0.1228***	0.0000	0.0000
	(0.0072)	(0.0075)	(.)	(.)
Hispanic origin	0.0046	0.0062	0.0917	0.0746
	(0.0322)	(0.0322)	(0.0691)	(0.0842)
Country FE	Yes	Yes	Yes	Yes
Age at arrival FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Observations	32015	32015	5945	5945

Standard errors in parentheses clustered at state level.

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

Notes: Weighted using IPUMS weights. All regressions include three categories of race (white, black, other), age at arrival, state, and country of birth fixed effects. This is the sample of female immigrants who arrived in the USA between 1989 and 2003 and who were married with or without children at the time of the 2019 ACS.

Table 3.6. ***Effects on unmarried women***

	Labor force participation			
	Unmarried with kids		Unmarried without kids	
	OLS	2SLS	OLS	2SLS
Speaking English Well	0.1001***	0.0948	0.1052***	0.2137
	(0.0117)	(0.0762)	(0.0151)	(0.1202)
Child at home under 5	-0.1279***	-0.1279***	0.0000	0.0000
	(0.0152)	(0.0151)	(.)	(.)
Hispanic origin	0.0548	0.0542	0.0376	0.0494
	(0.0468)	(0.0485)	(0.0442)	(0.0452)
Country FE	Yes	Yes	Yes	Yes
Age at arrival FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Observations	13443	13443	10996	10996

Standard errors in parentheses clustered at state level. *** p<0.01, ** p<0.05, * p<0.1

Notes: Weighted using IPUMS weights. All regressions include three categories of race (white, black, other), age at arrival, state, and country of birth fixed effects. This is the sample of female immigrants who arrived in the USA between 1989 and 2003 and who were married with or without children at the time of the 2019 ACS.

3.4.4. Effects on labor force participation using alternative country specifications.

In Table 3.7 below, I account for the fact that some countries may introduce bias in my main specification due to historical or institutional factors. Countries which are culturally and institutionally similar to the US may be poor controls for the non-language effects of an immigrant's age upon arrival in the US because there may be little to no difference between those countries and the US. I test the robustness of my results to excluding such countries. When I exclude Canadian immigrants from the estimation sample, I find that my estimates do not change significantly. In fact, the OLS estimate for the sample excluding Canadians remains the same as that for the general sample. The results remain robust when I additionally exclude immigrants from Australia, New Zealand, the United Kingdom, England, Wales, and Scotland which are advanced English-speaking countries, and which share cultural and institutional similarities to the US.

Table 3.7. ***Effect on labor force participation- Alternative Countries considered in the sample***

Dependent variable:	Labor force participation	
	OLS	2SLS
All countries	0.1407***	0.2105***
Speaks English well	(0.0092)	(0.0405)
N	*62,399*	*62,399*
Excluding Canada	0.1407***	0.391***
Speaks English well	(0.0093)	(0.0442)
N	61,498	61,498
Excluding advanced English countries	0.1408***	0.1699***
Speaks English well	(0.0092)	(0.0409)
N	*60,834*	*60,834*

Standard errors in parentheses clustered at state level.

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

Notes: Weighted using IPUMS weights. All regressions include three categories of race (white, black, other) age at arrival and country of birth fixed effects.

3.4.5. Effects of English language ability on educational attainment

In the US, classes in both public and private schools are mainly taught in English. This means that English ability is important for understanding study materials and progressing to the next class. As such, immigrants with lower language ability may find it hard to study and understand the materials taught in class which may negatively impact their studies. In cases where they can grasp the material, it may take a great deal of effort and time which are both costly.

Research has shown that English language is crucial for participating in the US labor force (Bleakley and Chin 2004, Kerr, Kerr, and Smith 2024). Since instruction in US schools is mostly taught in English language, it may be the case that English language ability acts through increasing educational attainment to impact labor market outcomes. In order to investigate this possibility, I estimate the impacts of English language ability on educational attainment. For this model, I alter my specification slightly. I do not include some of the controls included in my other models such as having a child at home under 5 years old. This is because, for immigrants who are yet to earn a high school diploma, there is a great chance that they do not have children at home yet.

The results in Table 3.8 show that speaking English well does not significantly impact the likelihood of completing college (2SLS estimates). This is consistent with prior studies (Fry, Richard 2002, Vernez, Georges, and Allan Abrahamse, 1996) which find that immigrants are less likely to complete college than their native counterparts. Additionally, only 24% of the women in my sample have completed college and this may be driving this insignificant estimate.

Speaking English well significantly increases the likelihood of obtaining a high school diploma by 53.48 percentage points (2SLS estimates). These findings are similar to those of Bleakley and Chin 2004, Kerr, Kerr, and Smith 2024, and Aoki, Yu, and Lualhati Santiago (2018) who all find that speaking better English increases educational attainment and goes on to promote better labor market outcomes for immigrants to the US. Since the literature has shown that obtaining a high school diploma is crucial for becoming employable in the US, these results may mean that English language proficiency helps to build the human capital necessary for becoming a productive member of the labor force.

Table 3.8. ***Effects on labor force participation and educational attainment: High school diploma and College degree.***

	Labor force participation		High School Diploma		College Degree	
	OLS	2SLS	OLS	2SLS	OLS	2SLS
Speaks English Well	0.1407***	0.1784***	0.2646***	0.5348***	0.1432***	0.0611
	(0.0093)	(0.0405)	(0.0177)	(0.0563)	(0.0099)	(0.0766)
Hispanic origin	0.0362	0.0394	0.0131	0.0360	-0.0459**	0.0529**
	(0.0212)	(0.0205)	(0.0212)	(0.0192)	(0.0170)	(0.0176)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Age at arrival FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	62399	62399	62399	62399	62399	62399

Standard errors in parentheses clustered at state level.

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

Notes: Weighted using IPUMS weights. All regressions include three categories of race (white, black, other), age at arrival, state, and country of birth fixed effects.

3.5. Conclusion

Several studies have long established English language ability as an important marker of assimilation upon arrival in the United States. My study reinforces these findings and contributes to the literature on the effect that age at arrival has on future labor market outcomes for female childhood immigrants to the US. In this paper, I find a strong positive effect of speaking English well on future labor force participation for female childhood immigrants to the US. I find the greatest impacts of English language proficiency for the subsample of female childhood arrivers who are now mothers with children at home under 5 years old. When I exclude advanced countries with similar cultures and institutions as the USA such as Canada, New Zealand, England, and Australia, I still find a significant positive effect of speaking English well on future labor force participation.

Based on my findings, the timing of migration has profound effects on a number of economic outcomes. These include the likelihood that female childhood immigrants complete at least high school and the likelihood that they participate in the labor force in future. Speaking English well increases the likelihood that female childhood immigrants obtain at least a high school certificate in future. It also increases their probability of future labor force participation. To the extent that obtaining a high school diploma increases human capital and makes immigrants more employable, policy makers may consider incorporating English language programs which target childhood arrivers since they have lower costs of assimilation. By receiving early exposure to English language, childhood arrivers are more likely to complete high school and develop employable skills to increase their future productivity.

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Appendix A - Chapter 1

A.1. Data and variable descriptions

Afrobarometer data from survey rounds 6 & 7: The questions asked on trust are structured as: "Do you trust your Parliamentarians?" for example, and responses are recorded as 0- "Not at all", 1- "Just a little", 2- "Somewhat", and 3- "A lot."

World Bank data: The question asked on the COVID-19 vaccine was framed as: "Would you take a free, safe COVID-19 vaccine if one becomes available?", and responses were recorded as 1- "Yes", 2- "No", 3- "Not sure."

A.2 Additional Tables

Appendix Table A.1. ***Oster (2019) test for selection on unobservables results***

	Estimate	**Sq. difference from controlled beta**	**Bias Changes Direction**
Beta	2.0575	3.61	
Alt. sol. 1	-2.5328	8.24	Yes
Alt. sol. 2	-0.5129	9.24	Yes
	Estimate	**R-squared**	
Uncontrolled	0.1580	0.090	
Controlled	0.1584	0.090	
R_max	1.000		
Delta	0.5		

Notes: This is estimated using the Oster (2019) test for selection on unobservables which shows how omitted variable bias can impact coefficient stability. In this test, I assume that delta is 0.5.

Appendix Table A.2. ***Results from reclassifying all 'Not sure' and 'Maybe' responses as 'Yes'***

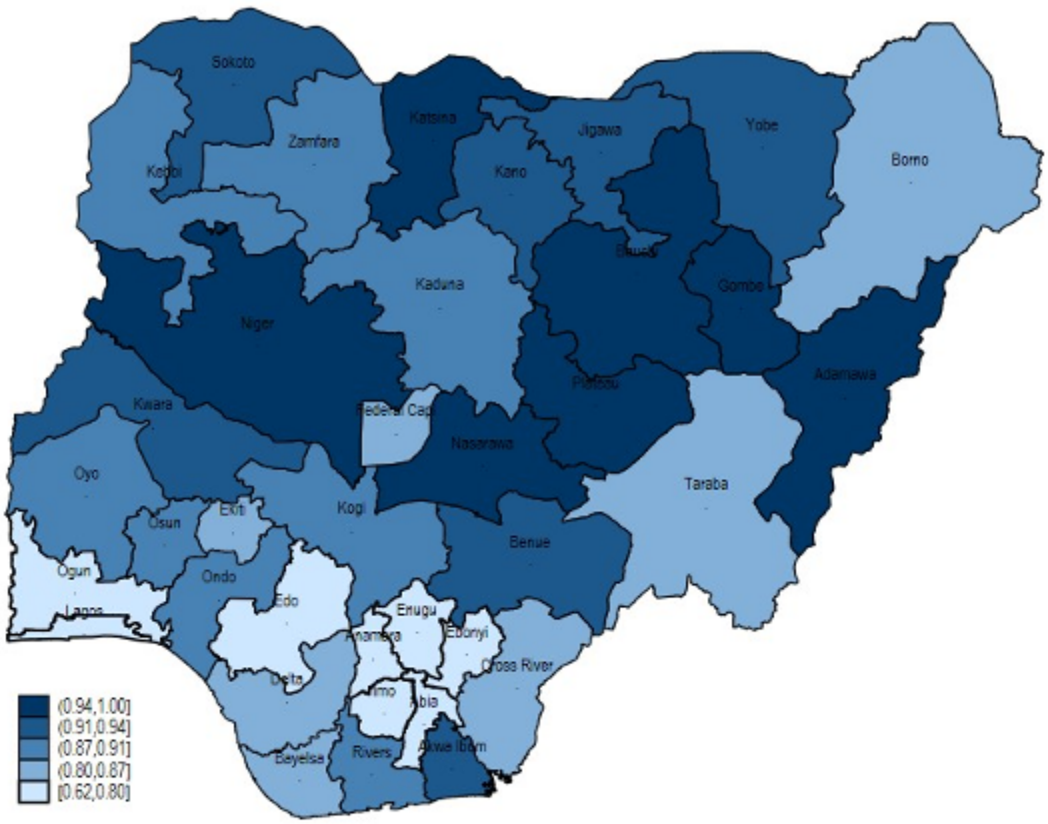
Dependent variable:	Vaccine acceptance			
Distance	0.1200***	0.1149***	0.1422***	0.1417***
	(0.0143)	(0.0143)	(0.0306)	(0.0307)
Age		-0.0004*	0.0001	0.0000
		(0.0002)	(0.0002)	(0.0002)
Male		-0.0057	-0.0047	-0.0049
		(0.0056)	(0.0055)	(0.0055)
Basic education		-0.0030	0.0024	0.0014
		(0.0098)	(0.0096)	(0.0096)
Secondary education		-0.0305	-0.0041	-0.0049
		(0.0291)	(0.0277)	(0.0277)
Employed		-0.0118*	0.0019	0.0034
		(0.0057)	(0.0055)	(0.0057)
Region FE	No	No	Yes	Yes
Time FE	No	No	No	Yes
Observations	11301	11301	11301	11301
Adjusted R^2	0.007	0.007	0.071	0.071
AIC	4838.4934	4835.7904	4122.9216	4129.1501

Notes: This regression is estimated using OLS. Standard errors (in brackets) are clustered at the city level. The dependent variable is people's willingness to accept a free COVID-19 vaccine. This is coded as 1 if people say "YES" and 0 otherwise. *** Means significant at 1 percent level, ** means significant at the 5 percent level, and * means significant at the 10 percent level.

Appendix Table A.3. ***Sample statistics for Afrobarometer data***

	Observations	Mean	Std. deviation	Minimum	Maximum
Distance	3179	0.5255	0.2109	0.1603	1.0185
Trust Score	3179	0.6930	0.2310	0.1477	1.0682
Age	3179	23.2828	18.6767	0.0000	100.0000
Basic Education	3179	0.0909	0.2875	0.0000	1.0000
Secondary Education	3179	0.0129	0.1128	0.0000	1.0000
Tertiary Education	3179	0.0035	0.0587	0.0000	1.0000
Employed	3179	0.4341	0.4957	0.0000	1.0000
Male	3179	0.5112	0.5000	0.0000	1.0000

Appendix Figure A.1. ***Map of Nigeria showing the likelihood of COVID-19 vaccine acceptance in different states***



Note: the numbers in each state show the proportion of respondents who answered "Yes" to the question on accepting free safe COVID-19 vaccines. On average, about 88% of Nigerians surveyed said they would take a free safe COVID-19 vaccine when one becomes available. Data was sourced from the World Bank COVID-19 National Longitudinal Phone survey for Nigeria.

Appendix B - Chapter 2

B.1. Definition of Variables

Appendix Table B.1. ***Definitions of some terms used in my research.***

Variable name	***Variable description***	***Numerator***	***Denominator***
Skilled birth attendance	Percent of live births facilitated by skilled medical practitioners	Number of live births in the 5 years preceding the DHS that were facilitated by a skilled medical practitioner in attendance	Total number of live births among women between ages 15-49 in the 5 years preceding the survey
Caesarean section birth	Percent of women who gave birth via caesarean section	Number of live births in the 5 years preceding the NDHS facilitated through caesarean section	Total number of live births among women aged between 15 years and 49 years in the 5 years preceding the NDHS
Child's birth weight (low birth weight less than 2.5kg)	Percent of live births in the 5 years preceding the survey weighing less than 2.5kg	Number of live births in the 5 years preceding the NDHS weighed and reported under 2.5kg	Number of live births in the 5 years preceding the survey who were weighed
Exclusive breastfeeding	Percent of youngest children under 6 months living with their mother who were exclusively breastfed	Number of youngest children under 6 months who are living with their mother who were breastfed and not given anything else in the 24 hours prior to the NDHS interview	Number of youngest children born within the 6 months preceding the NDHS who are living with their mother
Wealth Index	The wealth index is a composite measure of a household's cumulative living standard. The wealth index is calculated using data on a household's ownership of selected assets, such as televisions and bicycles; materials used for housing construction; and types of water access and sanitation facilities. It places individual households on a continuous scale of relative wealth. DHS separates all interviewed households into five wealth quintiles to compare the influence of wealth on various population, health and nutrition indicators.		
Highest educational level attended	This provides the level of education in the following categories: No education, Primary, Secondary, and Higher.		

Appendix C - Chapter 3

Appendix Table C.1. ***Results for general sample, all female immigrants using ordinal measure of English language ability***

Dependent variable:	English ability	Labor force participation	
	(1)	(2)	(3)
	First stage	OLS	2SLS
IV	-0.1319***		
	(0.0097)		
English language ability		0.0872***	0.1071***
(scale from 0-3, 3= best)		(0.0047)	(0.0203)
Child at home under 5	-0.0061	-0.1666***	-0.1666***
	(0.0117)	(0.0084)	(0.0082)
Age	0.0061***	0.0018*	0.0017*
	(0.0011)	(0.0007)	(0.0007)
Hispanic origin	-0.1558*	0.0279	0.0310
	(0.0673)	(0.0212)	(0.0206)
Country FE	Yes	Yes	Yes
Age at arrival FE	Yes	Yes	Yes
State FE	Yes	Yes	Yes
Observations	62399	62399	62399

Standard errors in parentheses clustered at state level.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: Weighted using IPUMS weights. All regressions include three categories of race (white, black, other) age at arrival, state, and country of birth fixed effects This is the sample of all female immigrants who arrived in the USA between 1989 and 2003 as captured in the 2019 ACs