

The Distributive Effect of Human Capital Formation (Via Education) on Welfare Outcome in Nigeria

by

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Abstract

The issue of inequality remains a contentious issue, especially in developing economies, and Nigeria is no different. Using 2016 Nigeria GHS data, this research assesses the distributional effect of education on welfare outcomes and examine whether residing in a Nigerian state with oil wealth contributes to the variation in the welfare outcome of heads of households.

This study uses the Ordinary Least Square (OLS) and Unconditional Quantile Regression (UQR) models as a technique of analysis, as well as the Gini-modified expenditure model in determining the extent to which education narrows welfare inequality.

The findings of the study indicate that welfare disparity is influenced by education levels and that having higher and secondary education levels contributes significantly to determining welfare outcomes across expenditure distributions. This is further amplified by the results of the Gini model which reveals that education helps to narrow welfare inequality for household heads.

Dedication

This study is dedicated to my parents, Ebenezer and Julie Osunde, who instilled in me during the formative years of my life the hard work, tenacity and discipline needed for the completion this research.

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One of the most significant decisions that I made in the last year is to come to the University of New Brunswick to study for a master's degree in economics. The experience has been one of growth and advancement. I will treasure the experience I have had here, and it will always be an indispensable component of my story.

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Chapter 1. Introduction

Numerous studies on human capital development have associated income inequality with economic growth, where it has been identified that countries with a substantial disparity in income still achieved rapid economic growth (Piketty, 2014). On the other hand, many studies reach the opposite conclusion. For example, Vo et al. (2019) found that income inequality contributes negatively to growth in middle-income countries and suggests that policies should be designed to help in the redistribution of income, especially targeted at those individuals who are at the lowest distribution of income, along with physical and human capital investment.

This study focuses on how welfare disparity in Nigeria is affected by human capital through the means of education and how residing in a Nigerian state with oil wealth impacts inequality in welfare outcomes using data from the 2016 General Household Survey (GHS).

1.1 Problem Statement

With more than 220 million persons and more than 37 billion barrels of crude oil (OPEC, 2022), Nigeria is incredibly endowed with both natural and human resources. Despite this, its level of development is still among the lowest in the world. On the Human Development Index, it is ranked 163rd out of 191 nations (UNDP, 2022). Despite its position as the largest economy in Africa and an oil exporter, this presents a stark contrast and a paradoxical instance, which calls for attention. This problem is further worsened by

the number of out-of-school children in Nigeria of over 10 million children, ranging from 5 years to 14 years, that are either not enrolled in basic education, never attended classes in school, or dropped out, placing Nigeria amongst the highest globally (UNESCO, 2022). It then becomes almost unavoidably correct to say that the country's government has not given education the attention it deserves, and efforts have not yielded the desired outcome.

1.2 Purpose of the Study

This study examines the distributional impact of education on welfare outcomes for heads of households in Nigeria. Both the Ordinary Least Square (hereinafter, OLS) and Unconditional Quantile Regressions (hereinafter, UQR) will be used in this study. No published papers on this topic, using Nigerian data, have used this method. The closest was a study by Ogundari and Aromolaran (2014) who used the Conditional Quantile Regression and the 2003/2004 Nigeria Living Standards Survey (NLSS) data.

Note that the term "unconditional" is suggestive of the existence of a Conditional Quantile Regression (hereinafter, CQR), whose estimates, in contrast to UQR, are conditional on the variables. Quantile regression is typically used when the requirements of linear regression are not applicable, especially when the researcher is interested in the quantile functions, which is equally the focus of this study. Quantile regression estimates are generally more resistant to outliers than OLS regression estimations.

This study uses data from the 2016 GHS, which was gathered for 5,000 households spread across 36 states in Nigeria, to examine the extent to which human capital formation through the means of education affects welfare disparity and to compare the welfare

outcome of households residing in states that have oil wealth and states that do not. This will be done in addition to estimating the Gini-modified expenditure model.

The dependent variable is the sum of expenditure (spending on non-food and food consumption) and the independent variables of interest are education levels, sex of the household head, age of household head, and state with oil wealth. Other control variables would be included in the model. See *section 3* for model specification.

1.3 Research Questions

The study seeks to find answers to the following research questions through the analysis of the data using the Recentered Influence Function (RIF) model of the Unconditional Quantile Regression:

- What impact does education have on welfare disparity for a Nigerian household?
- Does residing in a Nigerian state with oil wealth impact disparity in welfare for households?
- What is the magnitude of inequality (measured using the Gini Index) for households across the different levels of education?

1.4 Nature of the Study

The decision to use the stated methodology was influenced by a fascinating work by Alejo et al. (2014) that examined the distributional impact of schooling on Argentines using an Unconditional Quantile Regression. As a measure of inequality expressed as a

Recentered Influence Function (RIF), the Gini coefficient was computed in the study to evaluate the impact. Therefore, with this methodology, I will be able to examine not just how much education affects household welfare outcomes, but also explore sub-themes like whether living in Nigeria's oil-rich states have an increasing impact on the welfare gap.

The 2016 GHS data of the Nigerian National Bureau of Statistics used in this study was executed in partnership with the World Bank Living Standards Measurement Study (LSMS) of 5,000 households collected data from different states. The survey captures a wide range of topics for households, including demographics, spending, education, agricultural activities, housing conditions, health, and food security. The educational outcomes of household members were centered on individual reports of their literacy level, academic achievement and enrolment, and the barrier to academic registration.

1.5 Scope of the Study

The importance placed on how the formation of human capital impacts welfare disparity is supported by the social and financial gains that education offers an individual. According to Card (1999), these benefits raise productivity and increase the possibility that they will find better employment opportunities, both of which improve well-being.

There are 5,000 households across the Nigeria's 36 states represented in the study's data. Nigeria has a population size of over 220 million people, making it the most populous country in Africa and the seventh most populous country overall, with 200 people per square kilometer. Nigeria has more than 350 different ethnic groups and is a multi-cultural country with diverse languages.

The education of the male child is typically prioritized by households over that of the female child (EPDC, 2012). Several awareness-raising and advocacy activities have caused the pattern to start to change. Nevertheless, it continues to be a serious problem, especially in Nigeria's northern states where the number of out-of-school children remains alarmingly high.

Nigeria is the top oil producer in Africa and the eighth-largest crude oil exporter in the world. Although the oil industry produces around 90% of the export earnings, it only makes up less than 10% of the GDP (OPEC, 2022). As a result, the study would evaluate the economic impact education has on welfare disparity and how living in the states that have oil wealth in Nigeria affects welfare outcomes using the UQR and Gini expenditure models.

Note that expenditure variable has been used as a measure of welfare in this study, for the following reasons: in developing countries, the size of income is disproportionately from self-employed individuals and the seasonal variation can fundamentally affect earnings of individuals, which is usually not the case in developed economies. Hence, the choice of expenditure as a measure of welfare is the best fit for developing countries as opposed to using income variable (Sahn & Stifel, 2003). Additionally, Bang & Wunnava (2022) stated that the welfare of household members is better represented by expenditures. Firstly, the veracity of individual responses to income surveys in developing nations is a matter of enormous concern; secondly, expenditures represent consumption, and consumption indicates current material well-being more precisely than income. For example, the World Bank Microdata questionnaire for Nigeria specifically excluded

questions regarding income in favor of expenditure questions to evaluate households' welfare.

1.6 Significance of the Study for Policy

This research seeks to shed light and offer conclusions on a topic that has not previously been investigated in Nigeria using the UQR methodology. It further provides an understanding of the impact human capital formation has on the welfare gap and stresses the need for policies that are geared toward giving education a priority to improve the economic conditions of individuals, positively influence social change, and support human capital theory.

Since this is a new study in Nigeria in terms of the methodology and assessment factors of education on welfare outcomes and the Gini expenditure index model estimation, it might serve as a springboard for other researchers who would be interested in exploring themes that were also covered in this study. It would offer context for the fundamental concerns surrounding education in terms of how they influence the disparity in welfare. Additionally, this study would give insight into how residents of states with oil wealth fare in contrast to those who live in other states. Therefore, this study will provide government authorities with a knowledgeable perspective that will enable them to understand the breadth of the gap in welfare that is widespread across household members in their different states which could provide the justification for rationalizing public resources in favor of education in an efficient manner that is advantageous to all, particularly the least fortunate members of households in Nigeria.

1.7 Summary and Transition

Development still revolves around the problem of inequality. It doesn't matter if it's political, social, or economic. Policy discussions continue to center on the need for an equitable distribution of opportunity.

According to Galor and Zeira (1993), the development of human capital contributes favorably to a rise in income and helps to reduce income disparity. The connection between human capital formation and welfare disparity is further strengthened in this study. There are however contrary arguments, and one such study is Chani et al. (2014) that finds a direct link between human capital inequality and the income gap but conclude that education inequality does not always result in income disparity; rather, the disparity in income is what causes inequality in education. However, it important to mention that there are channels through which education can impact an individual's welfare outcome in terms of increased productivity and access to opportunities that can positively affect income which in turn promotes the living standards of individuals, especially in developing countries.

In conclusion, this study will examine the extent to which human capital formation affects income inequality and to compare the expenditure distribution of households in states with oil wealth and states without. The next sections of this study will be on the Literature Review; Methodology; Presentation of Data and Results Analyses; and Findings Discussion, Recommendations, and Conclusion.

Chapter 2. Literature Review

There are numerous studies that have assessed the link between education and inequality using different methodologies. However, very few have considered the case of Nigeria. Further, only a few papers have evaluated the effect of education on welfare inequality, and especially using the Unconditional Quantile Regression. The following brief summary of previous research will take a chronological approach, beginning with a study by Ram in 1984.

Ram's 1984 study assessed 28 countries of which 26 of them are less developed. He found that education differentials have no bearing on variations in economic inequality. Galor and Zeira (1993) provide a possible explanation. They posited that the advancement of an economy depends on its accumulation of human capital (education), which impacts positively the redistribution of income and specialization. However, they argued that poor countries are constrained by resources that limit the investment in human capital.

Park (1996) investigated the relationship between the level of education and share of income for the bottom 40% of income distribution and found evidence that the wider the differentials in education, the broader the disparity in income. The study concluded that educational attainment drives the difference in income and recommended policies that support the development of the education system and accessibility should be advocated for.

Moretti (1999) pointed out that social returns to education were the result of combining private and social returns, which offers additional perspectives into both the private and social gains from education. In this study, the author claimed that either the problem of omitted variables or general spillover in the study might account for the

significantly larger social returns found in the data used by Krueger and Lindahl (1999) for the 68 nations they analyzed.

Yang (2002) explained that despite reaching its peak economic development in 2000, China was still faced with severe income disparities between the urban and rural regions. It was noted that the widening of regional economic inequality was influenced by the huge income discrepancy in rural and urban communities. According to the study, regions with strong human capital advancement have lower disparity in income, while regions with weak advancement of human capital have higher inequality in income. This study was further accompanied by a recommendation that resources be allocated for the development of human capital to achieve development goals. Notably, China and Nigeria have characteristics in common. One example is the population strength.

In examining the nexus between education and economic inequality through a cross-country analysis between 1960 and 1995, Checchi (2003) found a negative association between enrollment in secondary schools and the income gap. This finding is corroborated by Gregorio and Lee (2003), which found that educational achievement and equitable distribution of education have a beneficial effect on earnings distribution similarly using cross-country data between 1960 and 1990. The variability in findings may be because of the difference in sample size or other unobservable factors.

Martins and Pereira (2004) use quantile regression estimates for sixteen developing economies to examine the relationship between education and the wage gap. They found that when returns from getting higher education increase, so does the effect of education on wage differentials for a designated within-group category.

The increasing interest in assessing educational returns was spurred on by wage inequality during the 1980s and 1990s in several countries, according to Psacharopoulos and Patrinos (2004). They also inferred from their analysis that making educational investments operates in a similar way to investing in physical capital. They, therefore, stated that there is a compelling need for evidence adopting a quasi-experimental approach to estimate how education affects earnings in developing nations.

Moretti (2004) used longitudinal data and employed a model of quasi-selection of working individuals. The data shows that an increase in the proportion of individuals with college degrees improves earnings. The use of longitudinal data enabled the author to account for the fixed effects of the individual and the city. The author was able to use two instruments to capture shocks associated with the cities that were not observable. The two instruments were land-grant institutions and the city's population structure. To identify potential issues that may result from using a specific methodology for evaluating how education affects people's income, pay, or spending patterns, it is useful to investigate these dynamics.

Although there are obstacles, education plays a crucial part in advancing development in underdeveloped nations. A common threat to education in developing countries, according to Glewwe and Kremer (2006), is the quality and availability of educators. They argued that teachers in these countries were less motivated since resources budgeted for education are frequently used for purposes that are unrelated to education. Education is no doubt paramount for the attainment of economic progress in any society, especially in developing countries where the distributive policy is yet to yield the desired results. A study by Lin (2007) that assesses the educational gap in Taiwan identified that

such discrepancy adds more evidence to the claim that income inequality is a result of the differences in human capital, and an increase in education leads to a narrowing of the income inequality gaps in Taiwan.

In assessing education's impact on income inequality in the Turkish context Duman (2008) believes that the allocation of more resources to schools and students would help to narrow the gap in incomes. He states that the benefits of education are greatest at the primary and secondary levels, and gradually decrease at the tertiary level. He concluded that the private benefits of higher education are generally bigger than their societal benefits.

Keller (2010) carried out a study using the panel data method for different countries categorized as developed and less developed countries since 1960 to determine the effects of various phases and indicators of education spending on income disparity. The findings showed that improved wealth distribution, particularly in industrialized nations, can be achieved by increasing educational spending per student. Moreover, secondary education enrolment rates and public spending, particularly in industrialized nations, have statistically substantial equalizing impacts. These results indicate that educational policy reform can play a significant role in improving income distribution by prioritizing increased spending in primary education and encouraging attendance at the secondary school educational level, while also ensuring that per-pupil spending is sustained as the number of enrolled students grows. Imperatively, Ejere (2011) viewed investment in human capital through education as an essential component for the development of Nigeria and argued that the reliance on natural resources and the stock of physical capital will limit its potential to be among the world's leading economies.

In 2012, D'Hombres, Weber, and Elia argued that the nexus between income and education has been established in the literature. However, their research found that there was no distinct connection between school attainment and economic disparity. Nonetheless, they did make the case that education was a valuable investment because of the advantages it offers. Furthermore, Bowles (2012) posited that income disparity permeates a society based on the existence of structure supporting economic management that directly impacts the level of income disparity, which consequently hinders GDP growth and its effects on an individual's capability for productivity. Therefore, the economic impact of income disparity cannot be understated, and it is necessary to establish a system that promotes equity and fair distribution of wealth and income, which remains an area of concern.

Alejo et al. (2014) used the UQR approach to explore the distributive effects of schooling in Argentina. According to their research, education gradually reduces inequality in Argentina. This study serves as a foundation for the use of related methodologies in subsequent studies. Although Chani et al. (2014) using Johansen co-integration and Granger Causality tests for an annual time series data spanning 1973 to 2009 found that income disparity generates human capital inequality rather than the other way around and that the income gap does not always lead to human capital disparities. It was however stressed that developing countries are more severely affected by inequality. Castelló-Climent and Doménech (2014) examined the same effect in 146 nations. They found that the discrepancy in income distribution has not improved, even though human capital inequality has decreased globally. They argued that no change in the income distribution would occur from improvements in education and income for people at the bottom of the

income distribution scale compared to those who have had an increase in education and earnings. This unexpected result emphasizes the value of micro-level analysis of the problem.

Fundamentally, a study by Shahpari and Davoudi (2014) that used the average level of schooling as a measure of human capital found in their research that increasing human capital led to a reduction in income disparities and promoted a more equitable distribution of wealth. Moreover, Dabla-Norris et al. (2015) discovered that the potential financial benefits of education and variations in labour earnings could compel people to invest in their human capital. However, the researchers emphasize that inequality trends in emerging and developing nations have been uneven, with many countries facing a growing disparity in access to healthcare, financial services, and education—all essential elements of human capital formation.

To accomplish development goals for many emerging economies, the issue of income inequality must be addressed. This is consistent with Chani et al. (2014) that examined the connection between disparity in income and human capital disparity in Pakistan and found a causal link between both phenomena. The study argues that creating access for individuals to advance their skills and improve the quality of their human capital through education would narrow the inequality gap and reduce the burden associated with achieving its developmental goals. They also find that income inequality causes inequality in human capital development rather than the opposite.

The amount of training or expertise has a significant impact on economic activities. As a result, the shared distribution of income and poverty is greatly influenced by disparities in the availability of opportunities in education. Education is essential for

national development. Due to investments in education, every developed country has accomplished progress in welfare improvement. So, while education is a multifaceted process, it also significantly contributes to a nation's ability to flourish economically. Due to their close links, education serves as a channel to eliminate poverty and income disparity (Khan et al., 2015).

The necessity of funding the development of human capital was further highlighted by Jain-Chandra et al. (2016) as a strategy for reducing inequality globally. Extending access to financial, medical, and educational resources was suggested as a crucial first step in alleviating inequality in Asia in their analysis of the problem. Coady and Dizioli (2018) found a strong, positive, and substantial association between education and income disparity, particularly in emerging nations. This result is in line with the research by Lee and Lee (2018) that found that economic inequality was greatly reduced when there was an equal distribution of educational attainment, with the argument that increased educational attainment is the primary driver of equality in both income and education. Adegoke (2018) supported this claim by underlining the crucial role that targeted measures could play in Nigeria's educational system improvement for it to achieve economic development.

Qazi et al. (2018) examined the connection between higher education and income inequality in Pakistan using the autoregressive distributed lag-bound testing co-integration method. Their result indicated that there was a long-term association between higher education and income inequality, with higher education having a significant and negative long-term effect on income disparity, but an insignificant and negative effect was found in the short run. In the same vein, Sehwat and Singh (2019) found that increasing access to

education significantly lowers high-income inequality in their study using a non-linear autoregressive distributed lag technique. They discovered specifically that a rise in the average number of years in school can result in a more equitable distribution of wealth. As a potent instrument to combat income disparity, the authors advised prioritizing education expansion with a focus on raising educational standards.

Hoffmann et al. (2020) investigated the impact of labour and non-labour income on wage disparity in the United States and bigger economies within the Eurozone and found that the major driver of the expansion in wage disparity is predominantly affected by the level of education which does not only account for the growth in inequality of labour income but also capital income disparity in the United States. As an extension to explaining how income may differ from individuals based on their level of education, Hui (2020) found a substantial inverted-U relationship between higher education and income disparity. In other words, when higher education is uncommon, it has a significant payoff that can exacerbate income inequality. However, the income gap will get less once higher education is more generally accessible. The author, therefore, recommended that increasing educational opportunities could help developing nations reduce economic inequality.

To examine the relationship between human capital inequality and income inequality, Castelló-Climent and Doménech (2021) used a revised set of data on human capital disparity for 146 countries from 1950 to 2010. They discovered an inverted U-shaped association between these two inequality indicators, implying that human capital inequality has a direct impact on income inequality as well as its impact on earnings inequality. They claimed that the outcome supports the theory that, in an economy with two demographic groups—low and high educational level—a shift of workers from the

former category to the latter increases the disparity of earnings until the high-education category attains a particular share, claiming that the distribution effect of the proportion of the population without schooling is the cause of the non-linearity. It is crucial to note that some of the discrepancies in findings identified in empirical studies may be explained by differences in the sample, measurements of inequality, and econometric methodologies.

A study by Olufemi et al. (2022) examined the relationship between human capital and income inequality in Nigeria between 1981 and 2019 using the autoregressive distributed lag (ARDL) bounds test estimation technique. According to their findings, enrollment in secondary and tertiary education, among other human capital indicators, are substantial long-term contributors to income inequality in Nigeria. From the study, only enrollment in postsecondary education is negatively correlated with income disparity, which suggests that the main factor lowering income disparity is tertiary education attainment.

Furthermore, according to Chen et al. (2023), rising income inequality encourages parents to spend more on their children's education. In their research, the authors found two potential causes for the rise in educational spending. Firstly, the rising skill premium and resulting widening of the income gap may confirm the parents' long-held cultural conviction that investing in their children's education is of utmost importance, leading them to expand their financial support of that endeavour. Second, increased wealth inequality may increase the value of a college degree, leading to a greater demand for access to higher education and more competitive pressures for those opportunities, which may encourage parents to make more educational investments in their children.

From the different studies that have been reviewed in this research, it is commonly found that education has a connection to inequality, especially in developing economies where the redistributive policies are limited and have struggled to narrow the gap in economic welfare. It is therefore clear that there is a correlation between income inequality and education, and investing in education to build human capital can often be used to close the welfare gap. Furthermore, as a means of tackling income inequality and fostering economic development, it emphasizes how critical it is to enhance educational access and quality, while highlighting that income inequality in emerging nations is hampered by issues with access to and quality of teachers as well as the distribution of resources within educational institutions.

Many scholars who have investigated economic disparity in Nigeria have associated it with GDP growth, ethnicity, and other topics related to the development of a nation but not specifically to education. Some of the studies are Olaniyan and Okemakinde (2008), Kanayo (2017), Aigbokhan (2000), Ogbeide and Agu (2015), Madu (2006), Oluwatobi and Ogunrinola (2011), and Chukwu (2019) Akinbobola and Saibu (2004), Egbiremolen and Anaduaka (2014). This research will examine the relatively neglected effect that education has on the disparities in welfare outcomes for households in Nigeria, to bring an additional perspective to the problem of economic inequality in Nigeria. Additionally, I will investigate whether residing in a Nigerian state with oil wealth significantly affects welfare outcomes for heads of households.

2.1 Oil-rich States and Welfare Outcome

One of the research questions that this study seeks to find an answer to is to determine if households in Nigerian oil-rich states fare better than those in non-oil-rich states in terms of welfare outcomes proxied by the expenditure on food and non-food consumption. Nigeria is recognized as a country with oil wealth, comprising 36 states that consist of states with oil wealth and states without oil wealth. Considering Kuwait's oil wealth, El-Katiri, Fattouh, and Segal (2013) performed research on Kuwait's welfare state of the residents. The study found that the country's oil wealth has greatly raised the standard of living for its people. Oil has been recognized as a useful resource that has helped people live better lives through the creation of an inclusive economy based on a robust distributive system that offers Kuwaiti citizens basic services including free healthcare, education, and social security. This was achieved through a comprehensive distributive welfare policy, developed over the years since it first discovered oil. Although there was no account of oil spillage that potentially hampers quality of life, if not controlled. However, they highlighted some of the policies of rent sharing, such as subsidies and public employment, which they believed have created distortions, wastes, and institutional shortcomings. Nonetheless, it is suggestive that oil wealth tends to contribute meaningfully to the living standards of the people.

On the other hand, Atanda (2018) studied the oil-producing states that formed the Nigeria's Niger Delta region. The study investigated data from 658 randomly selected households and determined that the reduction in well-being was caused by spillage from oil production. This was in combination with underdeveloped infrastructure for services

such as healthcare and potable water supply. Additionally, environmental deterioration was named as a major issue that impacts the negative welfare outcome of the residents in that region. Studying the difference in welfare across different quantiles between Nigerians who reside in states that have oil wealth and states that do not, is a worthwhile endeavour since it enables the assessment of the magnitude and significance of the gap in welfare outcomes that may exist. My apriori expectation in this study is that living in oil-rich states may positively impact welfare outcomes, because resource-rich states expectedly have more funds that could translate into creation of jobs and meaningful developments which consequently improves the welfare of the people.

2.2 Summary and Conclusion

From the different studies that have been reviewed, there is a clear indication that education is correlated with economic disparity and that education is a key contributor to an individual's productivity and earning capacity. Therefore, the benefits of investing in one's education far exceed the cost of education. Although there are several issues that the education sector in developing countries is faced with, Nigeria is non-exempt. The issues stem from a lack of funding, teachers' absenteeism, misappropriation of school funds, to poor teaching infrastructure. Regardless of these existential problems, investment in education remains a driving force to narrow the continuously widening gap in wages.

Through this study, using a methodology that has not been explored in the Nigerian context with the 2016 Nigerian GHS data and the estimation of the Gini expenditure index from the data, a new perspective on the issue of welfare disparity in Nigeria and the effect

of education across different expenditure distributions would be brought to fore in the analysis of the results that would be obtained.

Chapter 3. Research Methodology

Following Alejo et al. (2014), I adopt the UQR technique to evaluate the extent to which education affects welfare (proxied by expenditure variable) and if household heads residing in a Nigerian state with oil wealth contribute to welfare inequalities.

This section explains the sampling design for the collection of data applied in this research, outlines the methodology used to answer the research questions, and gives justifications for the methodology's selection as the best alternative, supported by data, analysis, and findings from other studies.

3.1 Data Collection Process

A multi-stage stratified sample design was employed to obtain the data using questionnaires. The data collection procedure involves two visits to a total of 5,000 households across the 36 states and the Federal Capital Territory (FCT) in Nigeria.

The questionnaires given to the participants contain questions about the demography of the community, household members, and involvement in farming activities. The community questionnaire gathered information on community changes, consumer prices in the community, infrastructure accessibility, and other community-related information. The questionnaire on household collects data on household characteristics, such as age, family size, education etc. The questionnaire on

agriculture gathered data on possession of land, types of inputs used on farms, land size, and different sorts of farm operations such as crop production, livestock, fishery, etc.

There were two visits in the data collection procedure, the first was the post-planting visit from October to November 2015 and the second the post-harvest visit which was from mid-April to May 2016. From the survey report, household sizes in the South are often smaller than those in the North. In the south, there are often 4 to 4.9 members per household, while in the north, there are typically 5.7 to 7.9 individuals per household. It was also reported that the incidence of dependency is greater in rural communities than it is in the urban areas.

Education and expenditure variables are the main variables of interest in this study. Regarding education, the report from the survey documentation indicates that male and female respondents with the age range of 20 and 30 years old have the highest number of years of education, at 10.9 and 8.6, respectively, compared to other age categories. Likewise, the survey reports that 91% of males are proficient in reading and writing, compared to 74.5% of women. For expenditure, meat, fish, and dairy products, valued at 1,359 Naira and 1,283 Naira per week account for the highest average food spending in both post-planting and post-harvest visits, respectively. During the post-harvest period, this experienced a fall of 5.6%. Notably, buying mats generally falls within the category of home expenses that are not related to food. However, households spend a significant amount on weddings, dowry, construction materials, and bedsteads.

In conclusion, the survey data give the details required for evaluating the human and physical capital of households, assessing the link between education and earnings, and

assessing how government initiatives and policies impact the general welfare of households.

3.2 Procedure for Sampling and Sample Size of the Data

The Nigerian GHS data will be used in this study, which captures a sample group of Primary Sampling Units (PSU) and family units chosen for the survey. In the survey, there are 5,000 households covering the 6 geopolitical areas of the 36 states and the FCT (the administrative center of the country) - 37 in total, in both rural and urban communities. The survey consists of 60 Enumeration Areas (EAs) for each of the 36 states and FCT, which makes a total of 2,220 EAs. A sample size of 22,200 households was obtained with 10 households from each EA. However, only 5,000 of the 500 EAs' selected households made up the survey's participants. It was reported that there was 8.4% attrition, primarily because of the insurgency that was raging in the country's northeast region at the time the data was collected, leaving a total of 14 EAs unvisited. Some stated reasons for attrition include: some household members declined interviews and were not traced; some households relocated; and some participants were reportedly dead (termed as crisis and natural events). 4,916 households participated in the first stage of the survey exercise, only 4,581 households were visited in total during the two periods of the visits, comprising 1,469 and 3,112 households residing in the urban and rural areas, respectively.

The World Bank and the National Bureau of Statistics in Nigeria worked together to conduct this survey. The National Government of Nigeria and the Bill and Melinda Gates

Foundation jointly provided the funding for the implementation. The survey data offers thorough and trustworthy assessments of key socioeconomic indicators of the sample population. A multi-stage stratified sample procedure was used and executed in a way that households were visited twice in each panel wave (post-planting and post-harvesting visits), and using a questionnaire, data from the household was gathered. No matter whether the household engaged in an agricultural-related activity or not, these visits were made. This process was also applied to the Panel Survey and the General Household Survey.

During both visits, important data on labour, food consumption, spending, and education were equally gathered. The survey's primary goal is to establish a connection between aspects of agriculture and non-agricultural-related household living standards.

3.3 Research Technique for Analysis

The UQR developed by Firpo et al. (2009), which is argued to be simple and comparable to OLS but different from the CQR developed by Koenker and Bassett (1978), will be explored as a technique for analysis to investigate the research questions in this study. CQR is a commonly used method of investigation for assessing the distributional effect of a variable on the dependent variable across different degrees.

In this analysis, there are five variables of interest and other control variables — The UQR would be employed as the research technique in estimating these variables. The approach entails a transformational process that produces the Recentered Influence

Function (hereinafter, RIF). The RIF refers to a technique or method that evaluates the impact or sensitivity of individual data points on the estimates of the quantiles. This evaluation increases the reliability or interpretability of the analysis. When performing unconditional quantile regression, especially in the presence of outliers or significant observations, researchers and statisticians may find it useful to evaluate how individual data points or groups of data points impact various quantiles of the response variable using the RIF. Although, the UQR is robust to outliers, but since this study would use OLS and UQR, the outlier checks and adjustments were done.

The procedure involves regressing the unconditional quantile's RIF on the predictor variables, and the influence function's ability to calculate distributional characteristics, which go beyond quantiles to compute metrics such as the Gini index and other measures of inequality, thereby making the UQR a superior alternative to the CQR for analysis (Firpo et al., 2009). They further argued that one notable advantage of implementing UQR is that it makes generalization simple and easy – this implies that the findings or results from using UQR can be applied or extended to a broader or more general context.

The following is the UQR component of the Firpo, et al. (2009) RIF regression model:

$$E [RIF(w; Q_{\tau}) | X] = X'g$$

The conditional expectation of the RIF at a specific quantile τ , expressed as Q_{τ} , is represented as $E [RIF(w; Q_{\tau}) | X]$, contingent on the values of the covariate X . The statistical concept related to quantile regression is $RIF(w; Q_{\tau})$. The equation basically indicates that the expected value of the RIF at the τ -quantile, conditioned on the covariates

X , can be written as a linear function of X , where g is the vector of parameters that establish this linear connection.

The RIF model can be predicted by OLS in a way that the estimates derived from the regression would demonstrate the impact of a predictor variable on an unconditional τ th quantile of the log-form expenditure in the context of this research. This would be calculated using a non-parametric kernel density approach along with the prediction of Q_τ and $f(Q_\tau)$ density value. Through such estimation, one can report different quantile statistics (e.g., from the 10th quantile to the 90th) owing to the process of transforming the response variable. In this study, the RIF will be calculated and will also be applied to quantify the inequality gap using a modified Gini expenditure model.

The UQR methodology is simple to implement when using common statistical tools (Borah and Basu, 2013). In this study, the statistical package that would be used in the estimation of the data is STATA - a multipurpose statistical software package, whose routines and commands will be used in the implementation of this method. Additionally, data cleaning, which entails the process of detecting missing or erroneous data and either imputing or altering them, will be done using the same statistical tools where required.

According to Killewald and Bearak (2014), choosing between UQR and CQR as a tool of analysis depends on the question being investigated. They supported this claim with an example of how they can be applied, arguing that while CQR looks at the effect unions have on within-group wage distribution, UQR is better suited to examine whether unionized members have significant benefits for high or low wage workers. Employing CQR allows for a more nuanced understanding of the within-group effects by examining how unions impact wage distributions within groups or for various percentiles. UQR, on

the other hand, offers a more thorough perspective of the overall impact of unions on wages across the entire population, making it appropriate for analyzing whether unionized members as a group experience substantial benefits for high- or low-wage workers. Depending on the research objectives, researchers can select any of these methods.

Moreover, Maclean et al. (2014) argued that the UQR provides information that is more policy-relevant than the usual CQR in most empirical policy studies. Additionally, Alejo et al. (2014) stated that despite studies examining the connection between education and incomes, it seems challenging to calculate and determine the distributional effect by making a case that UQR is a straightforward and convincing tool for illustrating variation in income disparity and elements involve in the distribution of income, which aligns with the objective of this research. The use of the unconditional quantile differs from the conditional quantile because in the UQR model, the impact of X on Y changes based on the value of Y and is not dependent on the value of another covariate in the model (Porter, 2015).

This method of analysis is suitable for assessing the degree of impact education has on the variations in household expenditure which measure their welfare outcome and to ascertain if a household's welfare status is influenced by the state of residence. UQR remains an appropriate choice for this study for the following additional reasons. It enables direct comparison of results and allows for the observation of the effect that education has on expenditure at various quantiles. The UQR allows for a more direct interpretation than the CQR since the UQR model ensures the independence of a predictor's effect on other variables of analysis, which further justifies using this technique (Alejo et al. 2014).

In this study, I will provide the results from the Ordinary Least Squares and the UQR estimations. The OLS method used to be the mainstay of quantitative analysis. This was due to its intuitive interpretation, ability to include several explanatory variables, and robustness against the violation of fundamental assumptions. But today among applied researchers, quantile regression is a method that is gaining popularity. Unlike OLS, quantile regression offers the effect of estimates at many points along the response variable's distribution, allowing researchers to understand the impact of each covariate on the distribution of an outcome instead of the average.

When Mishra et al. (2015) in their study on Bangladesh used the UQR to conduct their analysis, they discovered that the results produced unbiased estimates of the unconditional effect of non-farm earnings on expenditures on food and showed the heterogeneous effects that take place across the distribution of total consumption of food expenses. In this study, they highlighted the benefits of using the UQR over the CQR stating that the UQR addresses a wider problem than the conditional effect, which estimates how food expenditure is influenced by other factors like the size of the family. By using the UQR estimator through the application of the RIF they were able to assess unconditional quantile estimates for the participation in off-farm labour activity and addressed policy issues that rely on the unconditional statistical properties of the outcome variable which the CQR model developed by Koenker and Bassett in 1978 are unresolved.

Finally, the decision to use this approach is consistent with the line of thinking by Rodriguez-Caro et al. (2016) that UQR allows for ease in comparing the size of the effect of a regression predictor and making direct and clear interpretations of key variables from

the different percentiles of the response variable that is unconditional on the covariates in the model.

3.4 Econometric Model Specification

The model for the study is stated below:

$$\begin{aligned} \ln Exp = & \beta_0 + \beta_1 Edu + \beta_2 Gender + \beta_3 State + \beta_4 Age + \beta_5 Age^2 + \beta_6 HWP \\ & + \beta_7 HWNH + \beta_8 IHE + \beta_9 HWAA + \beta_{10} AHM + \beta_{11} Credit + \varepsilon \end{aligned}$$

My dependent variable ($\ln Exp$) is the natural logarithm of household total expenditure on the consumption of food and non-food items (a measure for welfare outcome in this study). It is transformed into logarithmic form because the value is reported in large numbers, and the logarithmic transformation helps to reduce the size of the value and improves the fit of the model by transforming the distribution to a more normally shaped bell curve. An additional benefit is the convenience of interpreting the estimates as percentage effects, which is useful from a policy perspective.

The independent variables are education represented as *Edu* in the model (which is a categorical variable with different levels of education, from nursery to higher education levels), *gender* (a dummy variable for either male or female), *state* (a dummy variable for states in Nigeria that are oil-rich and otherwise), *age* (reported as years) and *age-squared*. Age-squared is included because I would like to find and report the turning point of age where the critical time in which a change in life's event may affect the welfare outcome of the household head. Additional variables are *Hours Worked Per Week* (HWPW) in a

salaries or wage work, *Hours Worked on Non-Farm Household Activity* (HWNH) in the last 7 days, *Income from Non-Farm Household Enterprise* (IHE), Hours worked in *Household Agricultural Activity* (HWAA), *New Household Member* (AHM), which is a dummy variable for whether there is a new addition to household members, *Access to Credit* (institutional and other sources of borrowing), is a discrete variable of whether household head was able to access credit or not. I have done a Pearson correlation test and find that none of the variables estimated in the model are highly correlated.

As part of my estimation, I would test for the presence of heteroscedasticity. If present, I would correct it either by using the weighted least square approach or the Robust Standard Error to obtain unbiased standard errors.

3.5 Research Questions and Hypotheses

Recall that this study seeks to find answers to these research questions:

- What impact does education have on welfare disparity for a Nigerian household?
- Does residing in a Nigerian state with oil wealth impact disparity in welfare for households?
- What is the magnitude of inequality (measured using the Gini Index) for households across the different levels of education?

For hypothesis testing, I will test the hypothesis that education is statistically significant in explaining the variation in welfare outcome, and to answer the second

question, I will equally test the hypothesis that living in an oil-rich state in Nigeria is statistically significant in explaining the difference in welfare outcome.

Household consumption expenditure, state variables (indicating oil-producing and non-oil-producing states in Nigeria), and education levels are the variables of interest in this study. However, other factors, like hours worked in a salaried or waged job, income from non-farm household enterprise, age, gender, etc. were also considered in the model to ascertain the relative effects they have on household expenditure. The key variables of the study with the associated regressor estimates and how they influence the response variable will determine how the findings from this research will be interpreted. The probability value or t-statistics for each relevant parameter would be used to determine statistical significance.

3.6 Conclusion

This study's approach involved the use of the UQR methodology that requires the performance of a regression on the independent variables to determine the percentile of the response variable, also known as the RIF using the GHS 2016 data from the Bureau of Statistics in Nigeria.

In conclusion, the following are the main factors that influenced the decision to choose this method: First, like with OLS regression, the impact the covariates have on the response variable can conveniently be determined. Second, it is easy to detect the direct impact of a variable that has been identified across the distributions of the outcome

variable. The explanatory variable is unconditional on the covariates included in the model.

Third, the UQR is easier to compute, compare, and interpret.

Chapter 4. Data Presentation and Analysis of Results

In this section, I will summarize the most important details regarding the data collection procedure based on the demographics of the survey sample data as provided for in the survey documentation's data collection section of the 2016 GHS data used in this study. For the descriptive statistical analysis, I would present tables, charts, and graphs to highlight the outcomes that are suitably characterized in the sample. I will present the results using the OLS and UQR models, the Gini model, the Interpretation of the results, and the Summary of this chapter.

4.1 Pre-Estimation Analysis

- **Outlier Treatment:** Since OLS estimates are essentially sample average statistics, they could be impacted by the existence of outliers. By "trimming" the earnings data, some applied econometricians have tried to solve this problem. This is trimming the sample, for example, removing the bottom and top 1% of earnings observations, and then estimating the OLS using the reduced sample. Alternatively, other investigators engage in what is known as 'winsorization', which has been used in this study, which contrasts with deleting extreme data points, as is done with 'trimming'. This approach replaces the extreme values with those values at say the 95th percentile at the top end of the distribution or the 5th percentile at the

bottom end. However, neither of these approaches solves the ‘outlier’ problem at all and most researchers feel they represent *ad hoc* procedures that, while improving efficiency, may induce greater bias. There is an increasing tendency to exploit non-OLS estimators that are less sensitive to such outliers or extreme values if indeed such outliers or extreme values are considered a major problem. One such procedure is quantile regression.

- **Heteroscedasticity:** In checking for heteroscedasticity, I conducted a Breusch-Pagan test for heteroscedasticity and found that from the result, the 5% level of significance was used to reject the constant variance stated in the null hypothesis (*see appendix for results*), indicating that there is no constant variance (i.e., no homoscedasticity). To correct this, robust standard errors (White’s standard errors) would be used.
- **Normality:** It is imperative to state that the violation of normality does not portend a threat to the analysis of this study as the number of observations is large. This position is strengthened by the findings of Knief and Forstmeier (2021) who used a Monte Carlo simulation to show that aside from when sample sizes were small or the predictor's distribution was extremely skewed, parameter estimations were mostly unbiased and accurate. They advised that the transformation of the data before analysis was useful, as well as the visual check for outliers and heteroscedasticity as crucial assessment procedures. I have done the log-

transformation of the dependent variable and as seen in the *appendix*; the residual is close to normal.

4.2 Descriptive Statistics

Table 4.1: This table shows the summary statistics of the different variables (discrete and continuous) used in the study.

Variable	Observation	Mean	Std. Dev.	Minimum	Maximum
Total Expenditure	4,580	1721	2596	0	47320
ln (Expenditure)	4,329	6.682	1.560	1.609	10.76
Nursery Education	4,580	.003712	0.06082	0	1
Primary Education	4,580	.2430	.4289	0	1
Secondary Education	4,580	.2120	.4088	0	1
No Education	4,580	.3234	.4678	0	1
Higher Education	4,580	.1511	.3582	0	1
Informal Education	4,580	.0668	.2497	0	1
Female	4,580	.2035	.4026	0	1
State with oil wealth	4,580	.2546	.4357	0	1
Age	4,580	52.84	14.40	24	87
Age-Squared	4,580	2999	1598	576	7569
Hours Worked Per Week in Salaried Job	4,580	6.234	15.67	0	96
Hours Worked in Household Non-Farm Activity	4,580	14.49	21.12	0	60
Income from Non-Farm Household Enterprise	4,580	5904	8100	0	22000
Hours worked in Household Farm Activities	4,580	12.22	16.98	0	54

New Household Member	4,580	.1111	.3143	0	1
Credit	4,580	.1773	.3820	0	1

The above table shows all the variables estimated in the model, their respective means, minimum and maximum values, and the number of observations.

Table 4.2: This table shows the percentage of household heads with varying education levels.

Education	Frequency	Percent	Cumulative
Higher Education	692	15.11	15.11
Secondary Education	971	21.20	67.66
Primary Education	1,113	24.30	46.46
Informal Education	306	6.68	21.79
Nursery Education	17	0.37	22.16
No Education	1,481	32.34	100.00
Total	4,580	100.00	

From the sample data, 32% of household heads do not have an education, with the lowest being those with nursery education, which is 0.37%. 15% of household heads have higher education, 21% of household heads have secondary education, 24% of household heads have primary education, and 6.7% of household heads have informal education. It is worthy to mention that informal education is an example of adult education, qur'anic and integrated qur'anic education, while higher education, is education above secondary school level. Examples are teachers training college education, polytechnic and university education.

Table 4.3: This table shows the percentage of male and female-headed households.

Gender	Frequency	Percent	Cumulative
Male	3,648	79.65	79.65
Female	932	20.35	100
Total	4580	100	

From the above, it can be observed that there are about 80% of male-headed households and 20% of female-headed households.

Table 4.4: This table shows the percentage of state variable categories with oil wealth and without oil wealth per household heads.

State Categories	Frequency	Percent	Cumulative
State without oil wealth	3,414	74.54	74.54
State with oil wealth	1,166	25.46	100.00
Total	4,580	100.00	

75% of the sample heads of household live in states without oil wealth while the remaining 25% live in counterpart states.

Table 4.5: This table shows accessibility to credit facilities for household heads.

Access to Credit	Frequency	Percent	Cumulative
No	3,768	82.27	82.27
Yes	812	17.73	100.00
Total	4,580	100.00	

The table reports that 82% of household heads have no access to credit either to finance their consumption or other needs, while 18% of them reported that they have access and

have borrowed from either a formal (institutional) or informal credit arrangement to finance their needs.

Table 4.6: This table shows the gender categories of household heads and the number of those with access to credit and who have borrowed before or otherwise.

Credit	Male	Female	Total
No	2,980	788	3,768
Yes	668	144	812
Total	3,648	932	4,580

From the table above, of the 812 household heads who have taken credit before, 668 of them are males and 144 of them are females.

Table 4.7: This table shows the gender heads of households and the number of those who live in the two categories of states.

State	Male	Female	Total
State without oil wealth	2,836	578	3,414
State with oil wealth	812	354	1,166
Total	3,648	932	4,580

The report from the table shows that more household heads reside in states that are without oil wealth, of which 2,836 of them are males and 578 are females. On the other hand, 812 male household heads reside in states that have oil wealth, while 354 household heads who are females reside in states with oil wealth.

Table 4.8: This table shows education by gender of household heads.

Education	Male	Percentage of Male	Female	Percentage of Female	Total	Total Percentage
Higher Education	602	16.5	90	9.66	692	15.11
Secondary Education	860	23.57	111	11.91	971	21.2
Primary Education	873	23.93	240	25.75	1,113	24.3
Informal Education	288	7.89	18	1.93	306	6.68
Nursery Education	9	0.25	8	0.86	17	0.37
No Education	1,016	28	465	49.89	1,481	32.34
Total	3,648	100	932	100	4,580	100

From the table, it is revealed that more male household heads have higher education than females, and this is generally the same for all levels of education. This could also be because there are more male household heads than females or a reflection of the culture that prioritizes the education of the male against the female. It is important to consider this difference in terms of the total number of households per education level.

4.3 Study Result

Table 4.9: The (Log) Total Expenditure Estimates as Dependent Variable for Ordinary Least Square (OLS) and the Unconditional Quantile (RIF) Regression estimates.

Variables	OLS (Mean)	10th Percentile	25th Percentile	50th Percentile (Median)	75th Percentile	90th Percentile
Nursery Education	-.04971 (0.4753)	-1.156 (1.476)	.1164 (0.5653)	.1030 (0.3762)	.1515 (0.3728)	.01214 (0.4600)
Primary Education	.4680*** (0.0627)	.8173*** (0.1880)	.5898*** (0.0877)	.2950*** (0.0612)	.09684 (0.0628)	-.08875 (0.0778)
Secondary Education	.6995*** (0.0676)	1.139*** (0.1864)	.7183*** (0.0925)	.5000*** (0.0680)	.3559*** (0.0737)	.2136** (0.0947)

Higher Education	.7731*** (0.0803)	1.079*** (0.2130)	.8042*** (0.1018)	.6109*** (0.0764)	.4431*** (0.0870)	.3063*** (0.1148)
Informal Education	.4201*** (0.0842)	1.354*** (0.2249)	.4159*** (0.1356)	.0578 (0.0940)	-.1831** (0.0857)	-.2044* (0.1061)
Female	-.2819*** (0.0672)	-.3655* (0.2030)	-.2771*** (0.0935)	-.1590** (0.0628)	-.2330*** (0.0668)	-.2419*** (0.0841)
State with oil wealth	.3652*** (0.0516)	.1474 (0.1373)	.2216*** (0.0669)	.3422*** (0.0514)	.4314*** (0.0614)	.3457*** (0.0805)
Age	.01827* (0.0108)	.02359 (0.0314)	.005054 (0.0144)	.000581 (0.0102)	.008772 (0.0110)	.008866 (0.0143)
Age-Squared	-.0001866* (0.000099)	-.0002651 (0.0003)	-.0000831 (0.0001)	-.0000193 (0.000019)	-.0000664 (0.000099)	-.0000396 (0.0001)
Hours Worked Per Week in Salaried Job	.01153*** (0.0017)	.01479*** (0.0041)	.009034*** (0.0020)	.007668*** (0.0016)	.007542*** (0.0019)	.003889 (0.0025)
Hours Worked in Household Non-Farm Activity	.009451*** (0.0013)	.01820*** (0.0033)	.006006*** (0.0017)	.005463*** (0.0013)	.006123*** (0.0015)	.000745 (0.0019)
Income Household Enterprise	.0000303*** (2.94e-06)	.000022*** (7.07e-06)	.0000308*** (3.63-e-06)	.0000277*** (3.03e-06)	.000025*** (3.67e-06)	.0000196*** (4.81e-06)
Hours worked in Household Farm Activities	-.000991 (0.0015)	.002474 (0.0046)	.0000903 (0.0020)	-.002929** (0.0014)	-.006673*** (0.0015)	-.007769*** (0.0018)
New Household Member	-.1482* (0.0841)	-.4246* (0.2252)	-.1259 (0.1155)	-.1190 (0.0789)	-.1381* (0.0807)	-.05608 (0.1021)
Credit	.09615* (0.0512)	.2485* (0.1435)	.1713** (0.0718)	.09402* (0.0546)	-.07178 (0.0609)	-.04761 (0.0784)
Constant	5.437*** (0.2824)	3.232*** (0.8109)	5.312*** (0.3790)	6.455*** (0.2741)	7.201*** (0.0609)	8.158*** (0.3800)
R-Squared	0.1929	0.0490	0.0938	0.1254	0.1048	0.0364
Obs	4,329	4,580	4,580	4,580	4,580	4,580

Note: ***, **, * denote statistical significance at 0.01, 0.05, and 0.1 levels respectively

using two-tailed tests. The numbers in the parentheses below the estimates are robust standard errors for individual estimates.

4.4 Turning Point for Age

As seen in **Table 4.9**, the age variables have been estimated using the OLS and RIF regression models. Coefficients of age or squared-age are not significant at the 5% level. The age-squared was estimated to find the turning point. This estimation helps to identify a crucial moment in the age of heads of household at which a life's event may occur and make an influence in the welfare outcome (captured by expenditure), with a noticeable change in the expenditure pattern of a household head. The calculation is done by taking the derivative of the expenditure (log-transformed) with respect to age and age-squared and assigning the values of each parameter estimate from the OLS estimation in **Table 4.9** in determining the turning point age of household heads. See below the computation of the stationarity point:

$$\partial \ln exp / \partial age = \beta_7 + 2\beta_8 \times age$$

$$0.01827 + 2(-0.0001866) \text{ age} = 0$$

$$0.01827 = 0.0003732 \text{ age}$$

$$\text{age} = \frac{0.01827}{0.0003732} = 48.95$$

From the regression output, estimators for β_7 and β_8 are 0.01827 and -0.0001866, respectively. The interpretation therefore is, from the OLS estimation, age appeared to have a positive impact on household mean expenditure until a turning point is attained at the age

of approximately 49 years. This happens slightly below the average sample age roughly by 4 years.

4.5 Interpretation of Statistical Significance

The above results in **Table 4.9** report the estimates of the OLS regression and the Unconditional Quantile Regression with the log of total expenditure. The statistical significance is explained as follows:

For the OLS estimates, all the estimated education categorical variables are statistically significant at a 1% level while nursery school education level is statistically insignificant. Female and oil-rich variables are also both statistically significant at 1%, while age, age-squared, and new household member variables are all statistically significant at 10%. Hours worked per week in a salaried or waged job, hours worked in household non-farm activity, and income from household enterprise are all statistically significant at the level of 1%.

It is imperative to put a structure to the analysis. If a household head is at the τ^{th} percentile of the expenditure distribution, then the fraction $1 - \tau$ of the household heads has a higher log expenditure than this value. For example, if a household head is at 10th percentile of the log expenditure (that is, $\tau = 0.1$), 90% of household heads in the distribution have a higher log expenditure. If a household head is at the median (that is, $\tau = 0.5$), 50% of individuals in the distribution have a higher log expenditure.

The 10th quantile which is the bottom quantile (poorest 10%), result shows that primary, secondary, informal, and higher education levels are statistically significant at 1%. Similarly, hours worked per week in a salaried job, hours worked in household non-farm activity, and income from household enterprise are all statistically significant at 1%. Female, new household members, and credit variables are statistically significant at the level of 10%.

At the 25th quantile, the education categories of primary, secondary, informal, and higher education levels are statistically significant at a 1% level. Also, hours worked per week in a salaried or waged job, hours worked in household non-form activity, and income from the household enterprise are statistically significant at 1%, while the credit variable is statistically significant at the level of 5%.

Results from the 50th quantile show that primary, secondary, and higher education levels are statistically significant at a 1% level. Similarly, oil-rich, hours worked per week in salaried jobs, hours worked in household non-farm activity, and income from household enterprise are statistically significant at a 1% level. Female and hours worked in household farm activity variables are statistically significant at 5% level, while the credit variable is statistically significant at 10% level.

The 75th quantile shows that secondary and higher educational levels are both statistically significant at 1% level, while informal education is statistically significant at 5% level, with other education categories not statistically significant. The variables: female, oil-rich, hours worked per week in a salaried job, hours worked in household non-farm activity, income from household enterprise, and hours worked in household farm

activity are statistically significant at a 1% level. The variable new household member is statistically significant at 10%.

At the 90th quantile (top percentile), secondary education is statistically significant by 5% level, higher education is statistically significant at 1% level, and informal education is statistically significant at 10% level, while other education variables are not statistically significant at any of the significance levels. The variables female, oil-rich, income from household enterprises and hours worked in household farm activity are all statistically significant at a 1% level.

The difference in statistical significance levels is because of the different sample sizes for the variables estimated across the different percentiles, and since the power of a statistical test depends on the sample size, this may have influenced the difference.

4.6 Interpretation of the OLS and UQR Estimates

Table 4.9 shows the estimates of the OLS regression and RIF model regression. For the education categorical variables, household heads without education constitute the base or reference category, male is the base category for the variable female, non-oil-rich state is the base category for oil-rich state, no additional new member to the household is the reference category for new household member variable, and non-access to credit is the base category for credit variable. Note that in the interpretation of the dummy variable UQR estimates, *take the exponential of the coefficient estimator, subtract 1 from it, and multiply by 100*. This is the standard procedure of interpreting the partial effect of quantile estimates as it is more intuitive. Taking the exponential of the estimate allows for the

expression of the effect in a more meaningful way on the original scale of the dependent variable, which makes the results more interpretable.

The results of the OLS estimates show that household head with primary school education spends on average, 47% more than household head without any education, *ceteris paribus*. Heads of households who have secondary education and higher education have increased spending higher than those without education by 70% and 77% respectively, *ceteris paribus*, while those with informal education spend 42% more than those with no education, *ceteris paribus*. Being a female household head reduces spending by 28% compared to male household heads. Heads of household who live in states that have oil wealth spend more than their counterpart (household heads residing in states without oil wealth) by 37%, *ceteris paribus*. An additional year in the age of household head increases average spending by 1.8%, *ceteris paribus*. Additional hours in the number of hours worked per week in a salaried or waged job by household head would increase spending by 1.2%, *ceteris paribus*. Working an additional one hour in a non-farm household activity would increase spending by 0.9% for household heads, *ceteris paribus*. An increase in income by 10,000 Naira would increase spending by 30% for household heads, *ceteris paribus*. The addition of one new member to the household reduces expenditure by 15% for the household head, *ceteris paribus*, compared to households with no additional new member. Head of household with access to credit facility spend more than their counterpart by 9.6%, *ceteris paribus*.

The UQR estimate at the 10th percentile reveals that household heads with primary and secondary school education spend on average 126% and 212% respectively, more than those without any education, while household heads with higher education and informal

education spend an average of 194% and 287% more than those without education, *ceteris paribus*. Being a female head of household reduces spending by 30.1% compared to male-headed household spending, *ceteris paribus*. Living in a state with oil wealth increases spending for the household head by 15.9% more than household heads who reside in states that have no oil wealth. An additional hour in the hours worked per week in a salaried job increases expenditure by 1.5%. An additional hour worked in the household non-farm activity increases expenditure by 1.8%. These small effects could be as a result of the low-wage environment, where working additional one hour may not substantially increase expenditure outcome of individuals. If income from household enterprises increased by 10,000 Naira per week, expenditure is expected to increase by 22% for household heads. The addition of new members to the household reduces expenditure for household heads by 34.60% more than households with no new additional members. Household heads who have access to credit would increase spending by 28.2% more than household heads without access to credit, all *ceteris paribus*.

The result at the 25th quantile shows that household heads who have a primary school level of education spend on average 80.36% more than household heads without education. Household heads with secondary school education spend 105.09% more than household heads with no education. Household heads who have higher education and informal education spend more than heads of households with no education by 123.48% and 51.57% respectively. A female household head spends on average 24% less than the male household head. Household heads residing in a state that has oil wealth spend 24.81% more than resident household heads in states without oil wealth. An additional hour to the hours worked per week in a salaried job would expectedly increase spending by 0.9%,

while an additional hour increase in a household non-farm activity in a week would increase spending by 0.6%. An increase in income from household enterprise by 10,000 Naira would increase spending by 31% in a week for household heads. Household heads who have access to credit would increase spending by 18.68% more than household heads without access to credit facilities, all *ceteris paribus*.

At the 50th percentile, household heads with primary education would increase spending by 34.3% more than household heads with no education. Heads of households who have secondary and higher education levels would increase spending more than those with no education by 64.87% and 84.21% respectively. A female household head spends 14.70% less in comparison to a male household head. Household heads residing in states that have oil wealth spend more than those who reside in states without oil wealth by 40.80%. An additional increase in hours worked per week in a salaried job would increase spending by 0.8% for household heads, while an increase in the hours worked in a non-farm activity per week would increase spending by 0.55% for household heads. An increase in income from household enterprise by 10,000 Naira would increase spending for household heads by 27.7%. An additional hour to the hours worked in household farm activity would increase spending by 0.3% for household heads per week. Household heads with access to credit would increase spending by 9.88% more than household heads with no education, all *ceteris paribus*.

The estimates at the 75th percentile show that household heads with secondary education and higher education spend more than household heads who have no education by 42.75% and 55.75%, respectively. However, household heads with informal education spend less than household heads with no education by 16.73%. A female household head

spends less than a male household head by 20.78%. Household heads who reside in a state with oil wealth spend more than those who live in other states without oil wealth by 53.94%. An additional increase in the hours worked per week in a salaried job would increase expenditure by 0.8% for household heads in a week, while an additional increase in the hours worked in a non-farm activity would increase spending by 0.6% for household heads per week. An increase in income from household enterprise by 10,000 Naira would increase spending for household heads by 25%. An additional hour to the hours worked in a household farm activity per week would increase spending by 0.7% for household heads. The addition of new members to the household reduces expenditure for household heads by 12.90% more than households with no new additional members, *all ceteris paribus*.

The 90th percentile of the UQR estimates shows that household heads with secondary school education and higher education levels spend more than those with no education by 23.81% and 35.84% respectively. Household heads with informal education spend less than household heads with no education by 18.49%. Being a female household head reduces expenditure by 21.49% in comparison to male household heads. Household heads in states with oil wealth spend relatively more than those in the counterpart states by 41.30%. An increase in income from household enterprise by 10,000 Naira in a week would increase spending for household heads by 19.6%. An additional hour to the hours worked in household farm activity per week would increase spending by 0.8% for household heads.

The underlying reasons for the differences in outcome for the different education levels can be complex and may involve various factors. Some of the reasons could be prospects for career advancement and higher paying jobs which implies that possessing a higher degree might lead to greater job prospects, which in turn impacts on higher income

levels which then lead to higher expenditure outcomes for educated individuals. This could vary for individuals with different education levels. Furthermore, expenditure may grow among those with higher education levels who are more likely to be in their prime earning years due to demographic considerations like age.

The findings in the above results show that education plays a key role in the determinant of the differential in expenditure (welfare outcome). Across the different percentiles, the contribution of education on expenditure for those with higher (post-secondary) and secondary school levels of education remained substantially higher than other educational levels between the 25th and 90th percentiles. Likewise, living in oil-rich states portends a distinct welfare outcome from those who live in other states that are not oil-rich across all percentiles. From the result, there is the presence of a glass ceiling and sticky floor in terms of the expenditure pattern for female household heads. At the 10th percentile, female household heads spend significantly less than male household heads indicating a sticky floor, as there seems to be the presence of gender inequality at the bottom income distribution while there is an indication of a glass ceiling as female household heads spend relatively less compared to male household heads which possibly indicates that there is the existence of barriers that constitute a limitation to female household heads. This may be based on cultural or educational differences. This is suggestive that female household heads should be given more opportunities as this could potentially reduce the widening welfare gap.

4.7 Gini Index Model: What is Gini?

The Gini coefficient is used to assess the distribution of income or expenditure. Its values range from 0 (0%) to 1 (100%), with 0 being an indication of perfect equality and 1 being an indication of perfect inequality. Although in theory, the value could be greater than 1 especially when income is negative. A positive coefficient on a variable implies that there is a widening inequality, and a negative coefficient is an indication of a narrowing inequality.

The most often used indicator of inequality is the Gini index, which is calculated as the area between the Lorenz curve and the 45-degree line (see figure 3.1 in appendix 3) divided by the area under 45-degree line. The concentration area is the region that is between the straight line and the Lorenz curve (Gastwirth, 1972).

The formula for the Gini coefficient is given as:

$$\text{Gini Coefficient} = 1 - \frac{\text{Area under the line of equality}}{\text{Area under the Lorenz curve}}$$

The Gini coefficient is a summary statistic that measures the degree of inequality. Although, it has its own drawbacks, which includes the difficulty to distinguish between disparities resulting from various sources, such as those arising from gender discrimination and education disparities.

Data from World Bank (2022) shows Nigeria has a Gini Index of 35.1 in 2018 and has continued to operate at that level for the last five years and more. Nigeria is considered to have a moderately unequal but not very unequal income distribution. The Gini Index by itself, does not give a full picture of social welfare or economic well-being. Individual factors such as the rate of poverty, the availability and accessibility of healthcare and education, and other economic development measures are considerably important in determining the overall welfare state.

Table 10: Estimates from a Gini transformed dependent variable (Expenditure variable at level, not logarithmic).

Variables	Coefficient
Nursery Education	-.0179487 (0.0624)
Primary Education	-.0884224*** (0.0137)
Secondary Education	-.0717583*** (0.0167)
Higher Education	-.061567** (0.0251)
Informal Education	-.0730084*** (0.0156)
Female	-.0133181 (0.0157)
State with oil wealth	.0381387* (0.0201)
Age	.0034852 (0.0027)
Age-Squared	-.0000221 (0.0000236)
Hours Worked Per Week in Salaried Job	-.0003791 (0.0006)
Hours Worked in Household Non-Farm Activities	-.0011699*** (0.0004)
Income from Household Enterprise	-1.00e-06 (1.12e-06)
Hours worked in Household Farm Activities	-.0005895*

	(0.0003)
New Household Member	.0424126** (0.0214)
Credit	-.0504691*** (0.0146)
Constant	.5649115*** (0.0728)
R-Squared	0.0206
Observations	4,580

Note: ***, **, * denote statistical significance at 1%, 5%, and 10% levels respectively using two-tailed tests. The numbers in the parentheses below the estimates are robust standard errors (White's standard errors proposed by the econometrician Halbert White) for individual estimates.

4.8 Interpretation of the Gini Index Estimates

The Gini results from **Table 4.10** show that education variables are statistically significant except for nursery education which is not statistically significant at any of the levels. Similarly, the state with an oil wealth variable is statistically significant but at a 10% level. For the Gini interpretation, the focus would be on the variables of interest in this study, especially the education variables. The negative signs to each education estimate show that education helps to narrow the inequality gap and the positive sign to the state with oil wealth estimate implies that residing in a state that has oil wealth could potentially widen inequality.

Household heads with primary school education reduce welfare inequality by 8.8 percentage points compared to those with no education. Heads of households with secondary, higher, and informal levels of education help to reduce welfare disparity by 7.2

percentage points, 6.2 percentage points, and 7.3 percentage points respectively in comparison to household heads who have no education.

The state with oil wealth variable indicates that household heads residing in states that have oil wealth can contribute a widening effect on welfare disparity by 3.8 percentage points compared to those who reside in states without oil wealth. It is important to mention that from the standpoint of policy, age and age-squared do not show anything crucial.

4.9 Summary

The summary statistics from this study report the different variables used and a cross-tabulation of education variables by state and gender, as well as credit access by gender of household heads. An analysis of the descriptive statistics was also provided.

I have also provided the results from OLS, UQR and Gini-modified expenditure models, with interpretations of statistical significance and the estimates of each model as per the objectives of this study.

The next section (section 5) is dedicated to discussing the findings from the study; stating identified limitations that the study may have; providing recommendations from a policy standpoint and potential future research that may be carried out based on the findings of this study; and the conclusion.

Chapter 5. Discussions, Limitations, Recommendations, and Conclusions

5.1 Discussion of Findings

The study's findings indicate that disparities in oil endowments across states and disparities in education both contribute to welfare disparities between households and the welfare differentials between them. This implies that higher education tends to result in higher expenditure (a measure of welfare) when compared to household heads with no education, and this difference is found to expand across quantiles. These results support Gregorio and Lee (2003) assertion that the education plays a role in the substantial welfare disparity, as varying levels of education represents the different skills level which determines access to certain opportunities for high wage, which eventually impacts on welfare outcomes.

The results obtained from this study point to the difference in expenditure outcome of different gender groups which could be attributable to the educational difference between the male and female household heads. There is also evidence of a "glass ceiling" and "sticky floor". This is consistent with the study by Checchi (2003) that female education is strongly correlated with the family background of the female child, which affects the education of female children and in some instances takes effect at the primary education level. These findings are further corroborated by the report of EPDC (2012) on its assessment of Nigeria stating that male children receive greater consideration for education than female children.

According to the results of this study, having higher education and having completed secondary school have a considerable impact on the amount that household heads expend on food and non-food consumption (welfare) and are statistically significant throughout the estimated quantiles, and especially between the 25th and 90th percentile, where there seems to be a substantial difference in the impact of both higher and secondary education levels on welfare outcome when compared to other educational levels. Furthermore, the OLS mean estimates for secondary school education and higher education levels are both statistically significant and have a substantial impact on the difference in expenditures in comparison to household heads who have no education. The size of the impact is also distinctive when compared to other education categories. This supports the conclusion of Coady and Dizioli (2018) that higher educational level significantly reduces the disparity in income expansively.

The findings show that heads of households residing in states that have oil wealth expend more in comparison to those residing in states that have no oil wealth, which indicates that resident household heads in states with oil wealth have considerably better welfare outcomes than their base category. The difference is evident across the estimated quantiles, with the highest difference between the two groups being at the 75th quantile and the least difference at the 10th quantile (although at the 10th quantile, it is not statistically significant). However, this is contrary to Atanda (2018) which found that residents of states with oil wealth in the Niger Delta region of Nigeria have low living standards due to oil spillage from oil exploring companies. It is essential to note that the study by Atanda (2018) assessed the environmental effects of living in an oil-rich state and how that impacts their

livelihood. This may explain why the impact of living in a state with oil wealth has a widening effect on the Gini expenditure index.

The results from both the OLS and RIF regression estimates show that education plays a role in the difference in the welfare outcome. It can be argued that household heads with nursery education and household heads with no education might be comparable groups but not the same. To test the robustness of my findings, I combined the nursery and no education groups, and found the coefficients of other estimated variables in the model without the combination are close in magnitude and signs (see Appendix 2).

The effect of education is evident across all quantiles, especially with household heads with secondary and post-secondary (higher) education. This is therefore indicative of how increased investment in education would help to narrow the welfare differentials across households, in line with the position of Sehrawat and Singh (2019) who found that educational investment fosters equality of income for Indians.

From the Gini-model, we find that education has a narrowing effect on welfare disparity for all the levels of education, except for nursery education, which is not statistically significant. This goes to show that having at least a primary school education level can significantly help to narrow inequality in expenditure for heads of households. This finding provides an anti-thesis to the finding of Olufemi et al. (2022) that only enrollment in postsecondary education helps to narrow inequality. The difference in findings may be because of the differences in technique and data used for analysis.

5.2 Limitation of the Study

I have noted 3 major limitations in this study. The first is the paucity of studies that have addressed a similar topic on Nigeria as espoused in this paper. However, I have read and reviewed related literature to provide the needed insight. I, therefore, hope that this study will provide future researchers with some perspectives and possibly influence public policy decisions in the Nigerian context of educational investment in narrowing the widening welfare disparity.

The second limitation is the inaccessibility to some places during the data collection stage because of alarming insecurity in the North-East region of Nigeria during the period the data was collected. This was highlighted in the survey report of the data. Some data such as education expenditure was not collected at the first stage but at the second during which there was a security crisis. This explains the paucity of observation for that variable. Although this is not a variable used in the estimation of the models of the study, it is important to consider its usefulness in terms of other variables that might have been useful for this study. The data on food and non-food household expenditure was, however, gathered during the first stage of the data collection process. It was also reported in the survey data documentation that half of the attrition can be traced to this region due to insecurity. Nonetheless, other factors responsible were death, household member relocation, and refusal to be interviewed.

The third identified limitation is the size of the data. Although the size of the data is large enough for statistical analyses. However, juxtaposing the size of the data with the population strength of Nigeria may raise the question of the representativeness of the data. Although, the collection process of the data is efficient, methodical, and captures all the

states of Nigeria. Importantly, the methodology used in the analysis of the data makes the estimates true, reliable, and robust, which directs attention toward the distributional effect education has on welfare disparity in Nigeria. There is also the issue of data limitation, as some variables of interest, such as urban or rural areas.

5.3 Recommendation and Further Research

The data used in the study shows that 10% of household heads who have some sort of education are female compared to a staggering 57% of educated household heads (at least nursery education) who are male. In the same breath, 22% of male household heads have no education in comparison to female household heads 11% have no education. This indicates the education disparity between the two gender categories. To reduce this educational inequity, more investment should be made into the education of female children by prioritizing it as part of public policy, especially in rural communities where access to education is low. It is highly recommended that institutions of government should enter into agreements and collaborations with non-profit organizations to promote the importance of educating the girl child while also making budgetary provisions for educational projects that are targeted towards empowering the female child.

This study shows that inequality is fundamentally influenced by education, which gives further recognition to previous studies that have made similar findings. Therefore, if the problem of inequality is to be solved, the Nigerian government must prioritize education, as a means to tackling the widening gap in welfare outcomes.

For further research, estimating the interaction effect of education and gender may provide further insights. This will not be done in this study to avoid a deviation from the focus of this research. It may however be useful to future researchers who may be interested to see if the relationship between these two variables is contingent on the expenditure outcomes. Also, identifying the type of occupation the heads of households engage in, those who either live in rural or urban areas, where there is a robust dataset, and how that may have impacted the expenditure outcome might be useful in subsequent research.

There is the issue of endogeneity that I believe can be address in future studies that may consider the themes explored in this study, by identifying an instrumental variable for education, maybe *proximity to school*. It is usually difficult to identify an instrument, however for a variable to constitute an instrument, it should satisfy two conditions: *relevance* and *exogeneity*. Relevance in the sense that it should only affect the outcome variable only through the independent variable and exogeneity implies that the instrument should be uncorrelated with the error term.

5.4 Conclusions

This study has analyzed the 2016 GHS data using the OLS and the unconditional quantile regression (UQR) estimates. The OLS provides the means effect of each estimate in the regression results while the UQR provides the unconditional mean of the estimates at each quantile.

The result of the study shows that household heads with secondary and higher education have better welfare conditions than those with comparatively lower educational

levels. Additionally, household heads who reside in states that have oil wealth are better off than those residing in states without oil wealth in terms of their expenditure pattern, which is a measure of welfare in this study as indicated by the UQR and OLS estimates.

The Gini expenditure transformed model shows that education has a narrowing effect on welfare disparity, especially for those with at least a primary school education level, while residing in states that have oil wealth contributes to the broadening of the Gini expenditure index when compared to those residing in states with no oil wealth.

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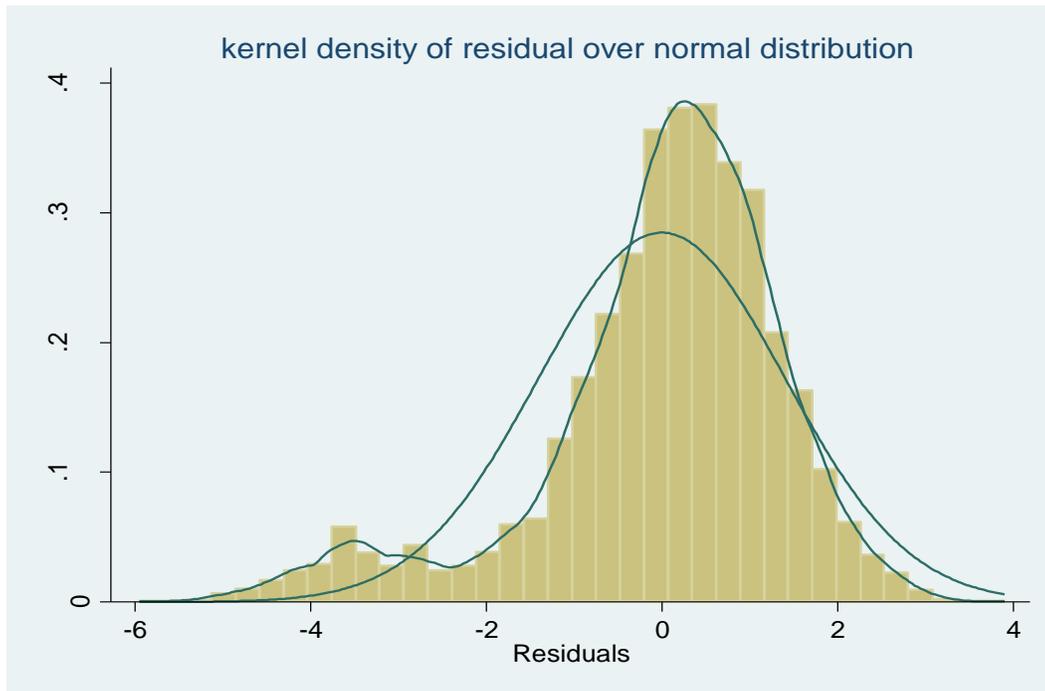
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Appendix 1

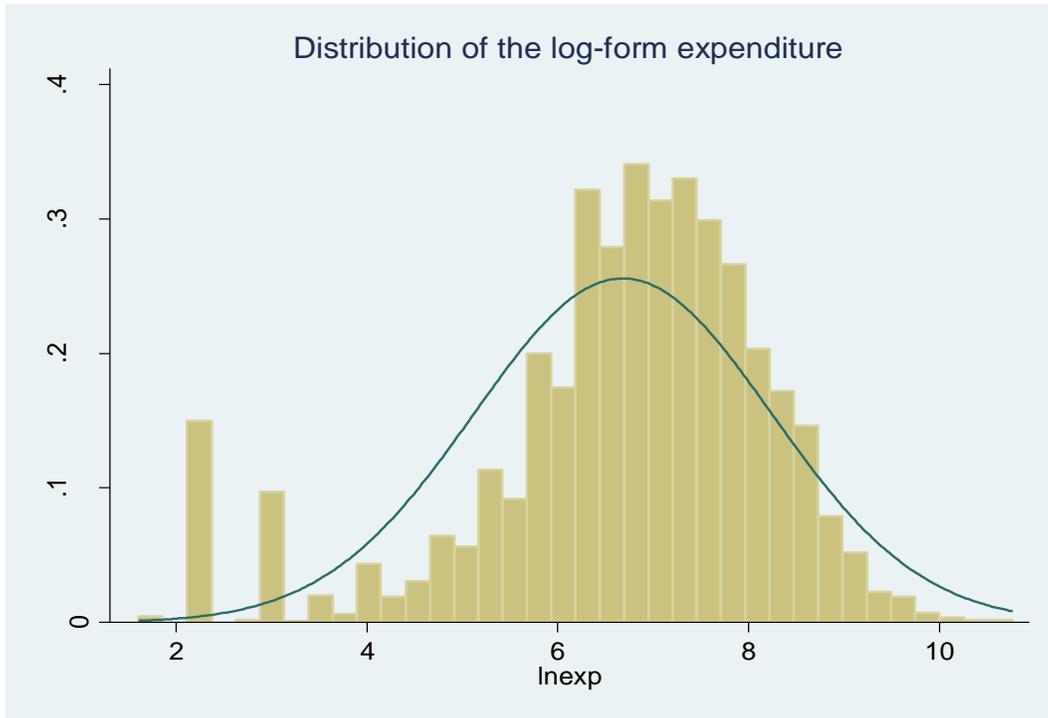
1.1 Normality Distribution of Residual with Kernel Density



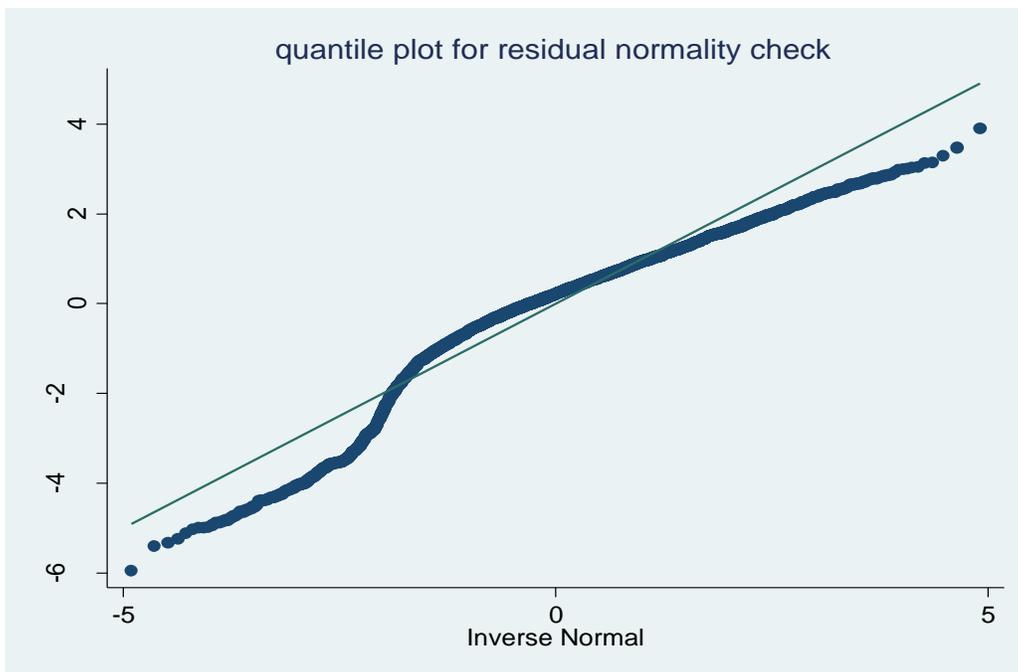
Epanechnikov kernel was produced, and the bandwidth is selected using the Sheather-Jones method. The Epanechnikov kernel is given by:

$$K(u) = \frac{3}{4} \cdot (1 - u^2)$$

1.2 Distribution of the log of expenditure



1.3 Normality Distribution of Residual with Quantile Plot



Heteroscedasticity Check

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Ho: Residuals are homoscedastic

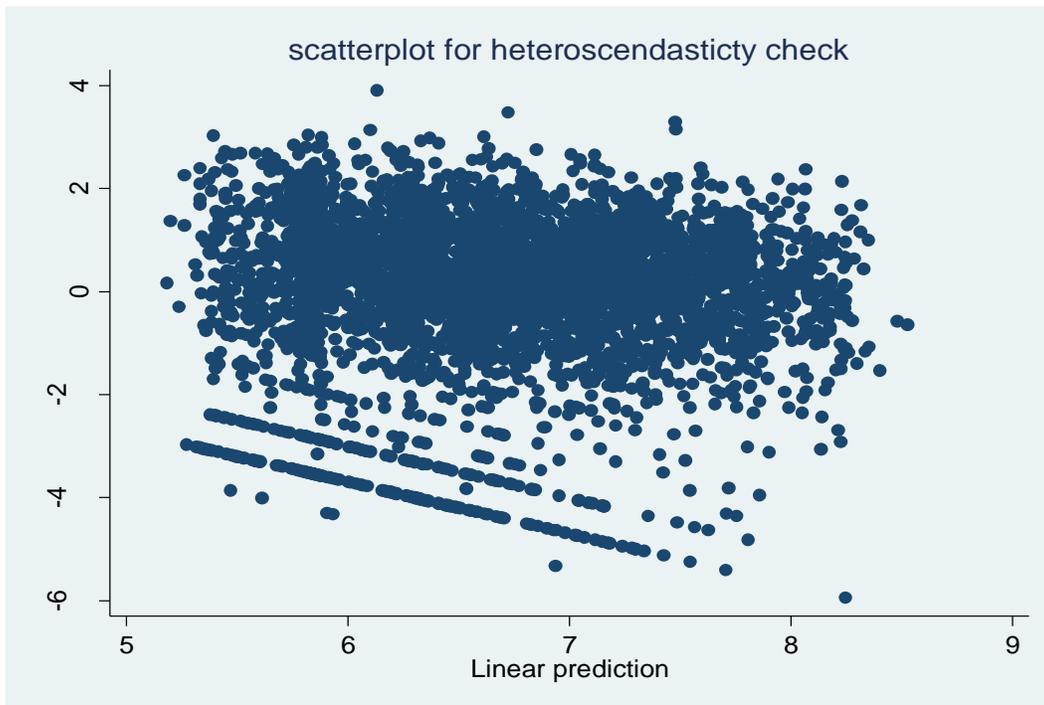
Variables: fitted values of lnexp

$\chi^2(1) = 117.41$

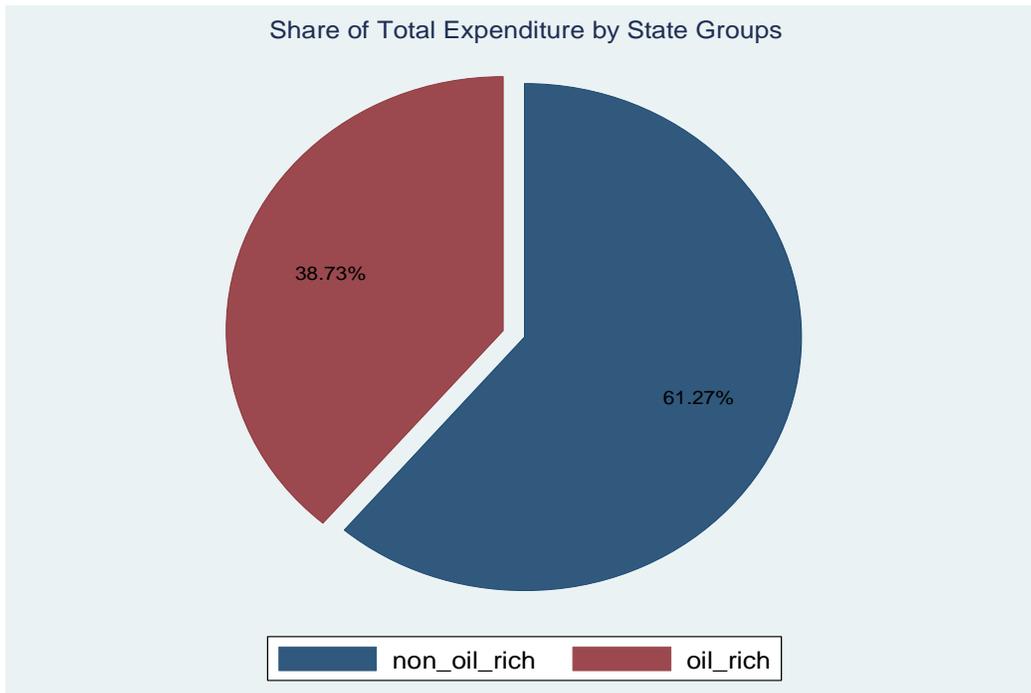
Prob > $\chi^2 = 0.0000$, therefore, cannot reject Ho.

This can be seen graphically as seen below:

1.4 Scatterplot for heteroscedasticity check

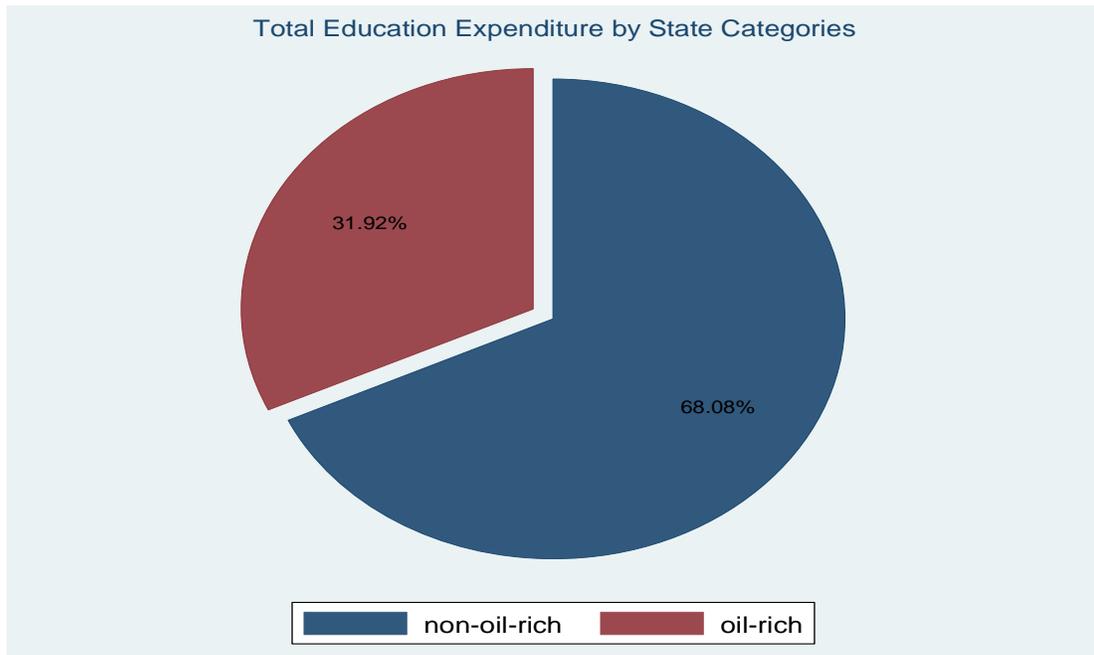


1.5 The distribution of total expenditure per state categories



The pie chart shows the distribution of total expenditure between the two states categories: states with oil wealth and states without oil wealth for household heads residing in the two different state categories. 61% of household heads contribute to the total expenditure that comes from states without oil wealth, while 39% of household heads contribute to total expenditure that comes from states without oil wealth.

1.6 The distribution of education expenditure by state groups



The pie chart shows the share of education expenditure for household heads by state groups. 68% of household heads contribute to the total education expenditure that comes from states without oil wealth, while 32% of household heads contribute to total education expenditure that comes from states without oil wealth.

Appendix 2

2.1 Stata Commands for Analysis

***RIF TRANSFORMED UNCONDITIONAL REGRESSION**

*** compute RIF for the 10th, 25th, 50th, 75th and 90th quantiles

```
foreach qt of numlist 10 25 50 75 90 {
```

```
  gen rif_`qt'=.
}
```

*** for all

```
pctile eval2= lnexp, nq(100)
```

```
kdensity lnexp, at(eval2) gen(eval_nw dens_nw) width(0.10) nograph
```

```
foreach qt of numlist 10 25 50 75 90 {
```

```
  local qc = `qt'/100
```

```
  replace rif_`qt'=eval_nw[`qt']+`qc'/dens_nw[`qt'] if lnexp>=eval_nw[`qt']
```

```
  replace rif_`qt'=eval_nw[`qt']-(1-`qc')/dens_nw[`qt'] if lnexp <eval_nw[`qt']
```

```
}
```

***Regression to produce estimates with Robust Standard Errors due to heteroscedasticity**

2.2 OLS Regression Output

reg lnexp nurseryedu primaryedu secondaryedu higheredu informaledu female oil_rich age_head age_headsqr hwpw hwnh ihe hwaa new_household_member credit, robust

Number of obs	=	4,329
F(15, 4313)	=	69.42
Prob > F	=	0.0000
R-squared	=	0.1929
Root MSE	=	1.4043

lnexp	Coef.	Robust Std. Err.	t	P>t	[95% Conf. Interval]
nurseryedu	-.0497118	.4752916	-0.10	0.917	-.9815278 .8821041
primaryedu	.4679933	.0627025	7.46	0.000	.3450642 .5909224
secondaryedu	.6995046	.0675712	10.35	0.000	.5670302 .831979
higheredu	.7731289	.0802553	9.63	0.000	.6157873 .9304706
informaledu	.4200888	.0842244	4.99	0.000	.2549656 .585212
female	-.2819057	.0672243	-4.19	0.000	-.4136998 -.1501116
oil_rich	.365179	.0515526	7.08	0.000	.2641095 .4662485
age_head	.0182742	.0108056	1.69	0.091	-.0029103 .0394588
age_headsqr	-.0001866	.0000996	-1.87	0.061	-.0003819 8.71e-06
hwpw	.011533	.0016725	6.90	0.000	.008254 .014812
hwnh	.0094513	.0012812	7.38	0.000	.0069394 .0119632
ihe	.0000303	2.94e-06	10.32	0.000	.0000245 .000036
hwaa	-.000991	.0015002	-0.66	0.509	-.0039321 .0019502
new_household member	-.1482399	.0841224	-1.76	0.078	-.3131632 .0166833
credit	.0961542	.0512485	1.88	0.061	-.0043191 .1966276
_cons	5.436649	.2823917	19.25	0.000	4.883017 5.990282

2.3 RIF 10 Output

reg rif_10 nurseryedu primaryedu secondaryedu higheredu informaledu female oil_rich age_head age_headsqr hwpw hwnh ihe hwaa new_household_member credit, robust

Number of obs	=	4,580
F(15, 4564)	=	14.95
Prob > F	=	0.0000
R-squared	=	0.0490
Root MSE	=	4.1254

rif_10	Coef.	Robust Std. Err.	t	P>t	[95% Conf. Interval]
nurseryedu	-1.156247	1.475844	-0.78	0.433	-4.049615 1.737121
primaryedu	.8173298	.1880339	4.35	0.000	.4486924 1.185967
secondaryedu	1.138778	.186362	6.11	0.000	.7734183 1.504138
higheredu	1.07923	.2130053	5.07	0.000	.6616363 1.496823
informaledu	1.353941	.2249011	6.02	0.000	.9130261 1.794856
female	-.3655334	.2030373	-1.80	0.072	-.7635848 .0325181
oil_rich	.1473819	.1372746	1.07	0.283	-.1217429 .4165066
age_head	.0235899	.0314089	0.75	0.453	-.0379866 .0851665
age_headsqr	-.0002651	.0002935	-0.90	0.366	-.0008406 .0003103
hwpw	.0147922	.0040888	3.62	0.000	.0067762 .0228081
hwnh	.0181971	.0033208	5.48	0.000	.0116866 .0247075
ihe	.000022	7.07e-06	3.10	0.002	8.09e-06 .0000358
hwaa	.002474	.0045916	0.54	0.590	-.0065278 .0114757
new_household_member	-.424615	.2551818	-1.66	0.096	-.9248948 .0756647
credit	.2484647	.1435375	1.73	0.084	-.0329382 .5298676
_cons	3.232494	.8109046	3.99	0.000	1.642728 4.822259

2. 4 RIF 25 Output

reg rif_25 nurseryedu primaryedu secondaryedu higheredu informaledu female oil_rich age_head age_headsqr hwpw hwnh ihe hwaa new_household_member credit, robust

Number of obs	=	4,580
	F(15, 4564)	= 34.42
	Prob > F	= 0.0000
	R-squared	= 0.0938
	Root MSE	= 1.9755

	Coef.	Robust Std. Err.	t	P>t	[95% Conf. Interval]
rif_25					
nurseryedu	.1163803	.5653497	0.21	0.837	-.9919786 1.224739
primaryedu	.5897541	.0877144	6.72	0.000	.4177914 .7617169
secondaryedu	.7182962	.0924776	7.77	0.000	.5369954 .8995971
higheredu	.8041515	.1017615	7.90	0.000	.6046498 1.003653
informaledu	.4159313	.135584	3.07	0.002	.1501211 .6817416
female	-.2771452	.0935358	-2.96	0.003	-.4605207 -.0937697
oil_rich	.2216089	.066877	3.31	0.001	.0904977 .3527201
age_head	.0050541	.0143748	0.35	0.725	-.0231275 .0332357
age_headsqr	-.0000831	.0001323	-0.63	0.530	-.0003425 .0001763
hwpw	.009034	.0019554	4.62	0.000	.0052005 .0128676
hwnh	.0060059	.0016943	3.54	0.000	.0026841 .0093276
ihe	.0000308	3.63e-06	8.47	0.000	.0000237 .0000379
hwaa	.0000903	.0020477	0.04	0.965	-.0039241 .0041047
new_household_member	-.1258629	.1154841	-1.09	0.276	-.3522676 .1005419
credit	.171302	.0717642	2.39	0.017	.0306094 .3119946
_cons	5.311557	.3789569	14.02	0.000	4.568618 6.054496

2.5 RIF 50 Output

reg rif_50 nurseryedu primaryedu secondaryedu higheredu informaledu female oil_rich age_head age_headsqr hwpw hwnh ihe hwaa new_household_member credit, robust

Number of obs	=	4,580
	F(15, 4564)	= 51.57
	Prob > F	= 0.0000
	R-squared	= 0.1254
	Root MSE	= 1.4286

	Coef.	Robust Std. Err.	t	P>t	[95% Conf. Interval]
rif_50					
nurseryedu	.1029768	.3761716	0.27	0.784	-.6345015 .8404551
primaryedu	.2949772	.061151	4.82	0.000	.1750917 .4148626
secondaryedu	.5000018	.0679367	7.36	0.000	.3668131 .6331906
higheredu	.610903	.076418	7.99	0.000	.4610866 .7607193
informaledu	.0577621	.0939671	0.61	0.539	-.1264588 .241983
female	-.1589693	.0628377	-2.53	0.011	-.2821616 -.035777
oil_rich	.3422171	.0513558	6.66	0.000	.2415349 .4428994
age_head	.0005808	.0102389	0.06	0.955	-.0194923 .0206539
age_headsqr	-.0000193	.0000925	-0.21	0.835	-.0002007 .0001621
hwpw	.0076675	.0015775	4.86	0.000	.0045748 .0107601
hwnh	.0054633	.0012765	4.28	0.000	.0029608 .0079659
ihe	.0000277	3.03e-06	9.12	0.000	.0000217 .0000336
hwaa	-.0029291	.001432	-2.05	0.041	-.0057365 -.0001217
new_household member	-.1189557	.0788569	-1.51	0.131	-.2735534 .0356421
credit	.094021	.0546417	1.72	0.085	-.0131031 .2011452
_cons	6.455244	.2740628	23.55	0.000	5.917949 6.99254

2.6 RIF 75 Output

reg rif_75 nurseryedu primaryedu secondaryedu higheredu informaledu female oil_rich age_head age_headsqr hwpw hwnh ihe hwaa new_household_member credit, robust

Number of obs	=	4,580
	F(15, 4564)	= 35.66
	Prob > F	= 0.0000
	R-squared	= 0.1048
	Root MSE	= 1.5608

rif_75	Coef.	Robust Std. Err.	t	P>t	[95% Conf. Interval]
nurseryedu	.1515134	.3727924	0.41	0.684	-.5793401 .882367
primaryedu	.0968374	.0627594	1.54	0.123	-.0262014 .2198762
secondaryedu	.3558917	.0737485	4.83	0.000	.2113089 .5004745
higheredu	.4430934	.0870278	5.09	0.000	.2724768 .61371
informaledu	-.1830521	.0857364	-2.14	0.033	-.351137 -.0149672
female	-.2329716	.0668499	-3.48	0.000	-.3640297 -.1019136
oil_rich	.4313847	.0613623	7.03	0.000	.3110849 .5516844
age_head	.0087719	.0109769	0.80	0.424	-.0127482 .0302919
age_headsqr	-.0000664	.0000986	-0.67	0.500	-.0002596 .0001268
hwpw	.007542	.0018777	4.02	0.000	.0038608 .0112232
hwnh	.0061234	.0014787	4.14	0.000	.0032244 .0090223
ihe	.000025	3.67e-06	6.80	0.000	.0000178 .0000322
hwaa	-.0066733	.0014512	-4.60	0.000	-.0095183 -.0038283
new_household_member	-.1381091	.0806954	-1.71	0.087	-.296311 .0200929
credit	-.0717757	.0608747	-1.18	0.238	-.1911195 .0475681
_cons	7.201016	.2933445	24.55	0.000	6.625918 7.776113

2.7 RIF 90 Output

reg rif_90 nurseryedu primaryedu secondaryedu higheredu informaledu female oil_rich age_head age_headsqr hwpw hwnh ihe hwaa new_household_member credit, robust

Number of obs	=	4,580
	F(15, 4564)	= 10.10
	Prob > F	= 0.0000
	R-squared	= 0.0364
	Root MSE	= 2.0046

rif_90	Coef.	Robust Std. Err.	t	P>t	[95% Conf. Interval]
nurseryedu	.0121357	.4599422	0.03	0.979	-.8895736 .9138449
primaryedu	-.0887463	.0777917	-1.14	0.254	-.2412556 .0637631
secondaryedu	.2136394	.0946972	2.26	0.024	.0279872 .3992917
higheredu	.3063128	.1148006	2.67	0.008	.0812481 .5313774
informaledu	-.2043918	.1061466	-1.93	0.054	-.4124905 .0037069
female	-.2418521	.0840605	-2.88	0.004	-.4066513 -.077053
oil_rich	.3457048	.080522	4.29	0.000	.1878426 .5035669
age_head	.0088657	.0142644	0.62	0.534	-.0190994 .0368309
age_headsqr	-.0000396	.0001288	-0.31	0.758	-.000292 .0002128
hwpw	.0038886	.0024973	1.56	0.120	-.0010072 .0087845
hwnh	.000745	.001873	0.40	0.691	-.0029269 .0044169
ihe	.0000196	4.81e-06	4.08	0.000	.0000102 .000029
hwaa	-.0077689	.0018165	-4.28	0.000	-.0113301 -.0042078
new_household_member	-.0560798	.1021042	-0.55	0.583	-.2562534 .1440937
credit	-.0476054	.0784183	-0.61	0.544	-.2013432 .1061324
_cons	8.157948	.3799549	21.47	0.000	7.413052 8.902843

Appendix 3

3.1 Gini Index Model Stata Code

findit rifvar

Then click on this link:

rif from <http://fmwww.bc.edu/RePEc/bocode/r>

and then click on 'click here to install'

*Run this

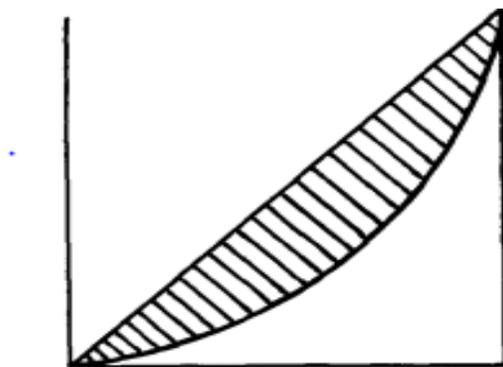
```
egen tot_exp_gini =rifvar(tot_exp), gini
```

*tot_exp is total expenditure.

Once this is computed, I ran the following regression:

```
reg tot_exp_gini nurseryedu primaryedu secondaryedu higheredu informaledu female  
oil_rich age_head age_headsqr hwpw hwnh ihe hwa new_household_member credit,  
robust
```

Figure 3.1: Lorenz Curve and 45-degree line



Source: Gastwirth, 1972

3.2 Gini Model Output

Number of obs	=	4,580
	F(15, 4564)	= 11.64
	Prob > F	= 0.0000
	R-squared	= 0.0206
	Root MSE	= .41437

tot_exp_gini	Coef.	Robust Std. Err.	t	P>t	[95% Conf. Interval]
nurseryedu	-.0179487	.0623951	-0.29	0.774	-.1402733 .104376
primaryedu	-.0884224	.0137283	-6.44	0.000	-.1153365 -.0615084
secondaryedu	-.0717583	.0166682	-4.31	0.000	-.104436 -.0390806
higheredu	-.061567	.0250811	-2.45	0.014	-.110738 -.012396
informaledu	-.0730084	.0156307	-4.67	0.000	-.1036522 -.0423645
female	-.0133181	.015722	-0.85	0.397	-.0441409 .0175046
oil_rich	.0381387	.0200592	1.90	0.057	-.0011871 .0774644
age_head	.0034852	.0027046	1.29	0.198	-.0018172 .0087876
age_headsqr	-.0000221	.0000236	-0.94	0.350	-.0000683 .0000242
hwpw	-.0003791	.0005972	-0.63	0.526	-.0015499 .0007918
hwnh	-.0011699	.0003613	-3.24	0.001	-.0018783 -.0004615
ihe	-1.00e-06	1.12e-06	-0.89	0.372	-3.21e-06 1.20e-06
hwaa	-.0005895	.0003144	-1.87	0.061	-.001206 .0000269
new_household member	.0424126	.0213512	1.99	0.047	.000554 .0842713
credit	-.0504691	.0145956	-3.46	0.001	-.0790836 -.0218546
_cons	.5649115	.0727863	7.76	0.000	.4222152 .7076078

Appendix 4

4.1 Robustness Check OLS Model

Variables	Coef.	RSE	t	P>t	[95% Conf. Interval]	
primary	0.469	0.063	7.49	0.000	0.346	0.591
secondary	0.700	0.067	10.39	0.000	0.568	0.832
higher_edu	0.774	0.080	9.66	0.000	0.617	0.931
informal_ed	0.421	0.084	5	0.000	0.256	0.585
female	-0.282	0.067	-4.19	0.000	-0.414	-0.150
oil_rich	0.365	0.052	7.08	0.000	0.264	0.466
age_head	0.018	0.011	1.69	0.091	-0.003	0.039
age_headsqr	0.000	0.000	-1.87	0.061	0.000	0.000
hwpw	0.012	0.002	6.9	0.000	0.008	0.015
hwnh	0.009	0.001	7.38	0.000	0.007	0.012
IHE	0.000	0.000	10.33	0.000	0.000	0.000
hwaa	0.000	0.002	-0.66	0.509	-0.004	0.002
householdmember	-0.148	0.084	-1.76	0.078	-0.313	0.017
credit	0.096	0.051	1.87	0.061	-0.005	0.197
_cons	5.436	0.282	19.25	0.000	4.883	5.990
R-Squared	0.1929					
Number of Observations	4,329					

4.2 Robustness Check RIF 10

rif_10	Coef.	Std. Err.	t	P>t	[95% Conf. Interval]	
primary	0.831	0.188	4.42	0.000	0.463	1.199
secondary	1.152	0.186	6.2	0.000	0.788	1.516
higher_edu	1.093	0.213	5.14	0.000	0.676	1.510
informal_edu	1.366	0.224	6.09	0.000	0.927	1.806
female	-0.369	0.203	-1.82	0.069	-0.767	0.029
oil_rich	0.145	0.138	1.05	0.293	-0.125	0.415
age_head	0.023	0.031	0.74	0.46	-0.038	0.085
age_headsqr	0.000	0.000	-0.89	0.372	-0.001	0.000
hwpw	0.015	0.004	3.61	0.000	0.007	0.023
hwnh	0.018	0.003	5.47	0.000	0.012	0.025

IHE	0.000	0.000	3.13	0.002	0.000	0.000
hwaa	0.003	0.005	0.55	0.585	-0.006	0.012
new_household member	-0.425	0.255	-1.66	0.096	-0.925	0.075
credit	0.245	0.144	1.7	0.088	-0.037	0.528
cons	3.230	0.812	3.98	0.000	1.638	4.821
R-Squared	0.049					
Number of Observations	4,580					

4.3 Robustness Check RIF 25

rif_25	Coef.	RSE	t	P>t	[95% Conf. Interval]	
primary	0.588	0.087	6.73	0.000	0.417	0.760
secondary	0.717	0.092	7.77	0.000	0.536	0.898
higher_edu	0.803	0.102	7.9	0.000	0.604	1.002
informal_edu	0.415	0.135	3.06	0.002	0.149	0.680
female	-0.277	0.094	-2.96	0.003	-0.460	-0.093
oil_rich	0.222	0.067	3.32	0.001	0.091	0.353
age_head	0.005	0.014	0.35	0.723	-0.023	0.033
age_headsqr	0.000	0.000	-0.63	0.528	0.000	0.000
hwpw	0.009	0.002	4.62	0.000	0.005	0.013
hwnh	0.006	0.002	3.55	0.000	0.003	0.009
IHE	0.000	0.000	8.47	0.000	0.000	0.000
hwaa	0.000	0.002	0.04	0.966	-0.004	0.004
new_household member	-0.126	0.115	-1.09	0.276	-0.352	0.101
credit	0.172	0.072	2.39	0.017	0.031	0.312
cons	5.312	0.379	14.02	0.000	4.569	6.055
R-Squared	0.094					
Number of Observations	4,580					

4.4 Robustness Check RIF 50

rif_50	Coef.	RSE	t	P>t	[95% Conf.Interval]	
primary	0.294	0.061	4.82	0.000	0.174	0.413
secondary	0.499	0.068	7.36	0.000	0.366	0.632
higher_edu	0.610	0.076	7.99	0.000	0.460	0.759
informal_edu	0.057	0.094	0.6	0.546	-0.127	0.241
female	-0.159	0.063	-2.53	0.012	-0.282	-0.035
oil_rich	0.342	0.051	6.67	0.000	0.242	0.443
age_head	0.001	0.010	0.06	0.952	-0.019	0.021
age_headsqr	-0.00002	0.000	-0.21	0.833	-0.0002	0.00016
hwpw	0.008	0.002	4.86	0.000	0.005	0.011
hwnh	0.005	0.001	4.29	0.000	0.003	0.008
IHE	0.000	0.000	9.12	0.000	0.000	0.000
hwaa	-0.003	0.001	-2.05	0.041	-0.006	0.000
new_household member	-0.119	0.079	-1.51	0.132	-0.274	0.036
credit	0.094	0.055	1.73	0.084	-0.013	0.201
cons	6.456	0.274	23.56	0.000	5.918	6.993
R-Squared	0.125					
Observations	4,580					

4.5 Robustness Check RIF 75

rif_75	Coef.	RSE	t	P>t	[95% Conf. Interval]	
primary	0.095	0.063	1.52	0.129	-0.028	0.218
secondary	0.354	0.074	4.81	0	0.210	0.499
higher_edu	0.441	0.087	5.08	0	0.271	0.612
informal_edu	-0.185	0.086	-2.16	0.031	-0.353	-0.017
female	-0.233	0.067	-3.48	0.001	-0.364	-0.102
oil_rich	0.432	0.061	7.04	0	0.311	0.552
age_head	0.009	0.011	0.8	0.422	-0.013	0.030
age_headsqr	-0.0001	0.000	-0.68	0.498	-0.0003	0.0001
hwpw	0.008	0.002	4.02	0	0.004	0.011
hwnh	0.006	0.001	4.15	0	0.003	0.009
IHE	0.00003	0.000	6.8	0	0.00002	0.00003

hwaa	-0.007	0.001	-4.6	0	-0.010	-0.004
new_household member	-0.138	0.081	-1.71	0.087	-0.296	0.020
credit	-0.071	0.061	-1.17	0.241	-0.191	0.048
Constant	7.201	0.293	24.55	0	6.626	7.776
R-Squared	0.105					
Obs	4,580					

4.6 Robustness Check RIF 90

rif_90	Coef.	RSE	t	P>t	[95% Conf. Interval]	
primary	-0.089	0.078	-1.15	0.252	-0.241	0.063
secondary	0.214	0.094	2.26	0.024	0.028	0.399
higher_edu	0.306	0.115	2.67	0.008	0.081	0.531
informal_edu	-0.205	0.106	-1.93	0.054	-0.412	0.003
female	-0.242	0.084	-2.88	0.004	-0.406	-0.077
oil_rich	0.346	0.080	4.3	0.000	0.188	0.504
age_head	0.009	0.014	0.62	0.534	-0.019	0.037
age_headsqr	0.000	0.000	-0.31	0.758	0.000	0.000
hwpw	0.004	0.002	1.56	0.119	-0.001	0.009
hwnh	0.001	0.002	0.4	0.69	-0.003	0.004
IHE	0.000	0.000	4.08	0.000	0.000	0.000
hwaa	-0.008	0.002	-4.28	0.000	-0.011	-0.004
new_household member	-0.056	0.102	-0.55	0.583	-0.256	0.144
credit	-0.048	0.078	-0.61	0.544	-0.201	0.106
cons	8.158	0.380	21.47	0.000	7.413	8.903
R-squared	0.036					
Observations	4,580					

4.7 Robustness Check Gini Model

tot_exp_gini	Coef.	RSE	t	P>t	[95% Conf. Interval]	
primary	-0.088	0.014	-6.44	0.000	-0.11507	-0.06135
secondary	-0.072	0.017	-4.3	0.000	-0.10417	-0.03893
higher_edu	-0.061	0.025	-2.45	0.014	-0.11050	-0.01220
informal_edu	-0.073	0.016	-4.67	0.000	-0.10342	-0.04221
female	-0.013	0.016	-0.85	0.395	-0.04419	0.01746
oil_rich	0.038	0.020	1.9	0.058	-0.00122	0.07742
age_head	0.003	0.003	1.29	0.198	-0.00182	0.00878
age_headsqr	0.000	0.000	-0.93	0.351	-0.00007	0.00002
hwpw	0.000	0.001	-0.64	0.525	-0.00155	0.00079
hwnh	-0.001	0.000	-3.24	0.001	-0.00188	-0.00046
IHE	-0.000001	0.000	-0.89	0.373	-0.000003	0.000001
hwaa	-0.001	0.000	-1.87	0.061	-0.00121	0.00003
new_household member	0.042	0.021	1.99	0.047	0.00055	0.08427
credit	-0.051	0.015	-3.46	0.001	-0.07912	-0.02191
Constant	0.565	0.073	7.76	0.000	0.42219	0.70755
R-Squared	0.021					
Observations	4,580					

4.8 Multicollinearity Test

	lnexp	nurser~u	primar~u	second~u	higher~u	inform~u	female	oil_rich	age_head	age_he~r	hwpw	hwnh
lnexp	1.0000											
nurseryedu	-0.0285	1.0000										
primaryedu	0.0312	-0.0346	1.0000									
secondaryedu	0.1743	-0.0320	-0.2985	1.0000								
higheredu	0.1569	-0.0259	-0.2421	-0.2234	1.0000							
informaledu	-0.0127	-0.0166	-0.1552	-0.1432	-0.1161	1.0000						
female	-0.1379	0.0457	0.0233	-0.1109	-0.0799	-0.0978	1.0000					
oil_rich	0.1728	-0.0011	0.1564	0.0962	0.1009	-0.1608	0.1449	1.0000				
age_head	-0.1424	0.0271	0.0744	-0.3056	-0.0647	-0.0063	0.1801	0.0650	1.0000			
age_headsqr	-0.1516	0.0266	0.0632	-0.2913	-0.0737	-0.0129	0.1776	0.0618	0.9885	1.0000		
hwpw	0.1631	-0.0153	-0.0905	0.0435	0.4049	-0.0936	-0.1043	0.0776	-0.1330	-0.1445	1.0000	
hwnh	0.2159	-0.0021	0.0232	0.1836	-0.1018	0.0468	0.0160	0.0468	-0.1964	-0.2010	-0.2418	1.0000
ihe	0.2811	-0.0263	0.0270	0.1678	0.0012	-0.0098	-0.0962	0.1286	-0.1234	-0.1333	-0.0702	0.5163
hwaa	-0.1369	0.0045	0.0282	-0.0842	-0.1841	0.0360	-0.1116	-0.1486	-0.0058	-0.0165	-0.1965	-0.2639
new_househ~r	-0.0838	0.0149	0.0050	0.0242	-0.0398	-0.0441	0.4532	0.0547	-0.1113	-0.0949	-0.0503	0.0020
credit	0.0641	0.0111	0.0079	0.0230	0.0609	-0.0118	-0.0313	0.0511	-0.0274	-0.0339	0.0420	0.0188
		ihe	hwaa	new_ho~r	credit							
ihe	1.0000											
hwaa	-0.1565	1.0000										
new_househ~r	-0.0974	-0.0952	1.0000									
credit	0.0456	0.0123	-0.0425	1.0000								

Curriculum Vitae

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Conference Presentations: None