BODA BODA:
THE IMPACT OF A MOTORBIKE TAXI SERVICE IN RURAL SOUTH UGANDA

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ABSTRACT

Rural sub-Saharan Africa suffers from a lack of transportation infrastructure, hindering rural access for populations in remote areas to social and economic opportunities available in urban areas. Scholars have studied this issue for decades, focusing on the monetary and social imbalances caused by this isolation. I will analyze a motorbike taxi service called Boda Boda, a means of transportation widely used in East Africa and the factors affecting its use. Binary probability regressions reveal counterintuitive behavior, such as a high sensitivity to distances only for accessing non-productive activities such as health infrastructure. Poisson regressions show that the likelihood of undertaking multiple trips in Boda Boda is high only in the presence of an agricultural surplus. A qualitative analysis based on four surveys shows that Boda Boda is largely used to foster social relations and confirms that it is rarely used as a method to access health or education facilities. I postulate that Boda Boda has a positive impact on the freedom and development of remote populations. The research for this paper took place in two villages in southern Uganda from December 2013 to January 2014.

INTRODUCTION

Academic literature shows that the physical, economic, and cultural integration of rural areas in sub-Saharan Africa with urban economic and social structures is a crucial step towards development. Although some would interpret this as building roads from urbanized regions to rural spaces, scholars have shown that constructing roads is not the fundamental determinant of social and socio-economic development among rural populations. Transport services offered by the private motor taxi system Boda Boda represent a partial solution to the problem of rural isolation. This paper evaluates Boda Boda's social and economic impact on the rural population in southwestern Uganda. The Kabale District, located in southern region of the country, is of particular interest because of its geographic features: abundant mountains and valleys with an absence of paved roads. The research for this paper was carried out in two villages: Nangara and Kigarama that are four and eight kilometers from the District capital respectively.

Existing literature neither discusses nor empirically evaluates the usefulness of these taxi services. This study provides a quantitative and qualitative analysis of the Boda Boda's impact on the welfare of remote rural populations. With a binary probability linear model, I show that individuals in Kigarama are distance sensitive with regards to the use of Boda Boda to access health facilities. I also show that subjects in Kigarama without agricultural surplus are not sensitive to the market distance. Additionally, I demonstrate that the presence of an agricultural surplus increases the likelihood of using the Boda Boda system. Compared to individuals in the village of Nangara, the data show that individuals in the village of Kigarama are not distance-sensitive with regard to the use of Boda Boda to access health facilities. The data also show that individuals in both villages are price sensitive with regard to Boda Boda costs.

I then use a Poisson regression to analyze the factors that affect the probability of taking multiple trips with Boda Boda taxis. The results confirm those of previous regressions, and show that education level is a factor in the use of Boda Boda for the village of Kigarama. Every additional year of schooling has a strong impact on the likelihood of undertaking multi-

ple Boda Boda trips per month. A qualitative analysis shows that villagers perceive the Boda Boda service to greatly enhance personal welfare. Survey data demonstrate that the population mainly uses the motorbike taxi service to maintain or create social interactions. Additionally, they do not use the service to access quality schools. These findings necessitate a reconsideration of the meaning of welfare in rural sub-Saharan Africa, as it may be different from the Western notion of welfare. My research suggests that different priorities shape the concept of welfare in rural southwestern Uganda as compared to urban communities. A survey I performed suggests that the populations in both villages perceive the Boda Boda transportation system as a valuable tool for increasing their welfare level.

In the first chapter, I present both a review of the academic literature about rural isolation, as well as an analysis on the concept of welfare. The paper continues with analyses of the economic, geographic, and road infrastructure of the southwestern Kabale District. After a brief review of the Boda Boda history phenomenon and a description of the research method, the fifth chapter reports on the research results.

CHAPTER 1 LITERATURE REVIEW

Chapter 1.1 Isolation Literature

Various scholars have analyzed the impact of isolation on the welfare of rural communities within developing countries. This chapter will analyze the strengths and flaws of the main academic ideas on the topic. I compare the development of remote communities with that of urban areas. The academic literature generally undertakes two different approaches: one, measures the economic differences between the two areas, and the second approach focuses on more qualitative aspects, such as the relationship between isolation and welfare for rural populations.

The main goal of the first method is to measure the economic inequalities between the isolated and integrated areas. It also seeks to investigate the cost-benefit ratio of potential infrastructure investments aimed at integrating remote populations into the national economic network. Chamberlain and Stiefel suggest that remoteness, defined as travel time during the dry season from the commune center to the nearest urban center, negatively affects agricultural productivity and incomes at the household level.[1, 2] Through their econometric analysis, Chamberlain and Stiefel show that the lack of road infrastructure negatively impacts agricultural output and productivity. The researchers point out that the insufficient number of roads is particularly serious in developing countries where the agricultural sector accounts for a large share of gross domestic product (GDP), and where poverty is mainly concentrated in rural areas. Fan and Hazell, using time-series data from India and the People's Republic of China, demonstrate how government spending has a positive impact on agricultural output in remote areas and generates a subsequent temporary increase in income.[3] Warr also illustrated that road improvements generated a 9.5 percent increase in rural food consumption in Laos between 1998 and 2003.[4] Similar evidence was found in Ethiopia, Tanzania, Zambia, and Mali.[5, 6]

An analysis of academic literature suggests that, "…the prevailing notion [of these authors] is that as household distance from roads increases (on roads which eventually lead to markets), the income/consumption expenditure of household decreases."[7] However, many authors acknowledge that investment focused solely on the growth of agricultural productivity and the increase of rural consumption does not necessarily reduce rural poverty[8]. Deininger, Okidi, and Fan show that despite government efforts, poverty in rural, and mostly remote, regions remains at high level.[9, 10] Moreover, other authors argue that the costs of significant investments in rural roads outweigh the benefits for developing countries.[11] The analysis of the impact of living in remote rural areas on personal welfare cannot be limited to an economic study of agricultural productivity and short-term consumption increases. It must also consider other variables, such as social relations and freedom of choice.

The second academic approach to the problem of isolation of rural communities in developing countries arises from a critique of the economic method to understand the issue. This approach suggests that isolation not only hinders accessing markets, but also impedes the rural population from accessing freedoms that stem from interaction with a broader network of opportunities. Indian economist Amartya Sen is a leading scholar of this school of economic thought. Sen critiques the idea that the development of rural areas should solely include the distribution of services to the populations and, possibly, safety nets for the very poor. In *Development as Freedom,* Sen suggests that the development of remote areas is a, "…process of expanding the real freedoms that people enjoy."[12]

The novelty of his thought is that development cannot be identified and measured simply with per capita production growth or increase of consumption. He argues that, "…capability deprivation is more [serious] than lowness of income since income is only instrumentally important […] and its value […] depends on social circumstances."[13] Furthermore, his argument contends that real development is the result of the interdependent bundle of political, economic, and social freedoms that guarantee self-determination.

The works of scholars like Raballand, Macchi, and Merotto suggest, in accordance with Sen, that human development is the result of the social structure, individual capabilities, opportunities, and social policies shared by the local population. Sen recommends that we analyze poverty, quality of life, and social inequalities not only through the traditional economic indicators such as income or consumption expenditure but also by analyzing the possible disparate views on life experiences. According to Sen, the key to development is not just the ability to feed oneself and one's family, but to have access to health care, education, and adequate shelter. It is the opportunity to participate in local social life and politics, which will then affect the territory.

Chapter 1.2 Need for interaction

Since the mid-1970s, scholars such as Michael Lipton have identified rural isolation and distance from urban centers as the greatest obstacle to the growth of developing countries.[14] The lack of connection between remote and urban populations is an impediment to the improvement of the social opportunities of rural inhabitants. For Sen, development must be understood as a process of increasing self-determination in both the private and socio-political spheres. Moreover, social exclusion in these remote areas, understood as non-participation in a nation's political and economic processes, also implies an irreparable loss of human capital.

One way to facilitate the development of personal well-being within these communities is to increase interaction with other local communities. An example of these activities comes from rural villages in southern Uganda where the forms of human mobility, almost paralyzed by a lack of infrastructure, are critical to the improvement of quality of life. These activities are a representation of livelihood, which has been defined as "the assets (natural, physical, human, financial, and social capital), the activities, and the access to these (mediated by institutions and social relations) that determine together the living gained by the individual or household."[15]

Many forms of mobility used by rural populations are an integral part of their life system. These forms of mobility lead to two different outcomes: social integration and economic interaction.

Mobility improves the possibilities of social connections among neighboring villages through which family and community ties are established, reaffirmed, and consolidated.

The second outcome relates to the interaction between rural and urban economies. The contact between two different local economies allows people gain greater financial security. In fact, for many families, the system of rural-urban mobility and the commercialization of intermediate agricultural products and handcrafts are a form of subsistence. It is the creation of capital that supports a strategy for the management of the risk of poverty of these families. Lovisolo extensively developed this concept, arguing that a key element for a regional development might be the "commercializzazione intermedia dei prodotti agricoli…come attivita' secondaria per integrare il reddito familiar."[i], [16] In the mid-2000s, scholars already considered activities cited by Lovisolo as crucial in limiting the vulnerability risk in rural areas, and showed that the commercialization of agricultural products within the rural urban network could be considered a poverty risk-coping strategy.[17]

Chapter 1.3 Welfare

The notion of welfare has evolved during the last two centuries from a strictly economic idea to a more anthropological concept. It represents an extension of the notion of wealth, the first goal of classical economics, emphasizing that the ultimate effect of capital is, or should be, to increase the wellbeing of the individual. This prevailing definition arose in close correlation with the development of the modern economy. In the last century, however, the evolution of this concept has brought welfare to, *"…diventare funzione fondamentale dell'espressione istituzionale della societa', ossia lo Stato."*[ii],[18] The concept of European welfare is thus based on the principle that the State should protect

i "intermediate commercialization of agricultural produce…as secondary activity to supplement family income"

ii "becoming the fundamental function of the institutional expression of the society"

the dignity of men, women, and the community as a whole. Because of the social, economic, and political history of most of the African continent, however, it is not possible to apply the Western concept of welfare. Because of their colonial pasts and the extractive institutions established by European colonizers, most African countries are not currently experiencing the political conditions that are instrumental of guaranteeing access to welfare for all of their citizens. Poor institutions and a general lack of economic means make a reasonable argument that the assumptions stated by Borgonovi are not applicable to many African countries. In Western (and particularly European) countries, welfare is a fundamental function of the State. In Africa, this function cannot be implemented. A different model of welfare for remote African rural communities should therefore be considered: one that emphasizes the principle of freedom for every individual, and that values the activities promoted by the individuals through their relational networks.

CHAPTER 2 GEOGRAPHY AND ECONOMY

Chapter 2.1 Kabale geography economy

The topography of the Kabale district, located in southwestern Uganda, plays a significant role in determining the type of agricultural produce of the region and the method by which the population brings it to the market. The Kabale district has an average altitude is of 6,000 feet and peaks at 8,360 feet in the Bafunda Hills. It is also characterized by the presence of many lakes, and only allows for scattered human settlements dispersed along the valleys and the highlands which account for 88% of the total district population. The exception is the district capital, Kabale, which has a population of about 50,000 people.[iii, 19] The district's rugged terrain and poor road infrastructure dictate the population's means of transportation.

In addition, the climate of the Kabale District determines the crops produced by the region. The Kabale District is located in Southwest Uganda and has a temperate foggy climate, which is typical of an equatorial region at significant heights. Its peak rain season falls between April and November. This climate permits two sowings and two harvests per year without the need for irrigation by farmers. This area mainly cultivates and consumes Irish potatoes, sorghum, maize, sweet potatoes and other crops that thrive well in high altitudes and relatively cold weather.

iii The names of the capital city and the district are both "Kabale."

Chapter 2.2 Welfare in Kabale District

The health and educational infrastructure of a medium-sized urban center such as Kabale has proven insufficient to guarantee the district population's access to the services necessary to increase their level of welfare to the minimum standards set by the Millennium Development Goals. One determining factor for this trend is that 88 percent of the population lives in villages structured around individual, isolated homes in the highlands.[20] The Ugandan Government officially guarantees all people living in rural areas access to education and health infrastructure. However, the quality of these services is generally low, and local governments do not offer transportation to the geographically dispersed population. These impediments to accessing services in rural areas have contributed to a literacy gap of about 20 percent exists between the country's rural and urban populations.[21] A further indication of the problems generated by poor road infrastructure is represented by the child mortality rate, which is more than double in the southwestern rural areas as compared to the urban areas.[iv] These data highlight the difficulties in pursuing the objectives of Millennium Development Goals in rural areas. The Ugandan Government indeed reports that the second objective, achieving universal primary education, will not be accomplished by 2015. Objective 5, improving maternal health, lags behind schedule; while objective 6, reducing the incidence of HIV, malaria, and other diseases, is experiencing mixed results.[22] These data, along with official Ugandan statistics, affirm the need for a different local administrative policy in rural areas to allow equal and effective access to public services across the country.

CHAPTER 3 TRANSPORTATION

Chapter 3.1 Transportation Network in South West Uganda

Given the country's poor transportation infrastructure and mountainous terrain, satisfying the rural population's demand for greater mobility remains a challenge. This population has higher levels of poverty, implying an even greater need for transportation infrastructure than in its urban counterpart.

The lack of infrastructure forces the majority of the rural population to utilize transportation particularly suited to the geographic features of the area.

iv The Uganda Demographic and Health Survey of 2011 reports that in the South West rural region, child mortality rate is 57 deaths per 1000 live births as compared to 25 deaths per 1000 live births in urban areas.

As previously mentioned, the transportation system in the area suffers, as in many other Sub-Saharan regions, from the "missing middle," a mobility instrument suitable to the geographic and socioeconomic features of the area. Empirical observations show that in the southwest rural areas of Uganda, the movement of people, "…goes from walking…to truck and bus in one technological leap."[23] Because of extremely high fuel costs (a liter of fuel costs 3,780 Ugandan Shillings, which is equal to $4.85 per gallon), cars are not feasible for the population. Trucks and buses, although more affordable, cannot reach every community.

In this context, Boda Boda, a system of private bikes and motorbike taxis, has emerged as the most used transportation method in the villages of the highlands. The two-wheel vehicles help the population overcome the lack of sufficient public transportation infrastructure by providing them a relatively affordable transportation system.

Chapter 3.2 History of the Boda Boda Taxi Service

At the beginning of the 1960s, Ugandan smugglers needed a cheap, reliable, and quiet way to move materials between Uganda and Kenya. Cars and motorbikes were too expensive and too noisy. As a result, bicycles became the transportation of choice, which, with a small luggage rack behind the seat, evaded the border police while transporting valuable goods. The idea had an unexpected development. The bikes were so strong that they were also suitable for transporting people. The profits attained from this practice were lower than those derived from smuggling, but the business was legal. This development gave rise to the Boda Boda taxi system, which quickly spread from the border between Uganda and Kenya where it was invented, into East Africa. Today, it is a common means of transportation, especially in rural areas of Southeast Asia and Central Africa.

The motorcycle Boda Boda, better suited for long-distance travel and climbing hills than the bicycle, first appeared on the Ugandan market in 1992 and experienced rapid growth in use due to the government easing restrictions on used vehicle imports.[24] The reduction in the cost of imported used motorcycles relative to cars made them particularly attractive.

The Boda Boda motorcycle taxi system has become a reliable, rapid, and relatively inexpensive service that can traverse dirt roads too rugged for a car, while going longer distances and into steeper terrain than bicycles. Boda Bodas are used by students and teachers to get to school, by workers and employees to get to work, and to facilitate travel to markets and health facilities in villages. Working as a motorcycle taxi driver, however, is not easy work and is currently only done by young men. Every day, drivers travel approximately fifty kilometers, which combined with accidents and inhaled dust while driving, can lead to over-exhaustion and other health complications. Even the local press recognizes the job as particularly dangerous. According to police reports, between 2008 and 2012 the injuries among drivers increased from 1,795 to 3,043.[25] Despite the hazards of the job, the accessibility and practicality of Boda Boda services have made it popular among the population. The growth of Boda Boda demand has led to the creation of a drivers' association that provides services to the Boda Boda drivers.

Chapter 3.3 Boda Boda Organization and regulation

It is not difficult to become a Boda Boda motorcycle operator. One must only own or rent a bike and pay an annual fee to the local Boda Boda association. The cost for a used motorcycle is about three million Ugandan shillings (about $1,200). The drivers are required to belong to Boda Boda associations, which are administrative tools created by the Ugandan Government to regulate the industry. The annual membership fee ranges from $6 to $10, and is comprised of the municipal operating license (plate) and the actual association membership subscription. The associations act as insurance agents and legally represent the drivers in cases of accidents.

CHAPTER 4 RESEARCH METHOD

Chapter 4.1 Questionnaire, method, research goals

This study aims to provide relevant insights into how the transport service offered by Boda Boda can better integrate the rural villages' economies and the southern Ugandan economic network, thus promoting the improvement of the rural citizens' welfare. The analysis of the socioeconomic realities of the area, and the evaluation of the research objectives, rely on the collection of data from two sources that are detailed below.

The first source is a baseline long-form questionnaire administered to 148 citizens of the village of Kigarama. A second source is a baseline long-form questionnaire was administered to 120 citizens of the

village of Nangara. The questionnaire interviews for the village citizens lasted thirty to forty minutes each. The data collected from the baseline long-form questionnaire for the rural citizens of Kigarama and Nangara contain details regarding the citizens' approach to the transportation problem, as well as a description of the households' economic situations. The questionnaire also includes questions about the citizens' agricultural production choices, including location and transportation decisions.

The questionnaires were designed to take into account the anthropological aspect of the Boda Boda transport services. The research investigates the phenomenon in its natural and sociological environment, exploring its meaning for the rural population. Particular attention is paid to gender disparity, the religious and ethnic differences in the region, and the perceptions of criminality, which might affect access to the service.

For each of the two selected villages, my target sample population consisted of 150 individuals. The participants in the survey were the heads of households, holding decision-making power over transportation services and household expenditures. In southern Ugandan villages, many households included single mothers, helping to eliminate any gender-related bias that could occur otherwise. All participants in the survey were eighteen years and older, the legal age of adulthood in Uganda. Also, Boda Boda users below this age are mostly passive utilizers, not actively involved in the choice of the transport service. The selection of interviewers from the sample population began with a meeting with the village chief to get a list of its inhabitants. The formal authorization for the directory of the citizens of the village was obtained on site after the village chief signed a permission form. The list was alphabetized, and subsequently using a random number generator, I extracted the names to be interviewed. The interview completion rate of the survey was 98 percent (147 out of 150) in Kigarama and 80 percent (120 out of 150) in Nangara.

I performed two rounds of interviews. The first round took place between December 16, 2013, and January 4, 2014, and the second between January 6, 2014, and January 20, 2014.

CHAPTER 5 RESULTS

Chapter 5.1 Demo Figure

Before beginning a quantitative analysis of the data, it is important to give a brief description of the two villages' location and demography. Kigarama is located in the southern side of the Kabale district, and lies six kilometers away from paved road. It is a remote settlement with a mature population and relatively high education level. Nangara, on the other hand, is

Figure 1: Kigarama education level

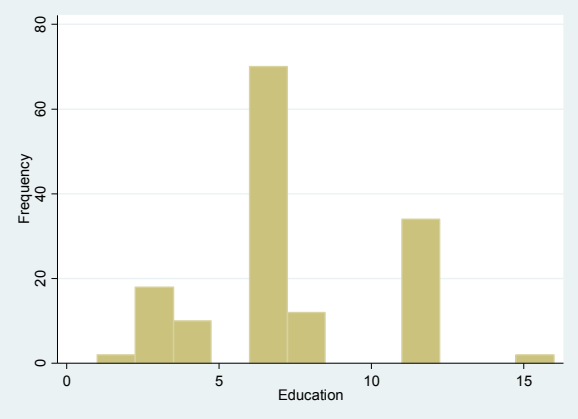


Figure 2: Kigarama age distribution

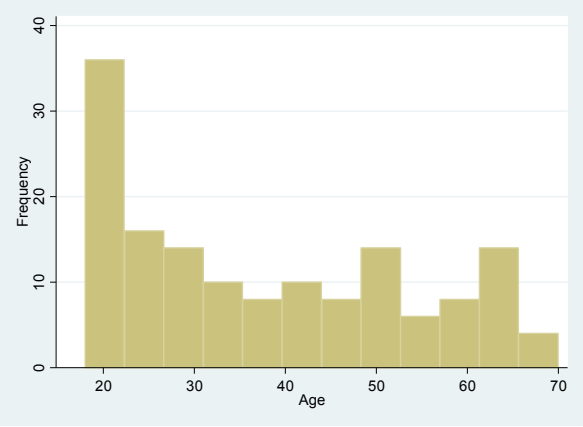


Figure 3: Nangara education level

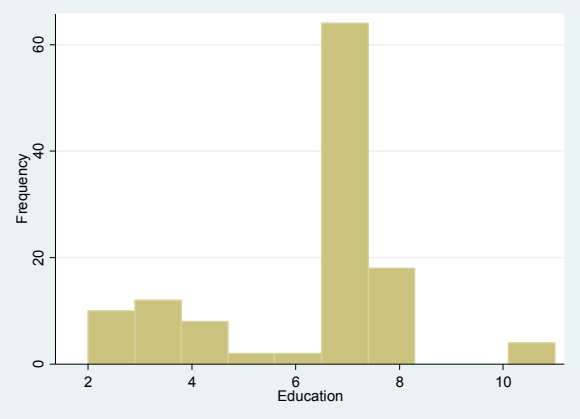


Figure 4: Nangara age distribution

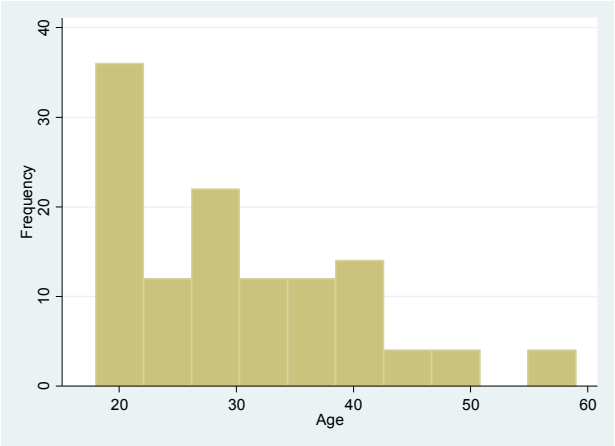
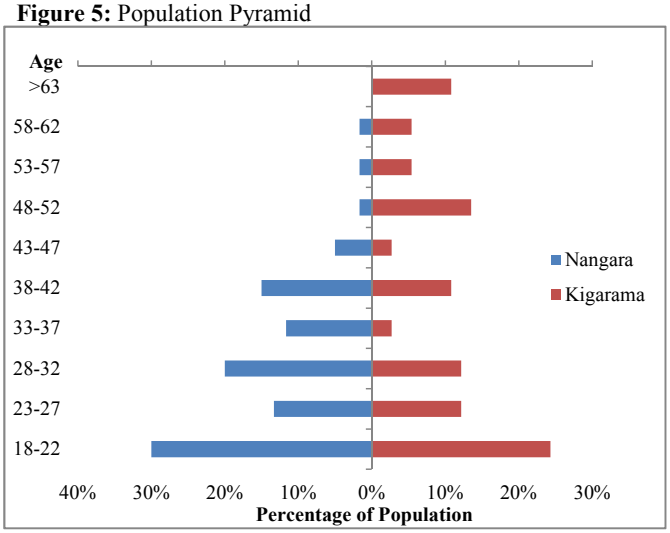


Figure 5: Population Pyramid



located in northern Kabale District, about two kilometers from the closest paved road. It has a younger population compared to Kigarama. Figures 1 to 4 show the most important demographic characteristics of these two villages.

The two communities display a similar mean educational level. However, it is important to note that Figure 1 shows a higher rate of secondary school completion in Kigarama. This detail will be of particular interest later in my analysis. Additionally, the age distribution between the two communities does not show striking differences, though Kigarama's older adult age population is slightly larger, as shown in Figure 5.[v]

From a monetary point of view both villages are considered below the poverty line by international standards.[vi] Although Kigarama's population has a higher household monthly income than Nangara ($13.51 US compared to $7.47), both devote almost the same percentage of their monthly savings to Boda Boda transportation costs (33.87 percent for Kigarama compared to 37.17 percent for Nangara).

Figures 6 to 9 provide a sense of the distances between every household in the two villages to the

Figure 6: Distances to clinic in Kigarama

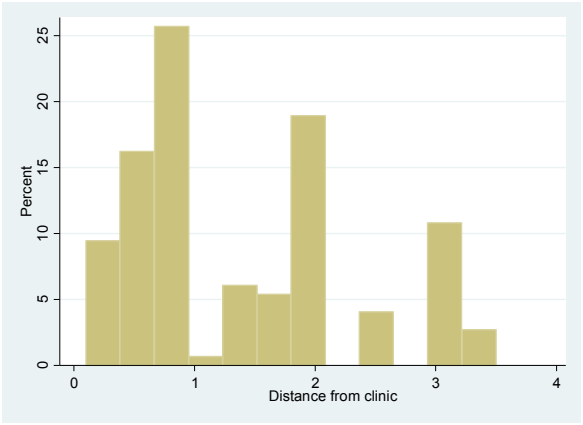


Figure 7: Distances to Clinic in Nangara

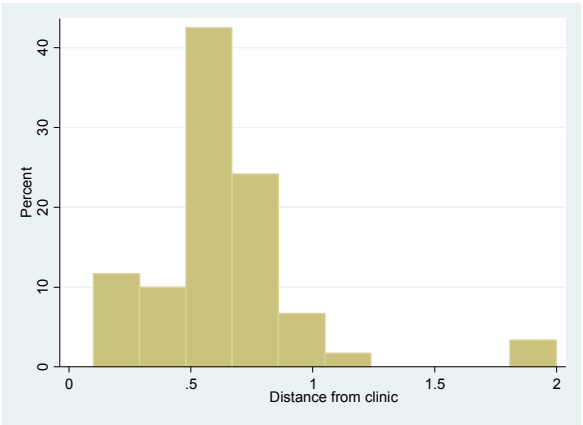
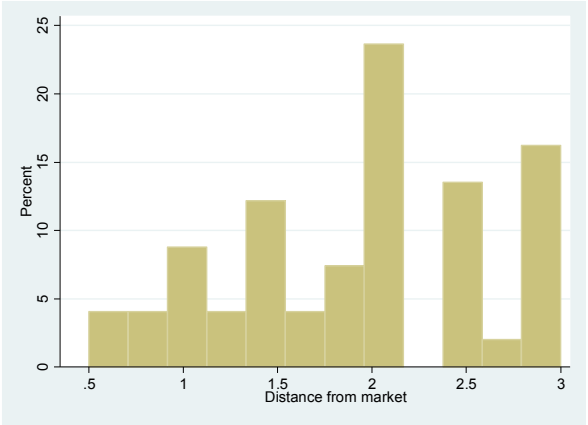


Figure 8: Distances to Market in Kigarama



v The average age for Kigarama is 37.9 while for Nangara is 30.2

vi The International Standard Poverty Line published by the World Bank defines any household who survives with less than $1.25 PPP per day as "poor".

closest functioning clinic and the central market. Figures 10 to 13 show the Boda Boda transportation costs to reach those facilities. The data illustrate a positive correlation between costs and distances between the villages and destinations. Kigarama's more remote location increases the costs of transportation to both the market and the clinic. Figures 14 and 15 summarize the data comparing the same as-

Figure 6: Distances to clinic in Kigarama

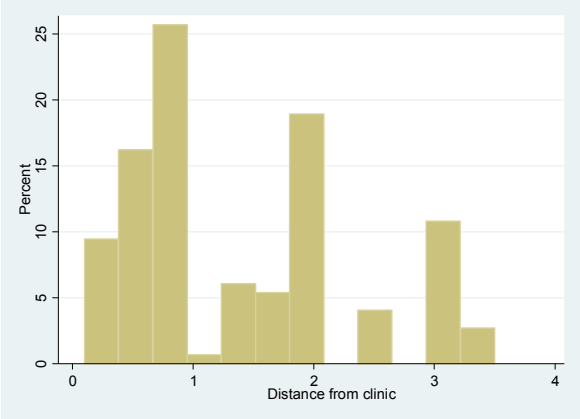


Figure 7: Distances to Clinic in Nangara

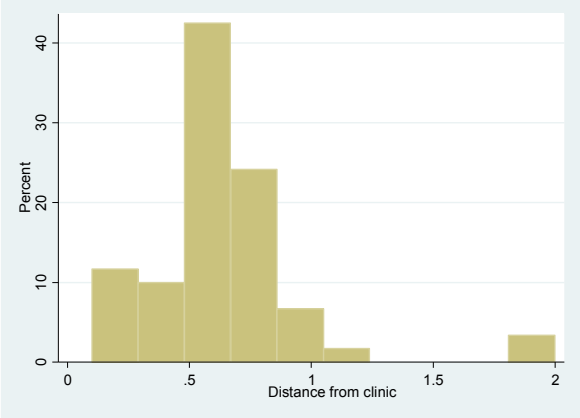


Figure 8: Distances to Market in Kigarama

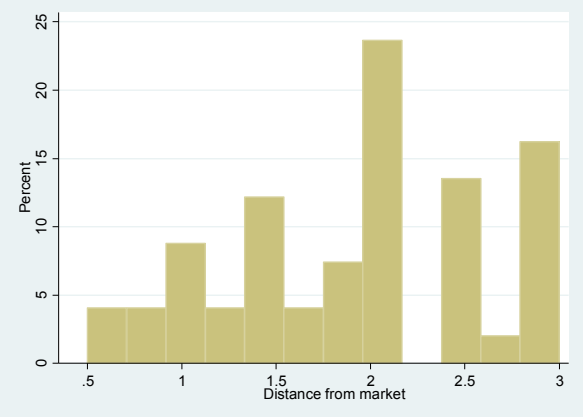


Figure 9: Distances to Market in Nangara

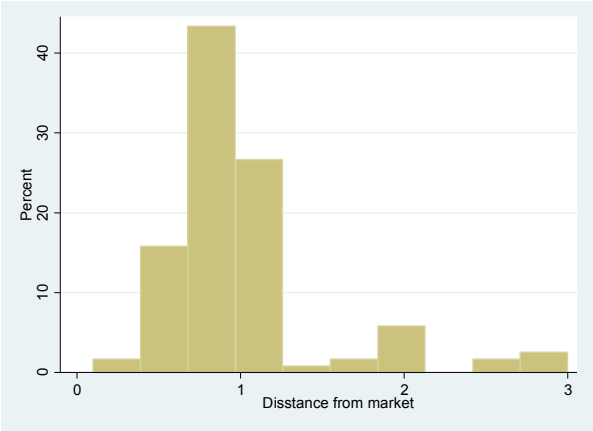


Figure 10: Cost of Boda Boda to market in Kigarama

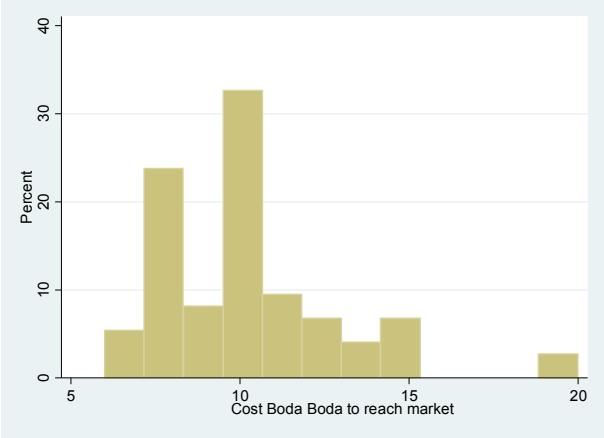


Figure 11: Cost of Boda Boda to market in Nangara

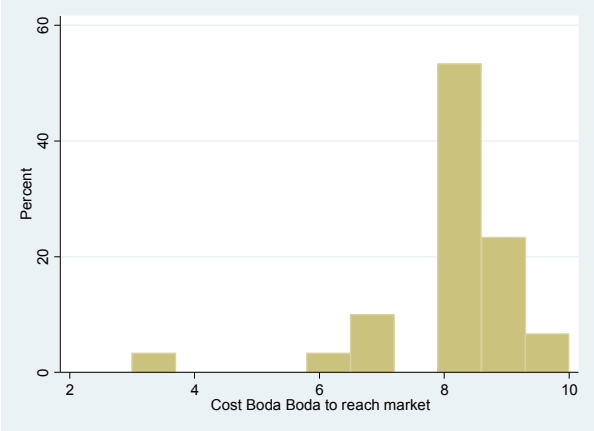


Figure 12: Cost of Boda Boda to clinic in Kigarama

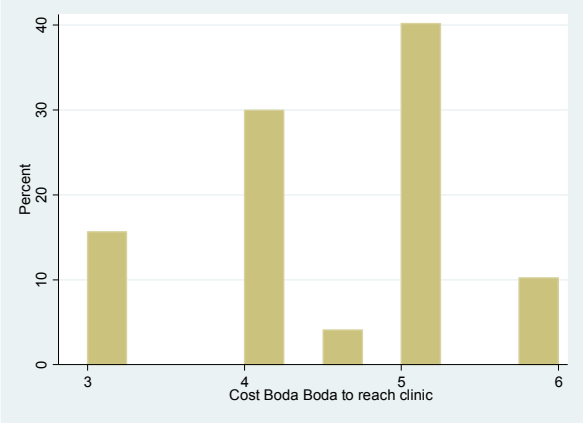


Figure 13: Cost of Boda Boda to clinic in Nangara

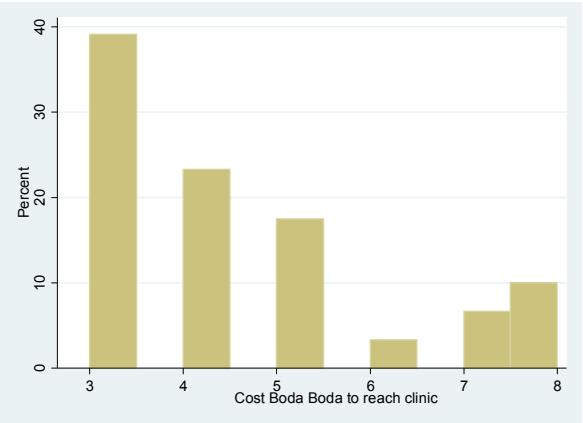


Figure 14: Monetary Comparison between Kigarama and Nangara

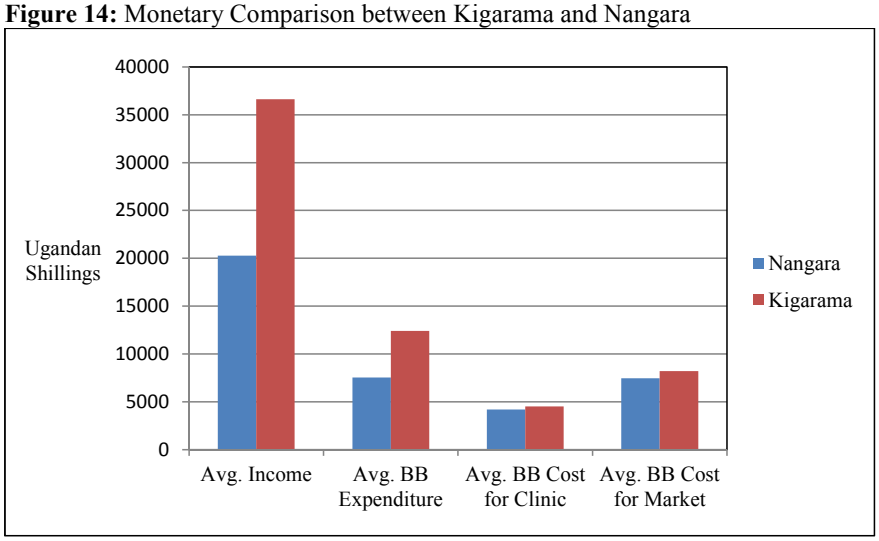
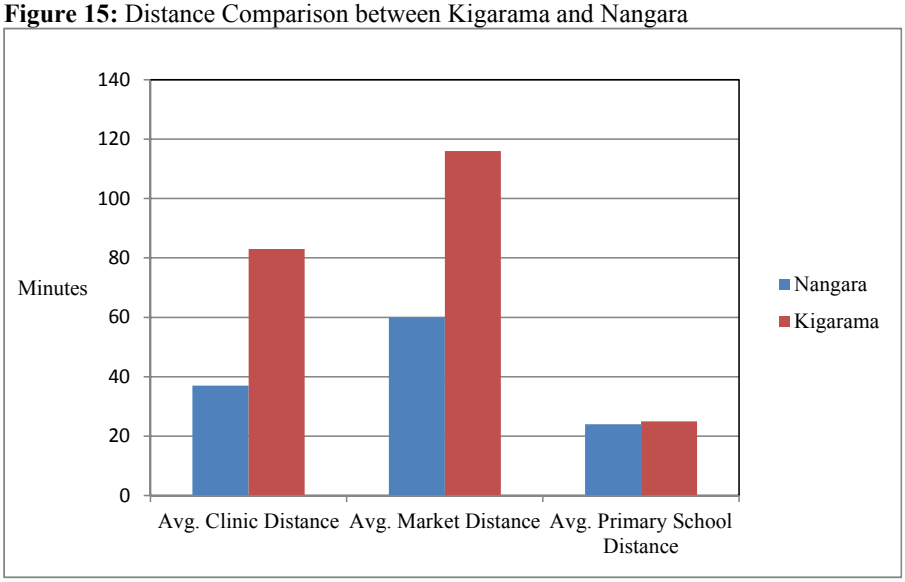


Figure 15: Distance Comparison between Kigarama and Nangara



pects of the two villages, giving a sense of the differences between the two areas. All of the data in the figures were drawn from interviews performed during the fieldwork.

CHAPTER 5.2 LINEAR BINARY CHOICE PROBABILITY MODEL

This section develops an econometric model that includes the measures presented above. My aim will be to explore the influence of those factors on the use of the Boda Boda motor taxi system for our observed populations. Several scholars, including Sen (1999) and Raballand (2009), have argued that welfare can be measured by finding the proportion of the population with access to basic services.[26,27] Hu et. al suggests that the easiest method to calculate welfare is to include the level of access to markets and health services in an econometric model.[28] The model I propose follows the latter approach. It considers the distance of the market and the closest clinic from every single household, and the costs incurred to reach those areas. Following Hu et al.'s study, I will consider those four measures as reliable proxies for personal welfare. It is essential to note that I measured the distances in hours on foot, rather than kilometers. I found that this method more accurately reflected the influence of the Kabale district's rugged geography on transport time across similar distances. Since the first model measures individual propensity to use the Boda Boda transportation system, it is suitable to use this subjective measure of distance to describe the transport experience of individuals to his or her closest market and clinic.

I also imputed a potential price for those individuals who declared to have never used the Boda Boda system. I created a model to assign a price that each individual would pay for this service. To do this, I analyzed the distances from each of these households to the clinic and the market, and I compared the Boda Boda prices paid by households located at similar distances. I then computed the average prices for each specific distance to the households that do not use Boda Boda.

The econometric model I utilized is a linear binary choice probability model. This model implies that the probability of the event α occurring is a linear function of a set of explanatory variables:

$$\alpha_i = \alpha(Y_i = 1) = \beta_1 + \beta_2 X_{2i} + \beta_3 X_{3i}$$

In my analysis of the data, I was able to exclude the presence of heteroskedasticity proportional to the model's regressors. However, I could not exclude the possibility that other types of heteroskedasticity af-

Table 1: Factors Affecting Demand for Boda Boda in Kigarama

	(1)	(2)	(3)	(4)	(5)
Distance from market	0.0665* (0.0260)	0.0557* (0.0256)	0.0694** (0.0246)	0.0792** (0.0237)	0.0886** (0.0228)
Cost Boda Boda to market	-0.0724** (0.00479)	-0.0266** (0.00415)	-0.0272** (0.00363)	-0.0267** (0.0035)	-0.0269** (0.00345)
Distance from clinic	----	-0.0321* (0.0157)	-0.0342* (0.0155)	-0.0296* (0.0159)	-0.0374* (0.0155)
Cost Boda Boda to clinic	----	-0.137** (0.00949)	-0.138** (0.00808)	-0.138** (0.00769)	-0.137** (0.00784)
Agricultural Surplus	----	----	0.0699** (0.0249)	0.175 (0.105)	0.157 (0.0920)
Agr. Surplus x Dist. Market	----	----	----	-0.0589 (0.0543)	-0.0504 (0.0464)
Education	----	----	----	----	0.0139** (0.00378)
Constant	0.0654 (0.0637)	0.0244 (0.0507)	-0.0315 (0.0436)	-0.0551 (0.0422)	-0.159** (0.0468)
p-value for Distance from the market=Agricultural surplus x Distance from market	----	----	----	----	0.0141*
Observations	147	147	147	147	147
R-squared	0.739	0.874	0.880	0.882	0.891

Note: * p<.1, ** p<.05, ***p<.01

fected the data. Thus, I assumed that the model's heteroskedasticity was a general association between the variance of the disturbance term and the regressor. Consequently, I chose to run the following robust regression with correction for White's heteroskedasticity:

$$Y_i = \alpha + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + u_i + X\Theta$$

where X is a vector of controls X= (X_1, X_2), and Y_i is the dummy variable "Use of Boda Boda." I ran several regressions adding controls to measure the causal effect of exogenous factors changes in the endogenous variables in the model. These controls are education, age, agricultural surplus, and an interactive variable between agricultural surplus and distance to the market. The results of these regressions are shown in Table 1 and 2.

Table 1 shows the results for the village of Kigarama. The first two columns show the result of the regressions using the welfare explanatory variables. The first column shows the market variables' impact on the Boda Boda utilization propensity. An increase in distance from the market by one hour, controlling for the price paid to reach it, increases the willingness to use the transportation system by 6.65 percent. On the other hand, an increase of the Boda Boda cost by 1000 Ugandan Shillings, controlling for the distance to the market, decreases the propensity to use this service by 7.24 percent. The second column adds the clinic's explanatory factors. Controlling for all other factors, an increase in distance from the nearest clinic produces a decline of 3.21 percent in the propensity of Boda Boda use. Similarly, an increase in cost has an important negative effect of 13.7 percent on the willingness to use this taxi service. All these results are statistically significant. As such, they provide a true glimpse of the contrasting realities between rural and urban settlements.

In columns 3, 4 and 5, I added controls for a dummy variable related to the household production of agricultural surplus, education level, and the interactive variable between agricultural surplus and distance to the market. Column 3 shows a remarkably high coefficient for the agricultural surplus dummy. Controlling for all other factors, the dummy variable increases the willingness to use Boda Boda by 6.99 percent compared to individuals without agricultural surplus. This value is of particular importance. It demonstrates that an individual with agricultural surplus will have a much higher willingness to use the Boda Boda service than individuals without the option to sell their produce, regardless of their distance from any facility. The expected agricultural income induces individuals, who perceive themselves as richer, to take

Table 2: Factors Affecting Demand for Boda Boda in Nangara

	(1)	(2)	(3)	(4)	(5)
Distance from market	0.00187 (0.00149)	0.00209** (0.000324)	0.00219** (0.000334)	0.00154** (0.000308)	0.00152** (0.000327)
Cost Boda Boda to market	-0.0902** (0.0108)	-0.0798** (0.00555)	-0.0817** (0.00536)	-0.0898** (0.00497)	-0.0897** (0.00479)
Distance from clinic	----	0.100** (0.0220)	0.102** (0.0222)	0.0656** (0.0156)	0.0657** (0.0158)
Cost Boda Boda to clinic	----	-0.0483** (0.00605)	-0.0465** (0.00638)	-0.0242** (0.00737)	-0.0243** (0.00753)
Agricultural Surplus	----	----	0.0223 (0.0188)	-0.241** (0.0381)	-0.240** (0.0410)
Agr. Surplus x Dist. Market	----	----	----	0.309** (0.0474)	0.308** (0.0486)
Education	----	----	----	----	0.000565 (0.00468)
Constant	0.257** (0.0896)	0.0703 (0.0475)	0.0574 (0.0466)	0.104* (0.0465)	0.100 (0.0607)
p-value for Distance from the market=Agricultural surplus x Distance from market	----	----	----	----	0.0001**
Observations	120	120	120	120	120
R-squared	0.723	0.867	0.868	0.901	0.901

Note: * p<.1, ** p<.05, ***p<.01

advantage of the transportation service. In column 4, I added the interaction term "Agricultural surplus x Distance to the market." The negative coefficient, which must be added to the coefficient for distance to the market, shows that individuals with agricultural surplus are less sensitive to distance compared to the other Kigarama farmers' population. If we assume that a low quantity of produce surplus in a household implies a similarly low agricultural production, it follows that these individuals will be in greater need of a market that supplements their nutritional needs. In the same column, the coefficient for the individuals with agricultural surplus, regardless of distance to the market, appears extremely high. This finding is a confirmation that a self-perceived higher income will persuade farmers to use Boda Boda more often.

I ran a nested F-test to assess if the coefficients of variables "Distance to Market" and "Distance to market x Agricultural surplus" are significantly different. The result gave a p-value of 0.0141. This p-value suggests that at a 95 percent confident level, these variables are not equal. The data thus suggest that individuals with surplus are more likely to use Boda Boda as their households' distances from the market increase. In column 5, I added the variable "Education Level," which is statistically significant. Its coefficient value reveals that every year of schooling increases the use of Boda Boda by 1.39 percent. At first, this propensity may seem statistically insignificant. Nevertheless, in an area where many children do not attend school, the completion of secondary school raises the probability of using Boda Boda by 16.68 percent relative to a person who did not attend school.

The inclusion of an education variable in my analysis produces important changes in the values of other explanatory factors. The coefficient that accounts for distance to the market increases by almost one percentage point. This change suggests that individuals with higher levels of education are more willing to reach a market. This might be due to the realization that a market is not only a place for exchanging goods, but also a central social hub. Living in a remote area might be experienced as a constraint, and the Boda Boda service is seen as a tool to expand the personal network of socialization. In addition, because education, in rural areas, is related to disposable income, the significance of the coefficient can also be considered as a proxy for ability and willingness to pay.

On the contrary, the coefficient for clinic distance decreases by 0.78 percent. In the survey performed during this study, 72.58 percent of Kigarama citizens declared that they would use the Boda Boda service to transport a sick child or adult to a clinic if they had the ability to pay the fee. The survey reveals the importance of economic constraints in decision-making. Despite their intentions to access health services in times of need, Kigarama citizens acknowledge that their economic circumstances may force them to forego vital priorities such as health care. Sick family members are expected to work in the family gardens. The hours spent going to a clinic are viewed as valuable time diverted from productive activities. Health is regarded as important, but less important than a household's food is vital as agriculture provides the goods necessary for subsistence.

The first two columns exhibit the result of the regressions using the welfare explanatory variables. An increase in distance by one hour from the market increases the willingness to use the transportation system by 0.01 percent, but this result is not statistically significant. Instead, the increase of its cost by 1000 Ugandan Shillings decreases the willingness of use by 9.02 percent controlling for the distance. The data are consistent with tour knowledge that the village of Nangara is relatively close to the Kabale market. In my survey, the vast majority of Nangara's population declared that walking was its preferred method of transportation. Conversely, an increase in distance from the clinic increases the propensity to use the Boda Boda by 10 percent. This finding suggests that relative proximity to health facilities lowers individuals' time to reach it, making people less sensitive to its distance from their respective households. The third column adds the agricultural surplus dummy variable, which describes how perceiving an agricultural income would increase the propensity to use Boda Boda by 2.23 percent.

The fourth column adds the interactive term between agricultural surplus and distance to the market. The positive coefficient, which must be added to the distance to the market coefficient, observes that farmers with agricultural surplus in Nangara are more sensitive to distance compared to the other villages' farmers.

This result is the opposite of that observed in Kigarama, and can be explained by the relative proximity of Nangara to the market. Even though distance from the market might increase, it is still close enough

Table 3: Factors Affecting Demand for Boda Boda

Distance from the market	0.00280** (0.000893)
Cost of Boda Boda to reach the market	-0.0526** (0.00421)
Distance from the clinic	0.0267* (0.0133)
Cost of Boda Boda to reach the clinic	-0.0674** (0.00617)
Agricultural Surplus	-0.0662 (0.0530)
Agricultural Surplus x Distance from market	0.0517 (0.0291)
Education	0.0121** (0.00309)
Kigarama	-0.185* (0.0195)
Constant	0.166* (0.0308)
Observations	267
R-squared	0.842

Note: * p<.1, ** p<.05, ***p<.01

to allow Nangara farmers to make reasonable profits by selling produce there. The fifth column adds the education coefficient which, by itself, is neither statistically significant nor produces material differences in the other coefficients.

Table 3 applies the prior regression but to the combined dataset of the two villages. I added a dummy variable in the regression to account for individuals living or not living in the village of Kigarama. The regression I ran was thus:

$$Y_i = \alpha + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + KX_j + u_i + X\Theta$$

where K is a dummy variable which assumes values of 1 if an observation is in the Kigarama village, and values of 0 if it is not, and where X is a vector of controls $X = (X_1, X_2)$

The coefficients are the averages of the two villages, while the statistically significant coefficient for the dummy variable Kigarama highly demonstrates that living in a remote, rural area reduces the propensity to use Boda Boda by 18.5 percent. This result confirms that location that affects transportation choice in the observed populations.

CHAPTER 5.3 POISSON REGRESSION

A further quantitative analysis of the factors affecting the use of Boda Boda should take into consideration the number of trips every individual is willing to make. This statistical analysis requires the use of a more advance mathematical tool. The variable "Number of time use of Boda Boda" is a counting variable, and follows a Poisson distribution.

This Poisson characteristic fits the objective of my analysis: every time an individual undertakes a trip with a Boda Boda the decision to have another ride is affected by the previous one. I thus decided to

Table 4: Factors Affecting Multiple Boda Boda Usage in Kigarama

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Distance from market	-0.460* (0.0959)	-0.236 (0.101)	-0.136 (0.125)	-0.112 (0.128)	0.000315 (0.135)	0.0956 (0.148)	0.249 (0.150)
Cost of Boda Boda to market	----	-0.0911* (0.0152)	-0.0900** (0.0152)	-0.0627 (0.0206)	-0.0807* (0.0233)	-0.0797** (0.0238)	-0.114** (0.0255)
Distance from clinic	----	----	-0.122 (0.0954)	-0.202* (0.103)	-0.149 (0.101)	-0.123 (0.103)	-0.189* (0.105)
Cost of Boda Boda to clinic	----	----	----	-0.130** (0.0608)	-0.125 (0.0671)	-0.122* (0.0682)	-0.0497 (0.0736)
Agricultural surplus	----	----	----	----	0.751 (0.139)	1.315 (0.386)	1.188 (0.379)
Agr. Surplus x Dist. market	----	----	----	----	----	-0.339 (0.217)	-0.284 (0.210)
Education	----	----	----	----	----	----	0.163** (0.0257)
Constant	1.278*** (0.177)	0.00931 (0.287)	-0.00626 (0.288)	-0.209 (0.320)	-0.957*** (0.366)	-1.151*** (0.391)	-2.684 (0.480)
Observations	147	147	147	147	147	147	147

Note: * p<.1, ** p<.05, ***p<.01

Table 5: Factors Affecting Multiple Boda Boda Usage in Nangara

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Distance from market	0.0136 (0.0153)	0.0134 (0.0153)	0.0135 (0.0153)	0.0164 (0.0161)	0.0158 (0.0162)	0.0117 (0.0164)	0.0107 (0.0164)
Cost of Boda Boda to market	----	-0.0242 (0.0375)	-0.0248 (0.0376)	-0.0171 (0.0416)	-0.000831 (0.0469)	-0.0894 (0.0603)	-0.0787 (0.0613)
Distance from clinic	----	----	0.120 (0.233)	0.225 (0.234)	0.207 (0.236)	-0.0855 (0.266)	-0.0716 (0.264)
Cost of Boda Boda to clinic	----	----	----	-0.140* (0.0422)	-0.155* (0.0470)	-0.0373 (0.0627)	-0.0453 (0.0633)
Agricultural surplus	----	----	----	----	-0.175 (0.241)	-1.807 (0.563)	-1.632* (0.591)
Agr. Surplus x Dist. market	----	----	----	----	----	1.729*** (0.514)	1.584* (0.534)
Education	----	----	----	----	----	----	0.0389 (0.0438)
Constant	0.189* (0.0861)	0.00747 (0.297)	-0.0719 (0.336)	-0.711 (0.452)	-0.601 (0.472)	-0.643 (0.547)	-0.853 (0.599)
Observations	120	120	120	120	120	120	120

Note: * p<.1, ** p<.05, ***p<.01

run the following regression:

$$\ln(\mu) = \alpha + \beta x_{2i} + \beta x_{3i} + \beta x_{4i} + u_i + X\Theta$$
where X is a vector of controls $X = (X_1, X_2)$

Again, I considered the distance between the clinic and the market, as well as the subsequent relative costs for reaching the clinic and the market, as proxies for personal welfare. I used the education level, age, and the presence of agricultural surplus as controls. One unit of increase in the regressor coefficient reflects a decrease by a percentage of the expected value of the counting variable. Table 4 shows the results for the Kigarama village.

The first four regressions show the impact of the variables used as a proxy for welfare, distances, and costs for reaching clinics and markets on the decision to undertake more Boda Boda trips. An increase of the distance from the clinic causes the likelihood of undertaking an additional trip to be 81.7 percent.[vii] The data do not show a statistically significant value for the market distance. However, the data set does show the importance of transportation service prices in poor, rural areas. An increase of 1,000 Ugandan Shillings for the Boda Boda service to the market causes the probability of taking an additional trip to decrease by more than 6 percent, while an increase in the costs to access the clinic decreases the probability of an additional trip by 12.2 percent.

These values are consistent with the findings of Cohen and Dupas, who argued the idea that individuals in poor African rural settings are more likely to use goods or services they pay for compared to the goods obtained for free.[29] In regressions 5, 6, and 7, the control variable "Agricultural Surplus" has a strong impact on the results. It appears that the availability of produce to sell is the main factor in the decision to undertake multiple Boda Boda trips. The presence of agricultural surplus causes the probability to undertake one more Boda Boda trip to increase more than threefold, because . The level of education is an additional element that seems to encourage Kigarama citizens to use the motorbike taxi system. This education variable also makes the coefficient for clinic distance further decrease.

Table 5 shows the results after running the same Poisson regression for the village of Nangara. This table does not show any statistically significant result, columns for the variable cost of Boda Boda for reaching the clinic except in columns 4 and 5. The highly negative values confirm that individuals in Nangara are price sensitive. A puzzling result arises from column 6. In the next to last regression, the addition of the dummy variable "Agricultural surplus x Distance to the Market" produces counterintuitive outcomes. The surplus dummy, by itself, suggests that the potential to sell produce decreases the probability of undertaking additional trips by more than 80 percent. On the contrary, when the same variable interacts with

vii The probability of the additional trip is 0.81709

the distance to the market, the coefficient suggests that the occurrence of extra trips increases by almost six times. In this case, the closeness to the Kabale market makes the trip relatively cheap, and suggests that a marginal increase in the price of the taxi service is not regarded as a burden.

Chapter 5.4 Qualitative Analysis

A qualitative analysis of the same factors makes it clear that the local concept of well-being is different from that used in either the United States or Western Europe. In these villages, social relations are an element fundamental to an individual's wellbeing. The survey shows that Boda Boda services are often used by both sexes to facilitate social interaction. Table 6 shows the results of the survey on the self-declared Boda Boda utilization in the village of Kigarama. Percentages refer to the proportion of the population that claimed to use Boda Boda "always" or "most of the time" to reach the different locations that were the same for each survey participant.

The data show that a greater proportion of the population uses Boda Boda for maintaining or creating social relations (51.72 percent) than for business-oriented utilization (39.65 percent). Another observation is the scarce utilization of the Boda Boda service for accessing school (14.49 percent). Table 7 shows the results for the same survey given in the village of Nangara. Based on the survey, a higher percentage of the Nangara population, compared to Kigarama, uses Boda Boda to facilitate social interaction. Both Nangara's relative proximity to the district capital Kabale and the road network that creates more options for interactions might explain this fact.

The analysis of this data shows that the Boda Boda service is perceived primarily as a tool to participate in the social life of the wider community, and that membership within this community requires visits and contact with people outside of one's home village. The Boda Boda's utilization is scarce in terms of access to the Western elements of welfare. Access to education is often limited to primary schools, which are located close to many villages and are easily reachable on foot, but provide poor education quality. This does not mean that the average family disregards the importance of education, but highlights the fact that the choice of Boda Boda utilization has different priorities.

The econometric analysis used earlier shows that the same concept applies to access to health services. Increased distance from the clinic makes individuals less likely to use Boda Boda. The time required to visit a clinic is considered less important than time spent in agricultural production. Western concepts of social welfare are thus not able to describe the utility of the Boda Boda transportation services.

Social interaction appears to be the crucial motivation for utilizing Boda Boda. The maintenance of old and creation of new social ties allows vulnerable populations to deal with the challenges that stem from their socioeconomic status. The Boda Boda service is an invaluable tool to achieve this goal.

An often-overlooked important step in development is the process of sharing knowledge, ideas, and insight with the population.[30] Figures 16 and 17 show the results of a survey of the Boda Boda service, in which residents of Kigarama and Nangara were asked about their changes in welfare and personal income. The answers for the question regarding perceived well-being ranged from a 0, which showed absolute disagreement with the idea that Boda Boda services increase welfare, to a 5, which signified complete agreement with the statement. Based on the survey results, the population views the service as a positive element for their welfare.

Table 6: Self-Declaration of Boda Boda Use in Kigarama

	Total	Male	Female
Access to market	39.65%	48.65%	23.81%
Access to education	14.49%	23.81%	0%
Access social activities	51.72%	51.35%	52.39%

Table 7: Self-Declaration of Boda Boda Use in Nangara

	Total	Male	Female
Access to market	53.57%	68.75%	33.33%
Access to education	50.00%	46.67%	55.55%
Access social activities	92.86%	93.75%	91.67%

Figure 16: Perception of Welfare Increase in Nangara

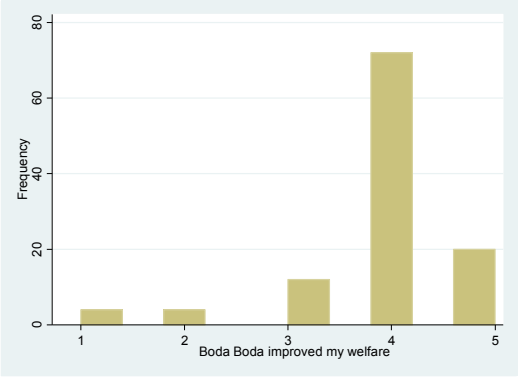


Figure 17: Perception of Welfare Increase in Kigarama

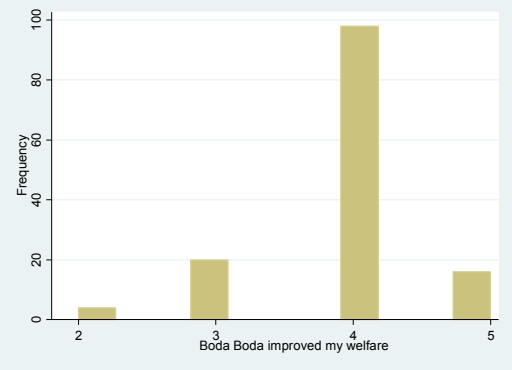


Figure 18: Perception of Increased Income in Nangara

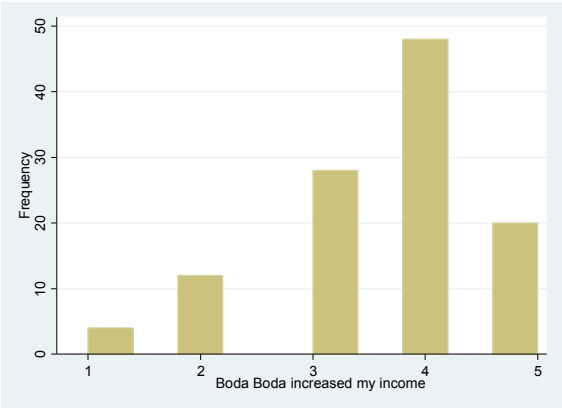
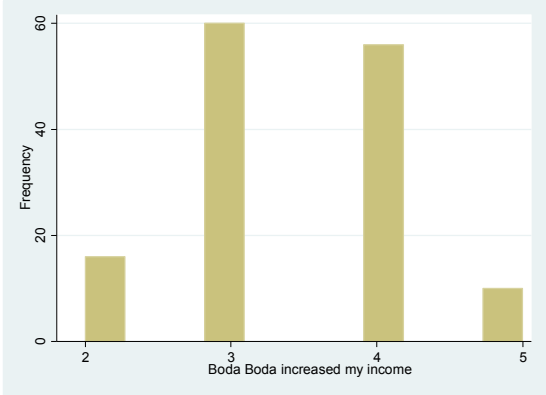


Figure 19: Perception of Increased Income in Kigarama



Figures 18 and 19 show the answers to the question regarding perceived usefulness of the Boda Boda services in increasing personal income. Following the previous scale, the answers do not show a strong conclusion about the real impact of the service.

The results are strikingly similar between the two villages, and seem to verify the theoretical benefits of a transportation service. Isolation limits the ability of remote populations to access the urban network of opportunities and the people deemed worth to connect with. In the case of rural southwestern Uganda, opportunities refer to the social interactions with the broader community. It should not be surprising that willingness to be transported to the market serves not only as a means to increase personal income, but also as a tool to achieve personal freedom. From this study, it can be inferred that Boda Boda service plays an important role in facilitating personal interactions that determine individual freedoms. Boda Boda transportation enables individuals in remote rural population to access the mobility they deem necessary for their welfare.

CONCLUSION

The widespread development of motorcycle taxis system in southern Uganda is changing the mobility habits of the rural populations. The need for reliable and effective transportation is being largely met by an organization of young men called Boda Boda. The present work investigates how, and to what extent, the Boda Boda system affects two isolated rural communities located in the Kabale District of southwestern Uganda. This study demonstrates that the service is utilized as a fundamental tool for improving social interaction, a key element of the welfare in the area. Results also reveal that access to health through the transport system is subordinate to economic activities.

Mobility in this area, as suggested by Bryceson, is dictated by the already established population activities.[31] This research confirms this interpretation and provides a further analysis. It contends that in various areas of the world, there are cultural frameworks that differently prioritize the activities improving our personal welfare. Moreover, those decisions are often affected by socio-economic constraints. These constraints force rural populations to make choices that do not seem appropriate given the economic context

of the area. In rural southern Uganda, it is neither the possibility of reaching the marketplace nor of accessing health facilities that influences the choice for mobility. Rather, the need for social interaction impacts the choice for mobility. The Boda Boda transportation system plays a crucial role in satisfying the local need for social relations. As Sen argues, this interaction among communities is necessary, but not sufficient, to foster development.

The Boda Boda phenomenon, while providing a service that is perceived as valuable by the population, must be understood to maintain or disprove the assumptions of the development economic literature. Scholars such as Devarajan have claimed that road infrastructure investments are not fundamental for the development of remote rural areas in poor countries.[32] Similarly, Bryceson has also argued that the transportation system is only a tool for enhancing already established socio-economic activities.[33]

However, this research demonstrates that the Boda Boda transportation system allows rural and remote populations to connect with a broader social and economic network. This trend will only increase in the future, as populations will likely have access to a larger amount of information. Remote populations, who now have the ability to get in touch with realities beyond their villages, will recognize that better road infrastructure is important. They might decide that their welfare depends on increased mobility through the strengthened Boda Boda transportation system. The opportunity to have different options from forced mobility, which Lovisolo defines as, "…un fenomeno diffuso che si configure come un esodo rurale da ambienti poveri…e pone problem complessi di urbanizzazione," is crucial for personal development. [viii], [34] The ability to interact with people with different personal experiences is crucial for individual development. The utilization of Boda Boda, which freely permits access to a larger marketplace of ideas, may allow populations to decide what their future should look like.

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