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Working Paper

The Reconstruction of the Border Roads and Household Welfare in Nigeria: A Gender Study

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A G D I Working Paper

WP/16/025

The Reconstruction of the Border Roads and Household Welfare in Nigeria: A Gender Study

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AGDI Working Paper

Research Department

The Reconstruction of the Border Roads and Household Welfare in Nigeria: A Gender Study**Efobi Uchenna¹**

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Abstract

This study provides an ex-ante analysis of the welfare effect from the improvement of border road infrastructure in Nigeria. It starts by describing the income distribution in the Nigerian states contained in the sample. It then analyses the relationship between income, household food expenditures, and household expenditures on imported rice. It is aimed at assessing how changes in the price of food commodities induced by border road improvements would affect different types of households. Finally, it investigates how simulated changes in local transportation costs stemming from road improvements would affect local prices of imported rice taking into consideration the simulated price changes effect on household welfare across household head gender and household area (rural and urban households). Results indicate that policies aiming to improve border roads and thereby lower transportation costs, and subsequently the price of imported rice, would be more beneficial for rural than urban households. Such policies would likely produce larger welfare gains for poorer households than richer households, and would be more beneficial for the poorest female-headed households than their male counterparts.

Keywords: ECOWAS; Gender; Household; Nigeria; Poverty; Trade; Welfare
JEL Code: D1; D6; F1; F2; R2

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1. Introduction

The availability of road infrastructure is one of the crucial prerequisites for cross-border trade between Nigeria and its neighbours, especially those in the Western Africa region. Both formal and informal trading activities require this form of infrastructure to transport imported and exported goods from the source to the destination market. As informal cross-border trade alone is estimated to account for around 20 per cent of Nigeria's gross domestic product (GDP) (Blum, 2014), road infrastructure clearly matters for the country's economy. The borders are also an important source of livelihoods for women, who constitute a major proportion of cross-border traders. In the western and central parts of Africa, 60 per cent of traders who use border access are women (Afrika and Ajumbo, 2012). The main traded items are vegetable oil, household items, rice, and other agricultural produce.

The Seme border is named after the Nigerian border town that connects with other West African countries via Benin Republic. This route is seen as an important channel for better regional integration within the Economic Community of West African States (ECOWAS), due to the prominence of Nigeria within the sub-region. Of course, this is because of Nigeria's immense and steadily growing national consumer market, thus, becoming an attractive trade partner for neighbouring countries (Blum, 2014). Additionally, major road transit routes crossing this border provide the most direct (and in some cases the only) road transport connection between the capitals of countries in the ECOWAS region (Akpan, 2014). The Seme border also is the starting point for roads connecting some landlocked countries in the hinterland, such as Burkina Faso. Most of these countries generate the bulk of their foreign exchange through transit and re-export (Golub, 2012), thereby creating a large and lucrative market, despite their geographic disadvantage. For Nigerian traders, on the other hand, the Seme border provides access to regional markets to trade agricultural products and locally made fabrics, among other products (Njikam and Tchouassi, 2011).

In view of the importance of the Seme border for trading activities within the ECOWAS sub-region, the Nigerian government, with the support of the ECOWAS Commission, the governments of neighbouring countries, and multilateral agencies (such as the World Bank), began reconstruction of the road leading to this border in 2009. The aim of this reconstruction include to reduce trade costs that arise from illegal checkpoints, and to enhance regional integration through cross-border trade. There have indeed been problems with heightened transport and insurance costs, accidents and haulage breakdowns, and illegal checkpoints, and it is widely acknowledged that some of these problems are mainly caused

by the poor road infrastructure to the border (Ackah, Turkson, and Opoku, 2012; Deen-Swaray, Adekunle, and Odularu, 2012).

As it is typical of development projects in a number of developing countries, including those in Africa, discontinuity of development projects has remained one of the prevailing endogenous problems hindering infrastructural development. There are many political and socio-economic factors that affect project continuity in these countries. They include bureaucratic bottlenecks tied to the allocations of economic resources to such projects (Jo-Ansie, 2007), corruption (Asongu, 2014; Efobi, 2015; Asongu and Nwachukwu, 2016), and the lack of political will to continue with development projects initiated by the preceding governments. New political regimes may set new goals and agendas, and there may be limited interest in completing or carrying on the goals of previous governments. In this context, it remains to be seen if, given the recent political transition in Nigeria,² the reconstruction of the border road will continue to be a priority for the current government.

Discontinuity in the reconstruction of the border road project would most likely have an important but differential impact on households. The most likely effect, as a result of increased transportation costs, would be increased prices of goods that are traded across the border, mostly non-food items like cosmetics, pharmaceutical drugs, and electronics, and food products such as rice (Afrika and Ajumbo, 2012; Blum, 2014). Such developments would translate into reduced household consumption, particularly of products whose prices would increase. Women may be more vulnerable than men because of their over-reliance on cross-border transportation for trade, and their other domestic responsibilities that involve road transport (Masika and Baden, 1997; Amoatey, 2006). Women as consumers would be particularly affected by the increased prices of food and household items coming from across the border because, as has been proven empirically (Newman, 2002; UNCTAD, 2011), women allocate more of their resources to the purchase of such products than men.³

The issue of gender, especially in relation to welfare, is beginning to gain policy attention in Nigeria. This is because Nigerian women, like women in other developing countries, are economically constrained in terms of their earning capacity and poorer than their male counterparts (Fapohunda, 2012; Makama, 2013; National Bureau of Statistics, 2013). Development practitioners therefore advocate for studies with a focus on household

²On 29 May 2015, Nigeria witnessed a historic political transition in which the incumbent president handed over the government to an opposition party. This is the first time in the history of Nigeria that there has been such a transition.

³According to the Nigerian Bureau of Statistics and the World Bank's General Household Survey, female-headed households in Nigeria allocate twice as much for household consumption as their male-headed counterparts.

poverty and consumption that include a gender perspective of the issues. In light of this, this study aims to examine the welfare effect that would arise from improving Seme border road infrastructure, with a focus on gender issues.

This study uses an ex-ante approach to estimate the effects of border road improvements on domestic prices of imported rice, the commodity with the highest share in the average household food budget in Nigeria. It analyses the potential impact of these price effects on household consumption and welfare by gender and household location. In particular, the study (a) describes income distribution in the Nigerian states contained in the sample; (b) analyses the relationship between income, household food expenditures, and expenditures on imported rice with the aim of assessing how changes in the price of such food commodities induced by border road improvements would affect different types of households; (c) analyses how simulated changes in local transportation costs stemming from road improvements would affect local prices of imported rice; and (d) estimates the effects on consumption and welfare of the simulated price changes by household head gender and household location (rural and urban households).

The findings of the study will be relevant for the empirical literature on trade and gender and policymaking. The contribution consists of examining not only how cross-border trade affects welfare across genders, but also how the distance from the household location to the border and the improvement in road infrastructure would affect household welfare. Nicita (2009) and UNCTAD (2011) used a similar analytical approach to explain the effects of trade liberalization on household welfare in Mexico and Cape Verde. However, this study differs by considering the relevance of the border road infrastructure project on household welfare, with particular emphasis on the Seme border. With regard to policymaking, a simulation analysis using transportation costs to the border from different household locations can provide insights into the impact of improved road infrastructure and border access on households. In broader terms, as the welfare of women is an important policy issue for the sustainability of national development,⁴ this study can offer policymakers an ex-ante analysis for implementation of the post-2015 Sustainable Development Goals. Given Nigeria's economic and socio-cultural influence within the region, findings relating to Nigeria on issues such as gender may be useful for policymakers in other African countries.

⁴Both literature and policy documents suggest that women are important economic actors, especially in African countries, because of their predominant participation in agriculture and the informal sector, and because of the huge impact that female economic empowerment may have on poverty reduction, especially in households (Seebens, 2006; Ellis *et al.*, 2007).

This study begins by situating the issues of interest in a policy context and presenting stylized facts about Nigeria's trade regime and household welfare. This is followed by a literature review, which also discusses the relevant theoretical underpinnings of this study and an explanation of the research method. The final section introduces and interprets the results and then concludes the study.

2. General Context of the Analysis

This section aims to clarify the context of the border road improvement policy by briefly assessing the importance of the Seme border as a major road transport corridor that connects Nigeria to Benin, and indirectly to other West African countries. We do this by looking at formal and informal imports coming from Benin into Nigeria. We subsequently analyse commodity expenditure shares and thus highlight the importance to household budgets of goods imported through the Seme border.

The Seme border connects Nigeria to Benin, and serves as a major trade channel with other ECOWAS countries. Trade data from the International Monetary Fund show that Nigeria accounts for only about 5 per cent of Benin's recorded exports (i.e. formal trade). Most of this trade does not originate in Benin but consists of imported goods that transit through the port of Cotonou and then the Seme border. However, Benin's informal exports to Nigeria are substantial. Data on informal trade do not exist, so we have to rely on indirect estimates. Geourjon, Chambas, and Laporte (2008) note that about half of formal imports via the port of Cotonou to Benin have the Nigerian market as their final destination. This provides an initial indication of the importance of informal trade. Golub (2012) uses a comparison between formal imports into Benin and Togo to make inferences about informal exports from Benin to Nigeria. The author starts by noting that the economies and populations of Togo and Benin are similar, so domestic demand in the two countries is therefore comparable. He then compares formal imports into Benin and Togo of commodities subject to either an import ban or high import tariffs in Nigeria.⁵ Table 1 shows that Benin's imports of items such as cars, cotton cloth, frozen chicken, used clothes, palm oil, and rice

⁵About 25 products are currently subject to import bans in Nigeria. They include live or dead birds (such as frozen poultry); port-beef; bird eggs; refined vegetable oils and fats; cane or beet sugar; cocoa butter/powder/cakes; spaghetti noodles; fruit juice in retail packs; water; bagged cement; medicaments (medicines) H.S. 3003 and 3004; waste pharmaceuticals; soaps and detergents; mosquito repellent coils; sanitary wares and plastics; tires such as rethreaded and used pneumatic; corrugated paper and paper boards; telephone re-charge cards and vouchers; carpets and other textile floor; foot wear; bags and suitcases; hollow glass bottles of a capacity exceeding 150 milliliters; used compressors; used motor vehicles above **15 years from the year of manufacture;** and furniture and ball point pens and parts including refills (Nigeria Customs Service, 2016).

are substantially higher than those of Togo. As the two countries are similar, these strikingly high imports suggest that these goods are not consumed in Benin, but exported through informal channels from Benin to Nigeria. Thus, informal trade from Benin to Nigeria clearly is important. In this context, the Seme border serves as a significant source of employment and tax revenue not only from formal commerce, but is also an important channel for meeting domestic demand for household items via informal trade.

Table 1: Comparison of imports to Benin and Togo of products subject to import bans or high import tariffs in Nigeria (in billions of CFA francs)

	<i>Benin</i>	<i>Togo</i>
<i>Commodities</i>	<i>Total imports</i>	<i>Total imports</i>
Cars	424.4	80.6
Cotton cloth	368.4	32.7
Frozen chicken	58.6	4.4
Clothing	36.7	36.1
Used clothes	55.5	10
Medicine	29	33.2
Palm oil	62.2	10.1
Vegetable oil	12	7.7
Rice	132.1	12.9
Sugar	16	9.3
Cigarettes	21.8	20.7

Source: Golub (2012: 12).

Until 2015, rice – the main food consumption item in Nigerian households, and the one that will be the main focus of this study– was among the items whose imports were banned. Despite the recent lifting of the ban, official rice traders still need to pay a 10 per cent import duty plus a 60 per cent levy for imports through a land border. Rice millers with a valid quota, who are a second type of official importers, pay a 10 per cent import duty and a 20 per cent levy. Treichel *et al.* (2012: 3) noted the impact of these trade policy measures by calculating that Nigerian consumers pay 77 per cent more for the same products than consumers in African countries that do not impose bans.

The above trade policy measures aimed at preventing or restricting imports, together with institutional issues at the border such as informal payments to customs officers, explain why food and household items are frequently imported into Nigeria through informal channels and why informal trading and smuggling remain a lucrative venture for the Nigerian population, including women (Afrika and Ajumbo, 2012). As a matter of fact, women

constitute the majority (about 60 per cent) of the traders who trade across the Seme border, especially those involved in informal trading (Afrika and Ajumbo, 2012).

Having highlighted the importance of commodities crossing the border from Benin to Nigeria, we now move on to household expenditure. Figures 1a and 1b present patterns of household consumption of both food- and non-food items in Nigeria. Figure 1a shows that the expenditure patterns of rural and urban households on food items are somewhat similar: they both spend more on cereals and fruits, vegetables, and proteins than on alcohol and tobacco, meat and seafood, dairy products, and oil and fats. For non-food item expenditures shown in Figure 1b, rural and urban dwellers also have similar expenditure patterns, spending the most on household utilities, a category that includes rent, fuel, insurance, and water utilities. The bulk of the non-food items that come through the border – such as clothing (especially second-hand) and household goods – constitute the next highest expenditure for rural households, while for the urban households, clothing and other services (such as information technology, insurance, and personal goods) are among their next highest expenditures. Since Nigerian households spend a considerable share of their budget on items that flow through the border (e.g. cereals, clothing, fruits and vegetables), it is most likely that they will be affected by improved border access.

Figure 1a: Share of food items in household expenditure (per cent)

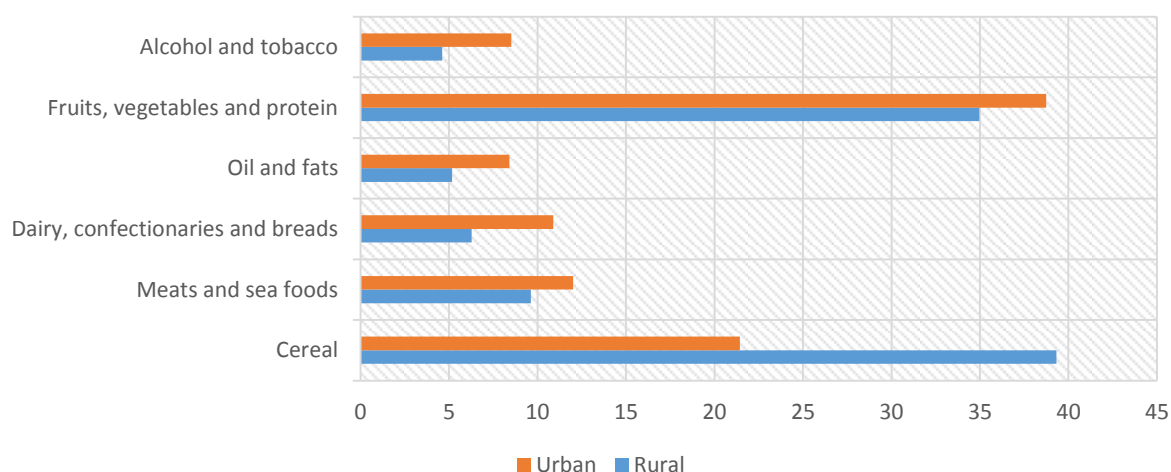
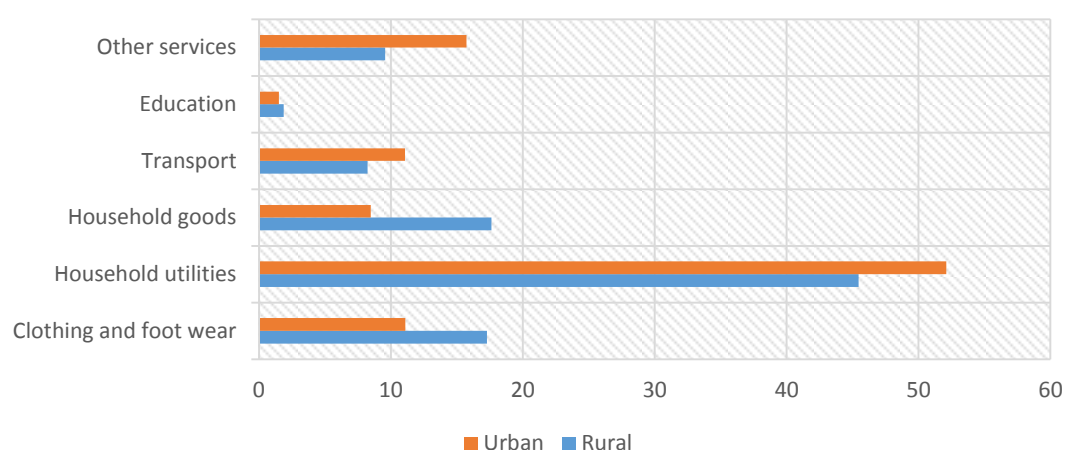


Figure 1b: Share of non-food items in household expenditure (per cent)



Source: Author's calculations based on data from the National Bureau of Statistics (2012).

3. Literature review

From a global perspective, the literature on cross-border trade – and, more importantly, the gender perspective of such trade – has received considerable attention (Lesser and Moise-Leeman, 2009; Afrika and Ajumbo, 2012; Asongu, 2013; Blum, 2014). Irrespective of the formal or informal nature of trade, border areas provide a wider market for both agricultural and non-agricultural products. Apart from direct exports and imports of these products, re-export and transit trade are prevalent in border areas (Golub, 2012). Trade in the border areas of Nigeria is seen as having different effects on households depending on whether they are net consumers or net producers (Olayinka, 2013). These effects are mainly indirect: the prices of goods that pass through the borders to the final market are adjusted for the increased trade cost at the border such as transportation costs (as a result of bad roads), increased insurance costs, or the cost of preserving products, to mention a few. These increased prices of the goods in the domestic market then affect household consumption. Olayinka (2013) discusses this by considering the ECOWAS common external tariff (CET) and its pass-through effect on domestic prices. Closely related is the study by Blum (2014), who examines the challenges faced in cross-border trade between Nigeria and Benin.

Most studies that have considered the welfare effect of Nigeria's intra-regional trade have only focused on the ECOWAS CET (Balogun and Dauda, 2012; Urama, Nwosu, and Aneke, 2012; Olayinka, 2013). The present study goes further than Olayinka (2013), for example, by considering the impact of border road infrastructure and performing a gender-specific analysis to estimate the impact on household welfare. It thus fits in the broader

literature on trade facilitation and household welfare, on the one hand, and the literature on gender and poverty, on the other.

Road infrastructure is seen as an important trade facilitator that can enhance regional integration and trade among neighbouring countries in Africa (Bassole, 2014). Akpan (2014) presents an elaborate description of the benefits of road infrastructure for respective ECOWAS countries. In relation to gender and poverty, the present study considers the extent to which the effect of higher prices of imported goods resulting from poor road infrastructure differs depending on the gender of the household head. Extant studies have pointed out that women are more vulnerable in terms of poor infrastructure (like road access) because of their involvement in trade, as well as their domestic roles and responsibilities that involve road transport (Masika and Baden, 1997; Amoatey, 2006).

The transmission mechanism through which the improvement of border roads affects domestic prices may be conjectured by looking at the literature that has examined how distance to the border affects household gains from trade policy. Nicita (2009) studied the price effect of tariff liberalization on household welfare. Among the important contributions of that study is that urban areas, as well as Mexican states that are closest to the US border, are found to be large beneficiaries from the trade liberalization policy. The author notes that Mexican states that are farther away from the border benefit less from this policy because of the transportation cost. Similar studies that have linked distance to the border with household welfare include Marchand (2012), who analysed tariff pass-through and distributional effects on Indian households.

Simulation analysis, which is used in the present study, is a frequently used tool today. For example, Antle *et al.* (2015) applied the simulation approach to assess the sustainability of agricultural technologies in integrated aquaculture-agriculture (IAA) in Bangladesh. The study finds that adopters and non-adopters of the IAA technology differed in terms of both productivity and profitability. Farms that adopted IAA achieved higher productivity compared to non-adopter farms. One important aspect of the study is that the authors used a simulation analysis for ex-ante impact assessment. Similarly, UNCTAD (2011) used a complex simulation analysis to examine the effect of policy changes that have a bearing on the distance from other islands in Cape Verde to the island with the sea port. The simulation computed price elasticities in relation to the transportation cost, taking into consideration policy changes that reduced the transportation cost by half.

4. Methodology and Data

4.1 Methodology

Building on the approach of UNCTAD (2011), which studied trade liberalization in Cape Verde and its effects on gender, the present study performs an ex-ante analysis using a similar three-step methodology. The first step consists of a purely descriptive analysis of the income distribution in the selected states of Nigeria that are close to the Seme border. The second step uses non-parametric regressions to analyse the relationship between income, household food expenditure, and imported rice expenditure. The aim of this second step is to assess how changes in food commodity prices (for instance, those caused by reduced transport costs due to improvements in road infrastructure) would affect different types of households. Finally, the third step uses a simulation analysis to assess the potential welfare impact stemming from improvement of the border road. This step is itself divided into two stages. Stage one clarifies how prices of imported rice – the commodity with the highest share in the average food budget of Nigerian households – would be affected by improvement of border road infrastructure. Stage two then estimates the welfare effects of these simulated price changes.

4.1.1 Descriptive analysis of income distribution

The first step of the analysis describes the income distribution of all households, as well as urban and rural households, by gender. Log per capita expenditure of households is used as a proxy for household income. This variable is preferred because it provides an unbiased estimate of the income level of the household and also follows the permanent income hypothesis. The analysis uses kernel density plots to describe the distribution of the log per capita expenditure by the gender of the household head and the household location. This technique does not assume any underlying distribution for the variables and provides clear output on the density distribution of the considered variables.

4.1.2 Analysis of the relationship between income and food expenditure

The second step analyses the relationship between income and food expenditure in general as well as income and imported rice expenditures in particular. This allows for assessing how changes in food prices would affect different types of households. The analysis is performed using non-parametric regressions of the share of food expenditure in total household expenditure, as well as the share of imported rice expenditure in total household expenditure, on income as measured by the log of per capita expenditure. The non-parametric regressions are estimated using the local polynomial regression approach. These regressions are used to

fit the relationships between the variables of interest. This implies that separate fitted relationships are obtained at different values of the independent variable in order to enable predictions of the regression lines. The essence of applying the non-parametric regression technique is to enable a flexible modelling of the regression curve.

Unlike the parametric linear regression technique, the non-parametric regression, importantly, allows for relaxing the linearity assumption and can predict estimators and inference procedures that are less dependent on functional form assumptions (Yatchew, 1998; Frolich, 2006). It allows for exploring the forms of the relationships between variables of interest, which makes it useful for exploratory data analysis and for practical and policyrelevant analysis. Finally, non-parametric regressions permit, in some cases and to some extent, the inclusion of endogenous control variables (Frohlich, 2008). These reasons make the non-parametric regression approach suitable for our analysis.

4.1.3 Simulations and computation of welfare gains

The third step of the ex-ante analysis methodology consists of two stages. Stage one simulates the effect of road improvements on prices of imported rice. In our sample, imported rice is the commodity with the highest share in the average food budget of households, representing roughly 11 per cent of average household food expenditure. Moreover, imported rice occupies third place in total average household expenditure, representing a share of over 6 per cent. Consequently, local prices of imported rice will be directly affected by a policy aimed at improving border roads. Stage two uses the simulated changes in the price of imported rice to compute associated household welfare changes.

In ex-ante studies, simulation analysis is an important tool that predicts scenarios using statistical data. It is helpful in assessing the effects of a change in government policies on variables of interest. The simulation-based approach can also be used to evaluate the effects of exogenous changes in conditions, such as transport cost to the border resulting from improvements in road infrastructure. Simulation analysis thus allows for generating different counterfactual scenarios.

Stage one: Simulating the effects of road improvements on the price of imported rice

Internal transport costs affect local prices of imported goods. This assumption has been corroborated by several studies such as Boysen (2009) for Uganda; Nicita (2009) for Mexico; and Olagunju *et al.* (2012) for Nigeria. The idea is formalized in the law of one price, which can be expressed as follows:

$$p_{ij} = p_i^* e(1 + \tau_i) + \gamma_{ij}, \quad (1)$$

where p_{ij} , the local price of good i in the specific household location j (a village or city within Nigeria where the household is located), depends on the international price p_i^* , the exchange rate e , international transaction costs tr_i , the import tariff rate τ_i , and γ_{ij} , the internal transportation cost from the border to the specific household location j . For simplicity, international transaction costs are omitted. This equation states that prices in a specific household location j of a good i that has been imported from the Seme border depend on:

- a) The price of good i at the Seme border ($p_i^* e(1 + \tau_i)$), and
- b) The transportation costs from the Seme border to the location j (γ_{ij}).

Within this framework, internal transportation costs γ_{ij} are assumed to vary regionally depending on the state of road infrastructure and the distances being covered. This implies that local prices of imported commodities (p_{ij}) also vary according to the location of the household and its distance to the border. Improvements of roads leading to the border can thus affect local prices of imported commodities by lowering transportation costs.

The elasticity of the local prices p_{ij} with respect to internal transportation costs γ_{ij} is thus given by:

$$\frac{\partial \ln p_{ij}}{\partial \ln \gamma_{ij}} = \frac{\gamma_{ij}}{p_i^{Seme} + \gamma_{ij}}, \quad (2)$$

where p_i^{Seme} is the price of good i at the Seme border as defined above. Therefore the percentage change in local prices can be expressed as:

$$\Delta p_{ij} \cong \frac{\gamma_{ij}}{p_i^{Seme} + \gamma_{ij}} * \Delta \gamma_{ij}, \quad (3)$$

where $\Delta \gamma_{ij}$ is the simulated percentage change in internal transportation costs due to road improvements. To simulate the effect of improved border roads on local commodity prices, three hypothetical scenarios are considered. These scenarios are based on the assumption that the completed road projects will result in either a 10, 20, or 30 per cent decrease in the transportation cost from the border to the household locations. The three scenarios are

hypothetical and cover a wide range of potential effects on transportation costs. Some studies that have used this approach include Antle *et al.* (2015), who applied the simulation approach to assess the sustainability of agricultural technologies in integrated aquaculture-agriculture in Bangladesh.

We apply this methodology to prices of imported rice. Two reasons motivate that choice. First, imported rice is the commodity with the highest share in the average food budget of households and the third highest share in total household budgets. Second, as imported rice is one of the main cross-border traded products, the local price of imported rice will be directly affected by improvements in border road infrastructure. These two features make imported rice a suitable commodity for the simulation of welfare effects of the border road improvement policy.

Stage two: Assessing welfare effects of the simulated commodity price changes

The change in the price of imported rice induced by a change in transportation costs as a result of improvements in road infrastructure is then used to compute the welfare effect for each household. We compute the percentage gain in household welfare as follows:

$$Welfare_gain_{ij} = [-(expenditure_ratio * \Delta p_{ij}) * 100], \quad (4)$$

where *expenditure_ratio* corresponds to a household's imported rice expenditure as a fraction of total household expenditure, Δp_{ij} is the simulated change in prices of imported rice obtained in stage one, and *welfare_gain_{ij}* is the change in welfare of household *i* at location *j*.

4.2 Data description

Different data sources are used for this study. Household data, including location and characteristics (i.e. gender of household head, and household income sources and consumption patterns) are sourced from the second wave of the General Household Survey (post-harvest) conducted in 2012–2013 by the World Bank and Nigeria's National Bureau of Statistics (2013). The survey provides information on expenditure, income, household characteristics, wages, sector of activity, education, and gender of 4,581 households in Nigeria. We preferred to use the second wave of the survey because it contains more recent information about the sampled households. Table 2 comprehensively describes the number of households across states and locations. Only the states close to the Seme border are

considered, as most of the rice imported through that border has these states as the final destination.

Table 2: Sample distribution (post-harvest) of households that participated in the General Household Survey

<i>Zone</i>	<i>State</i>	<i>Total</i>	<i>Urban</i>	<i>Rural</i>
South-West zone	Ekiti	72	51	21
	Lagos	146	138	8
	Ogun	110	76	34
	Ondo	119	53	66
	Osun	159	124	35
	Oyo	190	124	66
Total		796	566	230

Source: Author's elaboration.

Note: Nigeria is divided into six geo-political zones: South-West, South-South, South-East, North-West, North-East, and North-Central. Within those zones, there are 36 states including the Federal Capital Territory – Abuja.

Transportation costs from the Seme border to these household locations are sourced from a trans-state transport agency in Lagos State, Nigeria. The agency is an association of transport operators that travel the routes of interest. Using the freight capacity of their standard vehicle, we then compute transportation costs per kilogram.

Finally, we approximate the price of imported rice at the Seme border (p_i^{Seme}) by taking the average of quarterly international prices of different rice brands imported into Nigeria for the first trimester of 2016, as reported in the World Bank's Commodity Price Database, and add the import duty imposed by Nigeria on imported rice, sourced from the website of the Nigeria Customs Service. Using these two data sources, we then calculate the price of a kilogram of imported rice at the Seme border (Table 3).

Table 3: International rice prices and import tariffs in Nigeria

<i>Type of rice</i>	<i>Price in USdollars (per ton)</i>	<i>Tariff and levy (percent)</i>	<i>Final price in USdollars (per ton)</i>
Rice, Thailand 5 per cent	379.00	70	
Rice, Thailand 25 per cent	370.00	70	
Rice, Thailand A1	372.80	70	
Average	373.90	70	635.63

Sources: World Bank, Commodity Price Database; and Nigeria Customs Service.

Figure 2 displays the locations for which the data for the study were gathered. These locations correspond to the six states presented in Table 2, with each state being marked in a different colour. Figure A1 in the Annex shows these locations on the map of Nigeria. In the

text that follows, when we speak of the entire region, we are referring to the locations shown in Figure 2.

Figure 2: Locations from which household data were gathered



Source: Author's elaboration.

5. Results and discussion

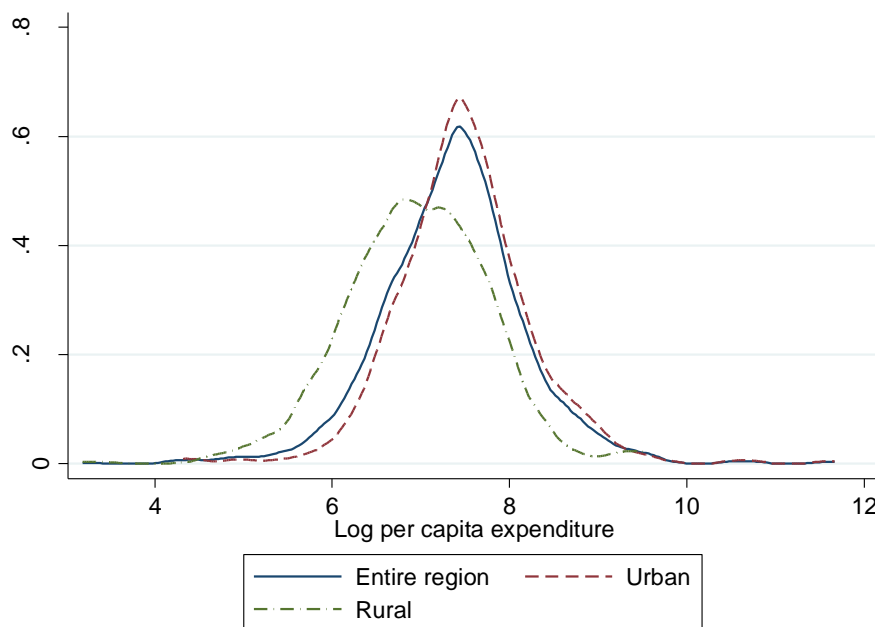
As stated earlier, policies geared towards the improvement of border road infrastructure are likely to have diverse effects on individuals, especially across genders. These individuals may be affected either through the impact of transportation costs on the domestic prices of goods, or through the income effect that provides wider opportunities for households to engage in productive economic activities that relate to the border. Due to the difficulty in accessing relevant data, this study does not consider the income effect. It focuses on the price effect by analysing the change in household consumption of imported rice stemming from an improvement in border roads and the subsequent reduction in transportation costs. The study aims to assess whether Nigerians who are serviced by the Semeborder will benefit from completion of the border road infrastructure project and, if so, whether there will be a gender bias in the gains.

5.1 Descriptive analysis of income distribution

The analysis starts with a brief examination of income distribution in the sampled regions of Nigeria. We use kernel density plots to describe the distribution of the weekly log per capita expenditures by the gender of the household head and the household location.

Figure 3 shows that rural household density is shifted to the left compared to urban household density, which indicates that per capita household income is higher in urban than rural areas. A Kolmogorov-Smirnov two-sample test indicates that this difference is statistically significant at the 1 per cent level. This result is consistent with prior findings from other countries such as Cape Verde (UNCTAD, 2011) or Tanzania (Ilomo, 2015).

Figure 3: Distribution of income by household location

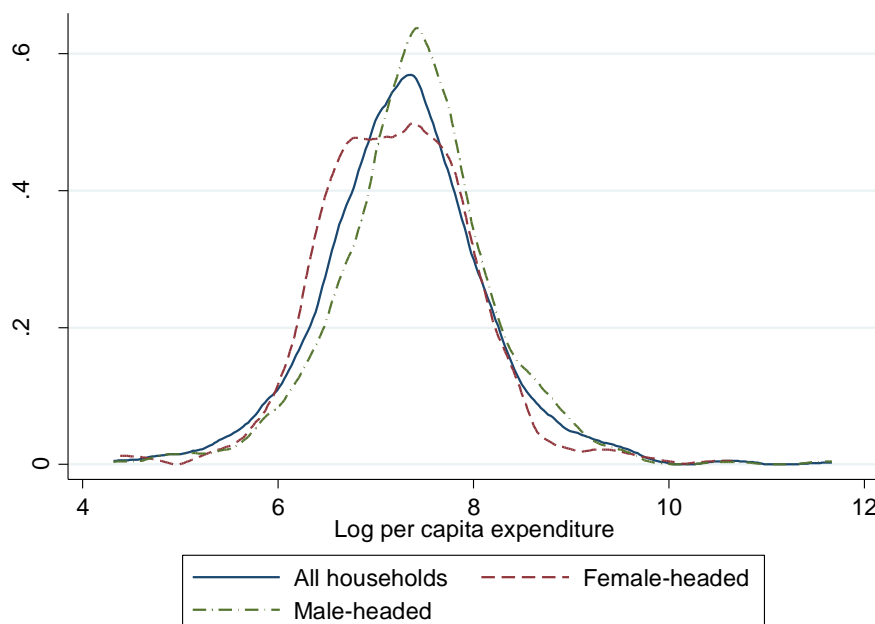


Source: Author's calculations.

We subsequently explore the distribution of per capita expenditure by gender of the household head in order to verify whether there is a gender bias in the income distribution. Figure 4 reveals that the density of female-headed households is slightly shifted to the left with respect to that of male-headed households. This means that female-headed households have lower per capita income and thus tend to be poorer than their male counterparts. These findings support earlier results of the national demographic survey showing that women are poorer than men in terms of their earning capacity (Fapohunda, 2012; Makama, 2013; National Bureau of Statistics, 2013). Note however that the difference in log per capita

expenditures between female- and male-headed households is (just barely) not significant at the 10 per cent level. The latter might be due to the relatively small size of our sample.

Figure 4: Distribution of income by gender of household head



Source: Author's calculations.

To conclude the overview of income in the Nigerian states contained in the sample, Table 3 presents average weekly per capita household expenditures by location and gender. The average per capita expenditures shown in the table further confirm the results of Figures 3 and 4: urban households have higher average per capita expenditures than their rural counterparts and female-headed households have lower per capita expenditures than their male-headed counterparts. Interestingly, Table 3 reveals a discrepancy when comparing female- and male-headed households by household location: while female-headed urban households have lower average per capita expenditures than male-headed urban households, female-headed rural households have (slightly) higher average per capita expenditures than male-headed rural households.

Table 3: Average weekly per capita expenditure of households

	<i>Female-headed</i>	<i>Male-headed</i>	<i>Total</i>
Total	2,130.1	2,254.5	2,230.0
Rural	1,521.9	1,480.5	1,489.3
Urban	2,405.9	2,560.6	2,531.2

Source: Author's calculations.

Note: The values are in the local currency unit (naira). For the period covered by the data in the table, the exchange rate was 156.81 naira per US dollar.

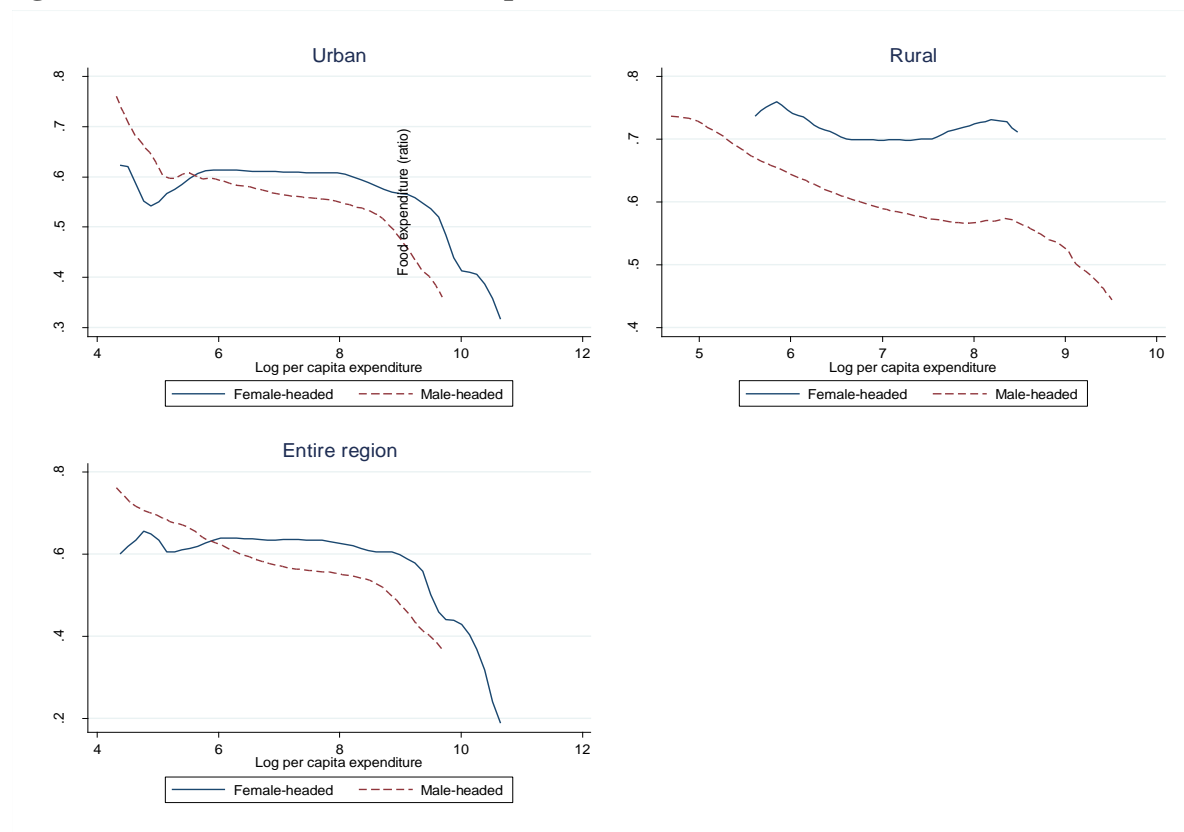
5.2 Relationship between income, food expenditure, and imported rice expenditure

Before simulating how border road improvements would affect the price of imported rice and subsequently the welfare of different households, we first analyse how different households would be affected by changes in the price of food in general and imported rice in particular. We start by taking a general look at the share of food expenditure in total household expenditure. We subsequently turn our attention to the most important food commodity – imported rice – and analyse consumption patterns of imported rice by the gender of the household head and by household location. The latter allows us to infer how different households will be affected by changes in the price of imported rice induced by a border road improvement policy.

5.2.1 Income and food expenditures

In most Nigerian households, food expenditure represents an important share of total household expenditure. We follow UNCTAD (2011) and use non-parametric regressions of the share of food expenditure on the log of household per capita expenditure to explore the relative importance of food in the budget of different households. Figure 5 displays the fitted regression lines for female- and male-headed households separately, with each point on the regression line reflecting the average food expenditure ratio for a given level of income (which we approximated using log per capita expenditures).

Figure 5: Share of household food expenditure and income



Source: Author's calculations.

The lower panel of Figure 5 displays the regression lines for the entire South-West region of Nigeria by gender. Poorer households with low log per capita expenditures spend a large part (more than 60 per cent) of their household budget to purchase food. The importance of food expenditure in the household budget then constantly declines with rising income. These results are consistent with economic theory and illustrate Engel's law, which says that the proportion of income spent on food falls when income rises, even if actual expenditure on food might rise. We also find some evidence of gender differences: except for very poor households, female-headed households seem to spend more on food than their male counterparts with similar per capita household income. These results are in line with findings for other countries (UNCTAD, 2011).

The upper panel of Figure 5 displays the fitted regression lines by gender separately for urban (left panel) and rural (right panel) households. The same overall patterns as already discussed for the entire South-West region of Nigeria can be found here. However, one striking difference between urban and rural regions can be identified: the difference between food expenditure shares of female- and male-headed households is considerably larger in rural areas than in urban areas.

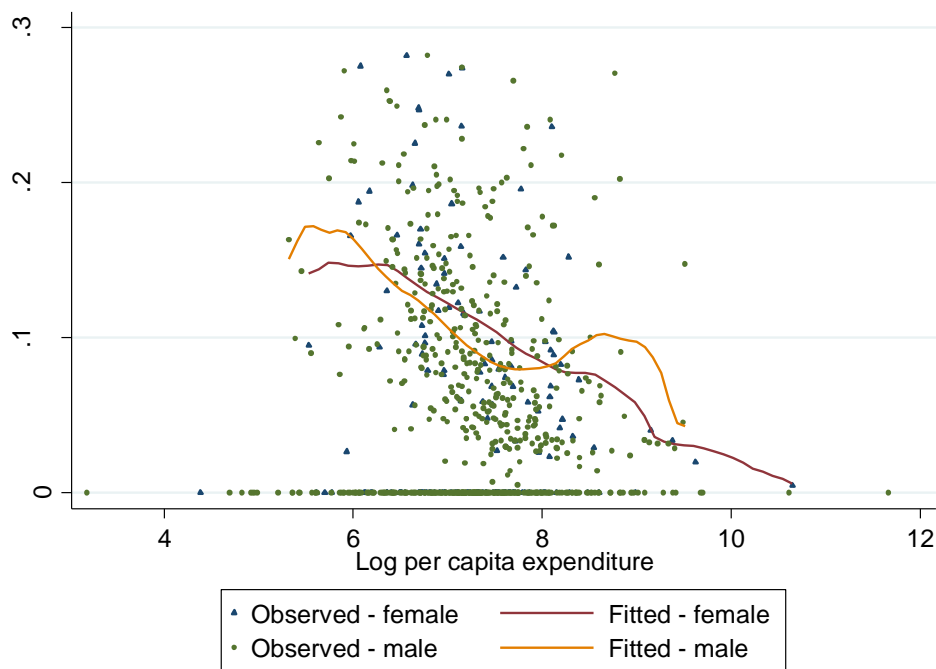
In terms of policy implications, Figure 5 indicates that a policy that reduces food prices in the local market has a pro-poor bias for both female- and male-headed households, in urban as well as rural areas, and in the entire South-West region of Nigeria. Moreover, female-headed households would generally benefit more from lower food prices than their male counterparts. Thus, in a hypothetical world where all food would be imported into Nigeria, a policy that improves border roads and thereby lowers transportation costs, and hence food prices, would benefit poor households and female-headed households more than rich and male-headed households. However, not all food is imported into Nigeria, so we are not in a position to judge how a border road improvement policy would affect different households, as the consumption patterns of imported food might differ from the general food expenditure pattern. The next section therefore looks at a particular food commodity that has the highest expenditure share in household food budgets: imported rice.

5.2.2 Income and imported rice expenditures

As above, we use non-parametric regressions to explore how changes in the price of imported rice could affect different households. For the regressions, we delete all households that do not consume imported rice (i.e. about 40 per cent of the households in the sample), but we display in the figures that follow all observations next to the fitted regression lines for the sake of completeness.

Figure 6 shows the regression lines for the entire sample region separately for female- and male-headed households. Poor households spend roughly 15 per cent of their household budget on imported rice. Overall, the share of expenditure spent on imported rice tends to decrease with higher per capita income, again confirming Engel's law. Note that the regression line for female- and male-headed households overlaps twice, indicating that poor as well as rich female-headed households spend more than male-headed households on imported rice.

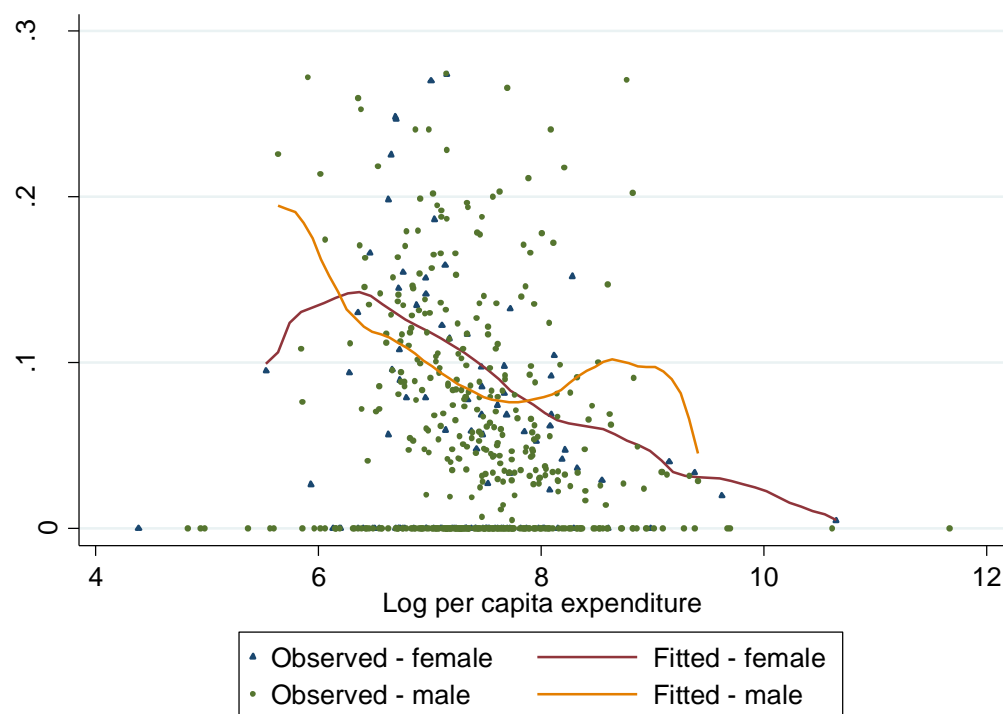
Figure 6: Share of household imported rice expenditure and household income – entire region



Source: Author's calculations.

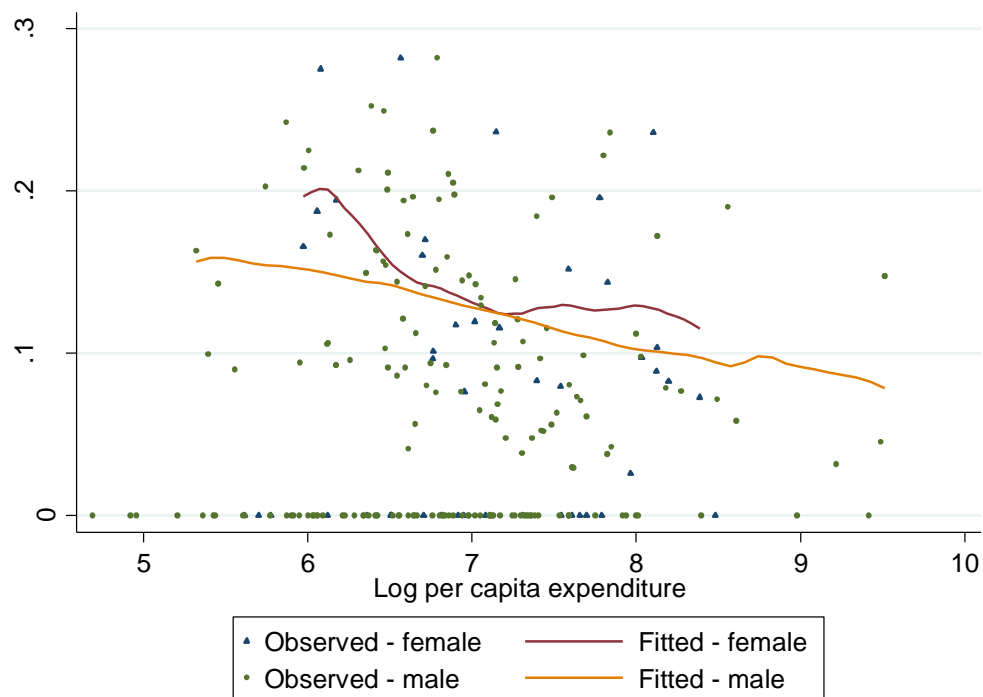
Figure 7 shows the regression lines for the rural sub-sample and Figure 8 shows the results for the urban sub-sample. While the general tendency in both sub-samples is the same – i.e. poorer households spend a larger share of their income on imported rice than richer households – a striking difference emerges when considering the gender of the household head: in rural areas, female-headed households spend more on imported rice, no matter their per capita income. In urban areas the pattern is similar to that of the entire region: poor and rich female-headed households spend a larger share of their total income on imported rice than their male counterparts.

Figure 7: Share of household imported rice expenditure and household income – urban areas



Source: Author's calculations.

Figure 8: Share of household imported rice expenditure and household income – rural areas



Source: Author's calculations.

Figures 6–8 thus show that a policy that improves border roads and thus lowers transportation costs and subsequently the local price of imported rice will affect different households in different ways. First, poorer households will benefit more from such a policy because they spend a larger share of their budget on imported rice. Second, poor as well as rich female-headed households will generally profit more than their male counterparts. Finally, all rural female-headed households will in general benefit more than their male counterparts. The next section will simulate the effects of border road improvements on the price of imported rice and compute potential welfare gains for different types of households.

5.3 Simulations and computations of the welfare effects from the construction of border road infrastructure

This section computes the welfare change for households as a result of improvements to border road infrastructure. As mentioned in Section 4.1, we first simulate the effect of an improvement in the road infrastructure on the price of imported rice, and then calculate the effect of this price change on household welfare.

5.3.1 Effect of road improvements on the price of rice

We apply Equation 3 (see section 4.1.3) to simulate the resulting change in the price of rice after a reduction in transportation costs that follows an improvement in road infrastructure. The equation states that the change in the price equals the change in transportation costs times the elasticity of the price of imported rice with respect to transportation costs.

As discussed in Section 4.1, we consider three different scenarios of changes in transportation costs, which are reductions by 10, 20, and 30 percent. The elasticity of the price of imported rice with respect to transportation costs is calculated as the share of transportation costs in the local price of rice. To calculate this elasticity we need the costs to transport rice to each region in Nigeria and the local price of rice, defined as the price at the Same border plus the transportation cost (see Equation 2 in Section 4.1.3). The price of rice at the Same border is measured as the international price of rice plus import tariffs (Table 3), and transportation costs are calculated using the information provided by the previously mentioned trans-state transport agency in Lagos State, Nigeria. The averages of the simulated changes in prices by state are presented in Table 4.

Table 4: Average change in the price of rice after a reduction in transportation costs(per cent)

<i>State</i>	<i>Transportation cost reduction</i>		
	<i>10 per cent</i>	<i>20 per cent</i>	<i>30 per cent</i>
Ekiti	-2.75	-5.51	-8.26
Lagos	-0.67	-1.33	-2.00
Ogun	-1.62	-3.24	-4.86
Ondo	-2.67	-5.33	-8.00
Osun	-2.38	-4.77	-7.15
Oyo	-2.17	-4.33	-6.50

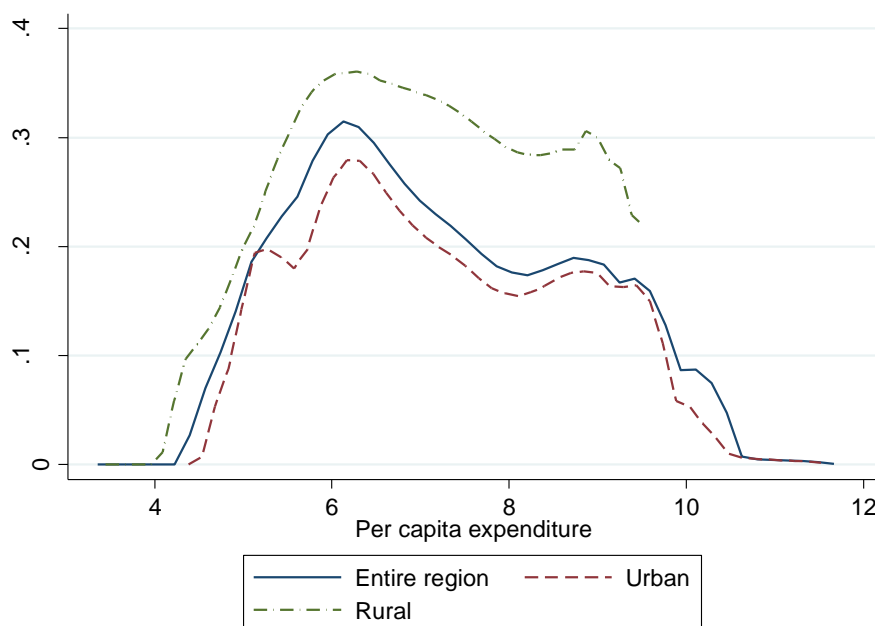
Source: Author's calculations.

5.3.2 Welfare effects

Once the changes in local rice prices are obtained, the final step is to calculate the welfare effects by applying Equation 4 (see Section 4.1.3). For each household, the budget share of rice is multiplied by the change in price that corresponds to the location of the household. Thus, the change in welfare for each household depends on how far it is located from the Seme border (the farther away the household, the higher the welfare effect), and on the budget share of rice of the household (the higher the budget share, the higher the welfare effect).

Non-parametric regressions are used to illustrate these changes in welfare by total expenditure level. Figure 9 shows the welfare effect for all households as well as its disaggregation by region (urban and rural) after a 20 per cent reduction in transportation costs. The shapes of the curves for the other two simulations (a 10 per cent and 30 per cent reduction in transportation costs) are identical, and are presented in Figures A2-A5 in the Annex.

Figure 9: Welfare effect on households of a 20 per cent reduction in transportation costs, by area



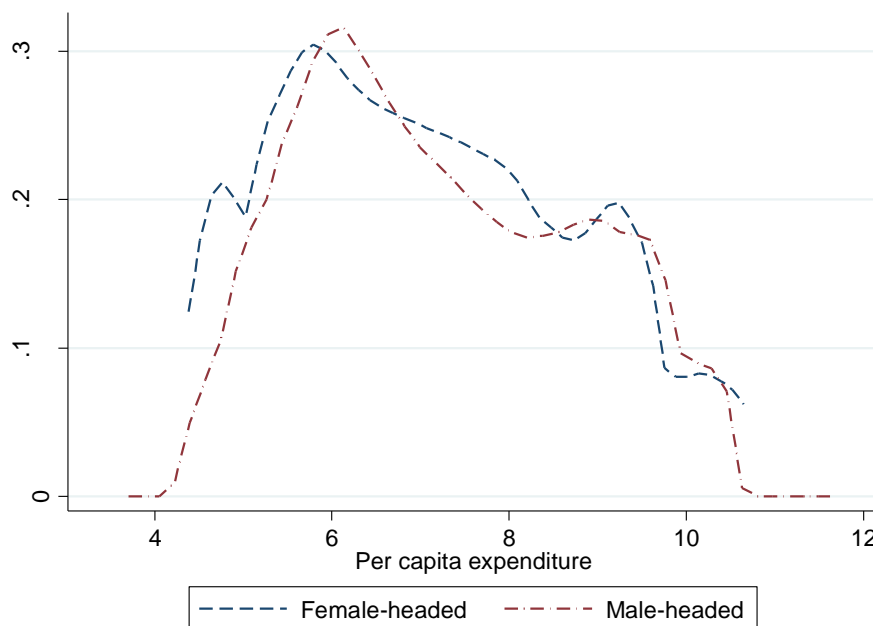
Source: Author's calculations.

It can be seen that rural households experience the highest change in welfare, and that in both urban and rural areas, poor households benefit the most from the reduction in the price of imported rice. An exception concerns the very poor and can be explained by the fact that these households did not report any consumption of imported rice (Figures 7 and 8).

When considering the gender of the household head, the analysis produces ambiguous results. Figure 10 shows that the welfare change curves cross each other several times. Nevertheless, we can observe that among the poorest female-headed households are those that benefit more than their male counterparts from the reduction in the price of rice.

It is important to point out that this analysis includes both the households that consume imported rice and those that do not. The analysis does not consider behavioural changes that would allow households that do not consume imported rice to start consuming it after a decrease in price. Therefore, in the analysis, only the households that reported any consumption of imported rice are shown as benefiting from lower prices.

Figure 10: Welfare effect on households of a 20 per cent reduction in transportation costs, by gender



Source: Author's calculations.

The simulation results lead to a conclusion that a policy that aims to improve border roads, and thereby lower transportation costs and subsequently the price of imported rice, will be more beneficial to rural than to urban households. Moreover, such a policy is likely to produce larger welfare gains for poorer households than richer households, and will at the same time be more beneficial for the poorest female-headed households than for their male counterparts. Note, however, that there are two major caveats of the simulation analysis. First, as already mentioned, we do not consider any behavioural changes induced by the reduction in the price of imported rice. Second, we estimate a lower bound of welfare gains, as we only consider one (although major) commodity (imported rice) and do not assess the effects of lower transportation costs on other imported commodities. Thus it is likely that the welfare gains due to commodity price reductions would be larger than the ones reported here.

6. Conclusion

The Seme border is one of the prominent trade hubs in West Africa connecting the rest of the West African countries with Nigeria, the largest market in the region. This border is the major source of Nigerian customs revenue. In light of the huge amount of commuter activities along the border road and the increasing deterioration of the road infrastructure, the Nigerian government began to take steps in 2009 to rebuild the road infrastructure. However,

it is not clear if the current government, which is run by the opposition party, will continue implementation of this project. In the past, new governments in Nigeria sometimes opted not to complete the previous government's projects.

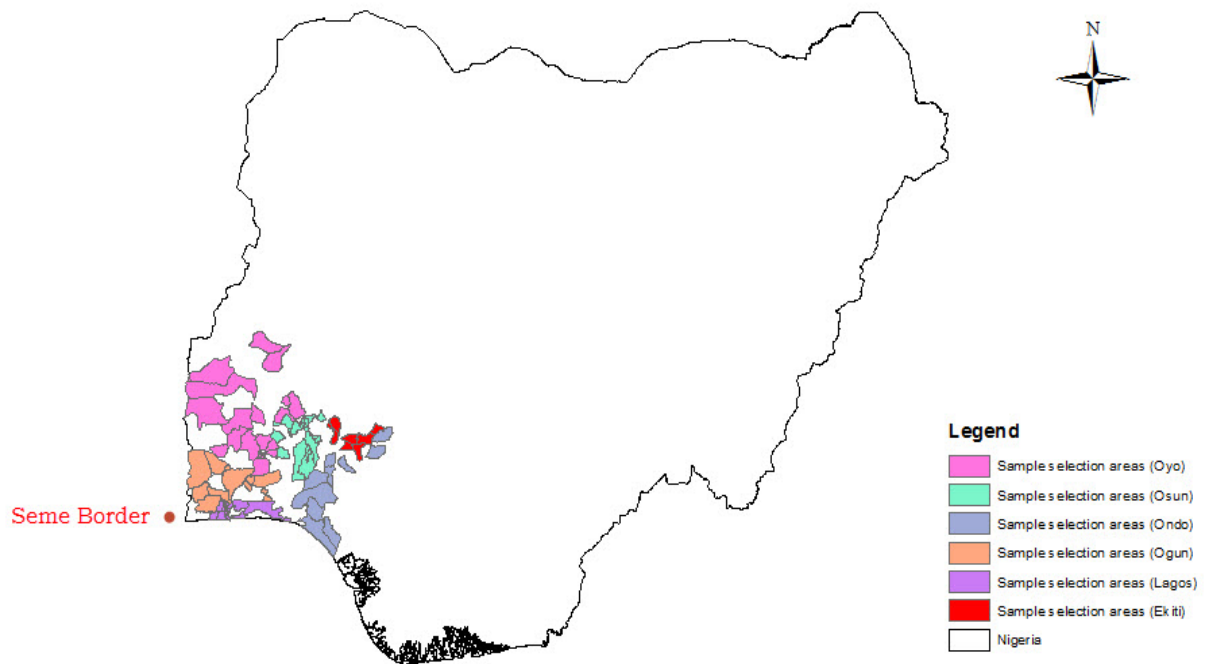
Using an ex-ante analytical approach, this study has aimed to quantify the welfare effects of completion of this project, with a special focus on its differentiated impact across genders. We described the income distribution in the South-West region of Nigeria as a whole and separately for urban and rural households. We then analysed the relationship between the level of livelihood of households and their food expenditure ratio as well as their imported rice expenditure ratio. Finally we simulated the welfare effects of completion of the border road improvement project by focusing on the impact of a policy-induced change in prices of imported rice, a commodity that has the highest expenditure share in household food budgets.

Results indicate that completion of the border road infrastructure would be more beneficial for rural households than urban households. Moreover, completion would likely produce larger welfare gains for poorer households than richer households, and would at the same time be more beneficial for the poorest female-headed households than for their male counterparts. Thus, the study shows that the welfare impact of border road improvements is generally positive, but varies across household location and gender.

Due to the lack of data, this study could only consider the price effects induced by the road improvement project, and did not consider the income effects of such a project. However, an analysis of the latter would be worthwhile, especially from a gender perspective, as women constitute the main bulk of traders operating on the Seme border. The project could thus generate considerable income effects that this current study did not quantify. Hence, there is scope for future studies that also consider the income effect of the border road reconstruction, focusing on livelihoods that may be affected by the border road such as agricultural activities, transportation, and other support services that may be needed along and across the border. It would also be useful for future studies to extend this analysis to other borders crossings of Nigeria such as the Ikom-Mfum crossing in Cross River State.

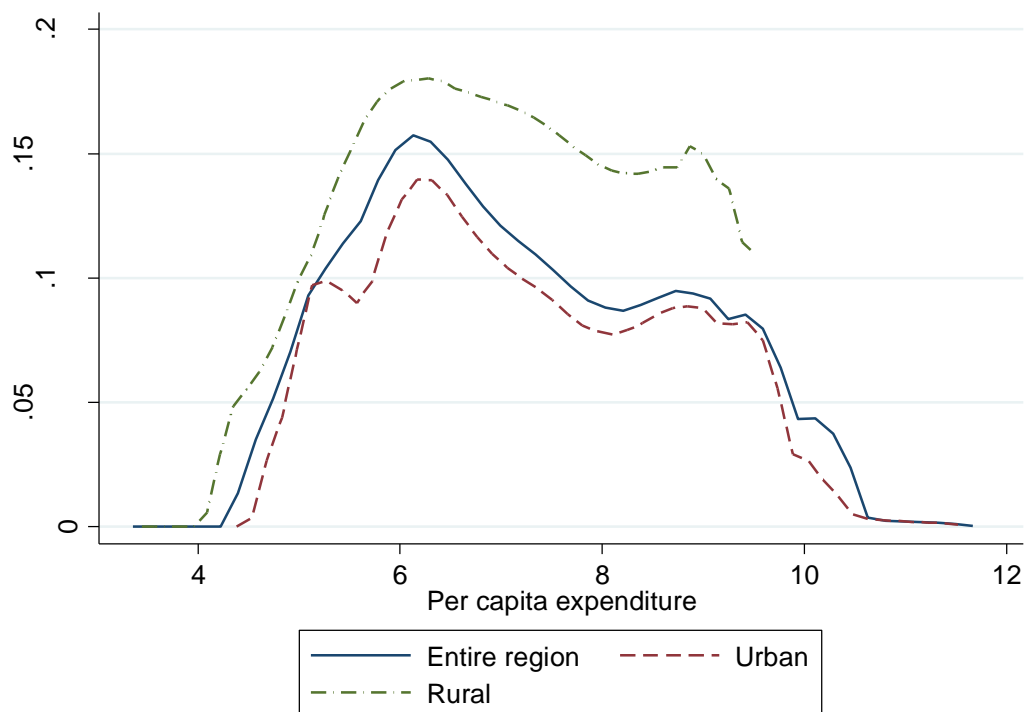
Annex

Figure A1: Locations of the sample selection



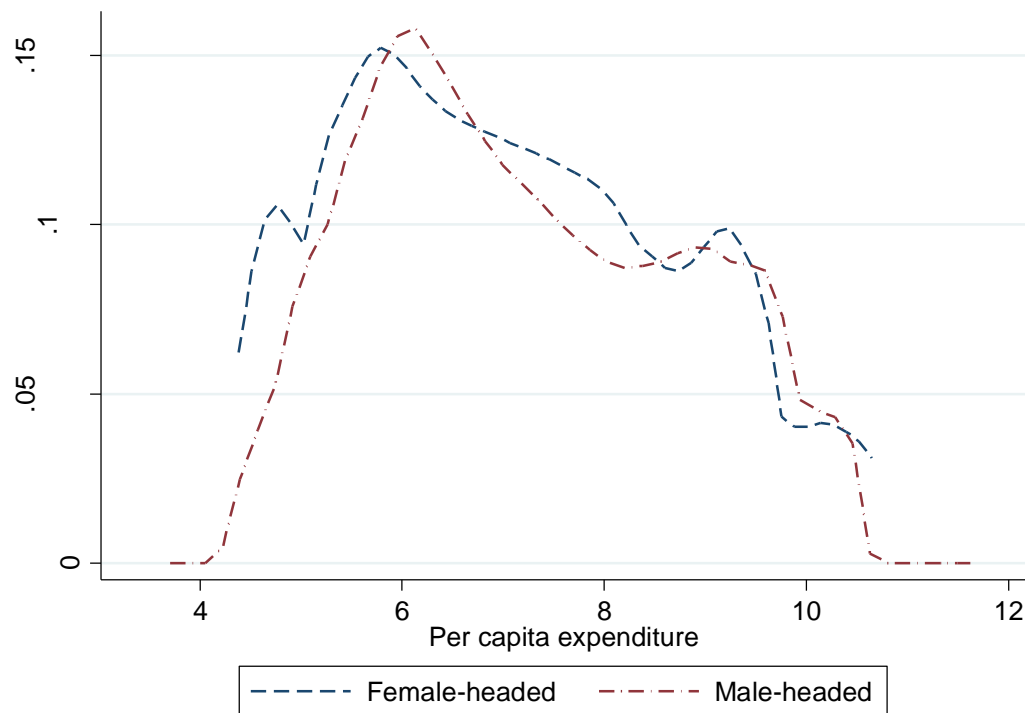
Source: Author's elaboration.

Figure A2: Welfare effect on households of a 10 per cent reduction in transportation costs, by area



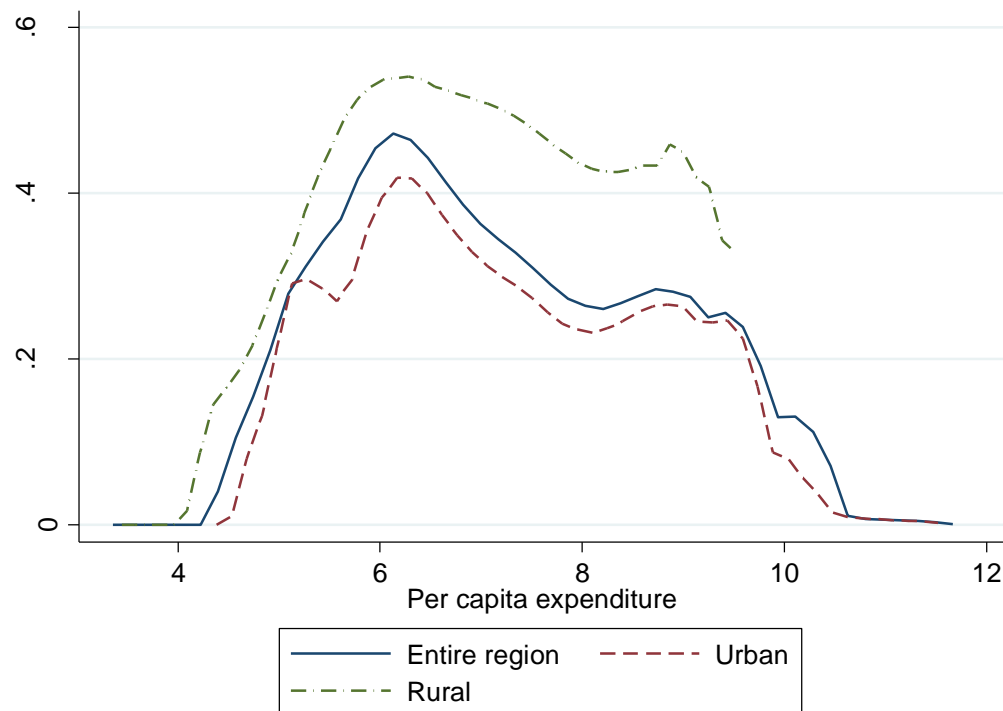
Source: Author's elaboration.

Figure A3: Welfare effect on households of a 10 per cent reduction in transportation costs, by gender



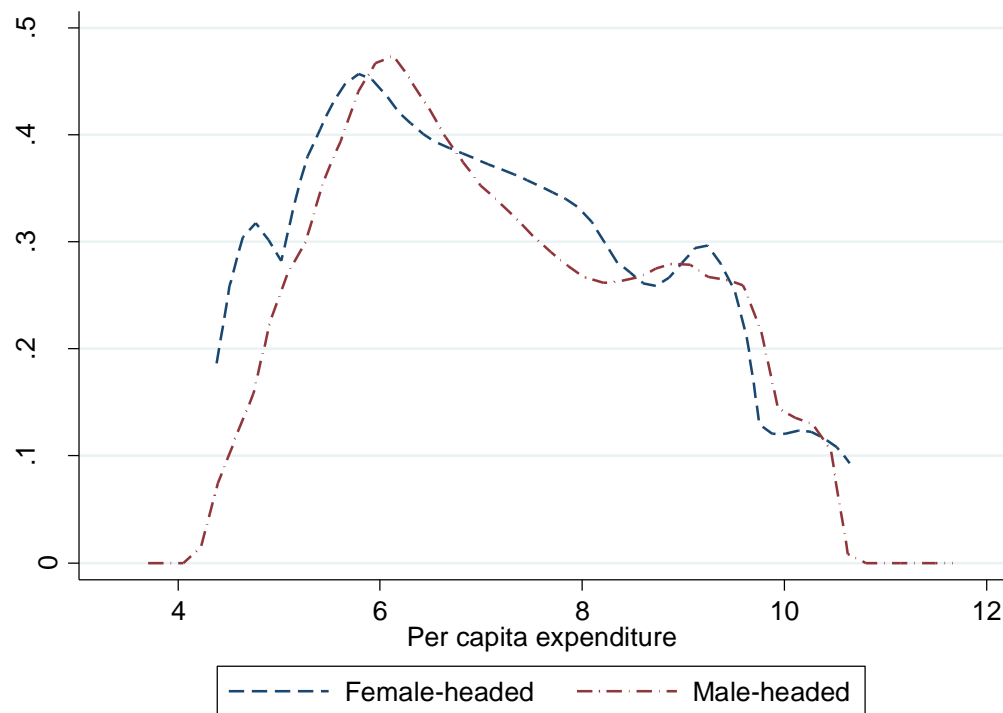
Source: Author's elaboration.

Figure A4: Welfare effect on households of a 30 per cent reduction in transportation costs, by area



Source: Author's elaboration.

Figure A5: Welfare effect on households of a 30 per cent reduction in transportation costs, by gender



Source: Author's elaboration.

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