Factors Determining Demand, Supply and Price Changes in the Bujumbura Charcoal Market Modeling of Possible Changes in the Long-Term Horizon

Jean Baptiste Aboyitungiye

Economics Program and Development Studies, Universitas Sebelas Maret, Indonesia

Abstract:- **The article presents the challenges faced by the trading and consumption of charcoal in Bujumbura city. The biggest challenge results from an increase in its price, which was triggered mainly by government politics, including the environmental condition standards and decrease in the efficiency of generating its production. The establishment of an autonomous and non-governmental structure or a Charcoal Marketing Company in charge of all activities of the energy sector based on the woodhave been proposed. This allows for determining the marginal price of a given product for a given generating unit in the system and the optimal production of charcoal to meet its demand. Disturbances in the charcoal market (oversupply or shortage situations) are reflected in the energy sector, for which the price and the main cost factors of charcoal should be on the head of this company. It is assumed that all charcoal activities must be preceded by the regulation works. In other words, investment expenditures in the charcoal sector have a high meaning and benefit to consumers. It has been shown that the distribution of charcoal capacities is not enough because of its transportation which meets different problems. Based on the presented arguments it can be concluded that a system of regulation that takes care of all the activities related to the production, transport, marketing of charcoal is the only one that will fight against this upheaval of prices at any time.**

Key Words: **Charcoal, charcoal market, commerce, energy, coal price**

I. INTRODUCTION

People need access to energy in order to escape from poverty. Although the Millennium Development Goals did not include specific targets on energy, the debates that are currently leading to the designof a post-2015 development agenda all include discussions of specific targets on energy access (Dobie & Sharma 2005).Many studies have been conducted on the use of wood energy in developing countries (Ferari, 1990; ESMAP, 1991; Bationo, 1993; Ouédraogo, 2006; Couture et al. 2008; Gazull, 2009; Meyers et al. 2009; Trefon et al., 2010). Most of these studies have focused on thesubstitutability between energy sources including wood, gas, electricity and fuel oil but Burundi is knowing a high cost of charcoal since 2004 and no one has brought the solution to the causes.A crisis in charcoal supply and in environmental degradation requires concerted action to manage charcoal production better, through improved forest management and agroforestry, improved production technology and improved cooking technology(Dobie and Sharma 2005).

Currently, energy from biological sources makes up only 10% of global use, although it has been estimated that bioenergy has the potential to provide 50% of global energy by 2050. Trees currently provide only the most basic energy services for poor people, namely cooking, warmth and some rudimentary lighting.More than 90% of the population of cities and secondary urban centers use charcoal as the main source of domestic energy, especially for cooking food (MEM, 2011a).The gradual disappearance of the plant heritage leads today, in addition to environmental and ecological problems, a wood crisis. Because of their impact on the Burundian forest, the use of wood and its derivatives as a source of domestic energy has been one of the fundamental concerns of the public authorities since 2018.The minister of the environment has dedicated the third day of the week to the environment. This crisis is so poorly known that some researchers refuse this name. In order to help better knowledge, this study focused on the analysis of factors that increase the price of charcoal.

The main objectives of this work are the identification, the analysis of the most relevantfactorsdetermining demand, supply and price changes of charcoal. The analysis identifies as relevant explanatory variables of the change in the price of coal, the total consumption expenditure of households, the normal price of coal, the consumption of household gas, the price of wood and the size of the household.

The measures recommended reflected the analyzing made, and they recommend actions whose main objective is total control of the quantity of coal placed on the markets. In the current context of state disengagement and in order to dispel the mistrust of the charcoal producers, the first action to be taken is the establishment of an autonomous and non-governmental structure or a Coal Marketing Company in charge of all activities of the energy sector based on wood.

This will consolidate all attempts to find solutions to the domestic energy crisis. In order to facilitate the start of these actions, the public authorities may consider a project to support the extension of gas. The marketing company of this product will establish a company in the city of Bujumbura that will facilitate the import work of the wood of the countryside to the city.

To remedy the problem of the lack of charcoal products, several recommendations were made following this study, namely:

- at the source: the rehabilitation of cut woods, the establishment of better techniques for settling afforestation with more suitable species on productive plots,
- On its market: greater penetration of energy substitutable for wood energy such as gas, electricity or combustible briquettes, establish a commercial company only based on charcoal and its value chains.
- To its consumption: growth in the use of improved stoves in households and greater efficiency in the charring of wood.

II. METHODOLOGY

The surveys, with the specific objective of analyzing, the charcoal market and its consumption, were conducted among wholesale merchants and households-users in different areas of the city of Bujumbura. The main data has been collected through the documentation on update newsletters and blogs on Burundi economic situation.

1. Burundi energy situation

Burundi`s energy consumption relies to a great extent on biomass. Households are the main consumers of energy in the country, accounting for 94% of total consumption. Their needs are almost exclusively met by traditional biomass (99%). Electricity (0.3%), and oil products (0.4%) play an insignificant role.If industry and transport are included, 94% of all energy consumption relies on biomass, which is composed of around 70% of fuelwood, 18% of agricultural residues, 6% of 6% of charcoal, and1% of bagasse. A key feature of the power sector in Burundi is the very low level of electrification. Less than 5% of the population has access to the national grid (average in Sub-Sahara Africa 26%), and even they are facing power cuts on a daily basis during the dry season. Besides the low generating capacity, the key problem of the whole energy sector of Burundi is the scarcity of technical and management skills which affects the prospects for developing the country's energy resources, and it also reduces the scope for effective policy-making and the planning and operations of energy producing, marketing, and consuming institutions.

The Burundian energy sector needs a radical change in its dimensions, its structures, and its traditions to contribute effectively to the growth of the national economy, to improve the living conditions of the population in a sustainable and respectful way environment and become an asset to the country rather than discourage investment.

In Burundi, natural resources, in general, are in decline because of the high pressure and demographic density that drives the search for new agricultural land and generates a considerable gap between annual supply and demand of wood energy (wood and charcoal).

More than 90% of households use wood as a source of energy mainly for cooking. Population and livestock movements, as a result of the conflicts that the country has experienced since 1993, have caused considerable environmental pressure for deforestation and encroachment on protected parks complicated by the lack of legislation concerning its use in rural areas. The main actors involved are numerous and varied. These are the owners of the woodlots (State, commune, private), the coal merchants, the transporters, the wholesalers, the retailer resellers for the wood-energy sector. We must also add small and large consumers (bakeries, restaurants ...) for firewood. All these actors work without any coordination and have no framework for consultation.

2. Burundi Production of charcoal

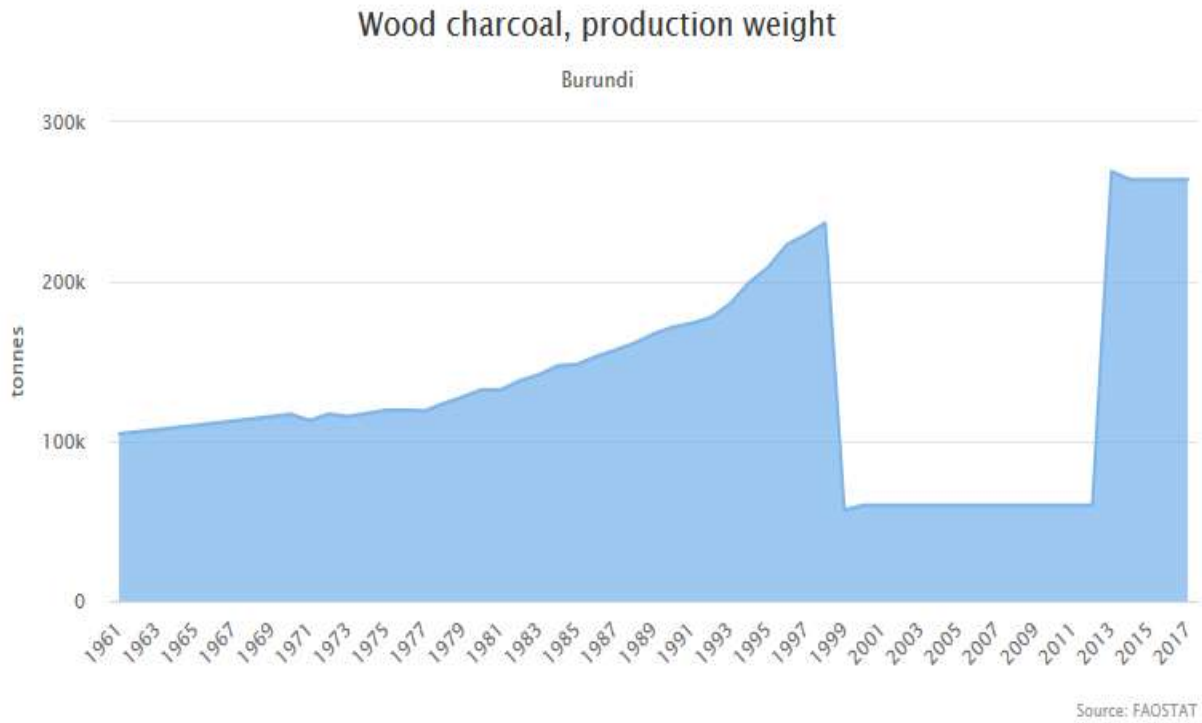
Although a major emitter of CO_2, coal is the second most consumed energy in the world and the world's leading producer of electricity. Its reserves are well distributed on the planet and its production meets local needs. The coal is the main source of energy; it is a driving force for their economies, much of which is used in urban environments.

The producers of charcoal are the coalmen. The latter obtain wood from private farmers and public administrations which own wood plantations (State, Communes).

The charcoal consumed by households in the city of Bujumbura comes from different parts of the country. OBPE data on the source of charcoal indicates that in 2014 (OBPE, 2014), the large quantity that is consumed in the city of Bujumbura came from private woodlots (89.3%), agroforestry (9.8%) and protected areas (0.9%).

According to the Burundian Forest Code, natural forests are protected. They must not be used for charcoal. Current laws must be enforced to prevent the exploitation of protected forest resources (The Republic of Burundi, 1985).

As surprising as it may be, policymakers pay little attention to how coal is produced and sold, particularly if the wood used is sustainably harvested. Without coherent policies, almost all production, transportation and distribution of charcoal remains informal and unregulated. This leads to inefficient and risky production methods.



2.1. The common problems that characterize the charcoal production chain

Despite the scarcity of wood, the price of coal remains generally underestimated by more than 20% to 50%, as only the cost of labor, capital required for production and transportation are taken into account. The raw wood production price does not often reflect the price of regeneration when the timber is harvested from unsustainably managed areas (e.g.: open access areas). In addition, (forest royalties) are collected inefficiently. This underpricing of the fair price results in excessive production and consumption. This undervaluation creates unfair competition and has a strong deterrent effect on good forest management and tree growth.

Characteristic of charcoal inefficient;

- Unregulated/illegal resources
- Endemic and systemic corruption
- Ineffective transformation technologies
- The impression that it is a poor business
- A profession considered "dirty" and economically unattractive
- Free access to wood resources leading to deforestation and degradation
- A trade dominated by a few powerful individuals

2.2. Transport and Trading

The charcoal trade in many cities in Burundi is largely informal and is characterized by a high turnover rate. There is no real storage. All stocks produced are quickly consumed. The coal trade is visible through the cities and surrounding areas. The roads in the city center, as well as in the periphery and near the production areas, are lined with bags of coal for sale.The charcoal trade is a key segment in the supply/demand chain, and dealers are the main players in this area. Carriers often serve as middlemen or wholesalers. The transport of charcoal is by trucks from the packing sites to the city.

Modes of transport depend on the distance to be covered, the local availability of different means of transport and the financial means of traders (Terpend, 1997, Schure et al., 2011). The means of transport used for the transportation of charcoal in the city of Bujumbura are men's heads, bicycles, Fuso trucks, other trucks, transport vans, public transport buses, and trailers.).

Stakeholders in the transportation of charcoal are numerous. Indeed, there are vehicle owners and drivers and their conveyors who are not usually the same people.

Trucks and vans are the most popular motorized transportation because of their carrying capacity. Coal is not a heavy commodity, but it is bulky. Bicycles are the most non - motorized form most commonly used for transportation. Some carry up to five bags of coal. In addition, the use of carts is also a remarkable form of transportation. In areas inaccessible by the means of transport mentioned above or over short distances, it is the men who carry the bags. Transport costs are an essential element not only in the definition of fuel prices in urban areas but also in identifying the area from which this fuel can be supplied at competitive prices.

3. The use of charcoal in Bujumbura town

Charcoal is either consumed by householders in combination with other fuels or on its own (PERACOD 2010). Charcoal is the main source of cooking energy used by households in the city of Bujumbura. Of the 240 households surveyed83% use only charcoal, 5% combine charcoal and firewood while 12% combine charcoal and electricity (Sabuhungu 2017).

In Bujumbura town,the number of cooking sessions varies from one to three times a day according to the household. 5.4% of households cook once a day (evening). Those cooking twice daily are the most numerous, representing 85.4% (midday and evening) while the remaining 9.2% are those who cook three times a day (morning, midday and evening). Three types of equipment are used for cooking with wood energy: the improved charcoal grill (stove) (saving on charcoal and cooking time), the non-improved charcoal grill (stove) and the traditional three-stone fireplace. In the sample as a whole; 30% of households use the improved charcoal grill; 65% use the non-improved charcoal grill and 5% use the traditional three-stone fireplace. It is noted that the penetration rate of households using improved charcoal grills is low in the city of Bujumbura.

The factors that influence consumption can be classified into three categories: economic factors (income, prices, credit, and advertising), social factors (composition and size of family, age and sex, etc.) and sociological factors (social group, lifestyle, etc.). Regarding charcoal consumption, the main factors which influence expenditure are household income, the price per kilogram of charcoal, the size of household, number of cooking sessions per day in the household, the weekly frequency of food preparation that requires longer cooking times.

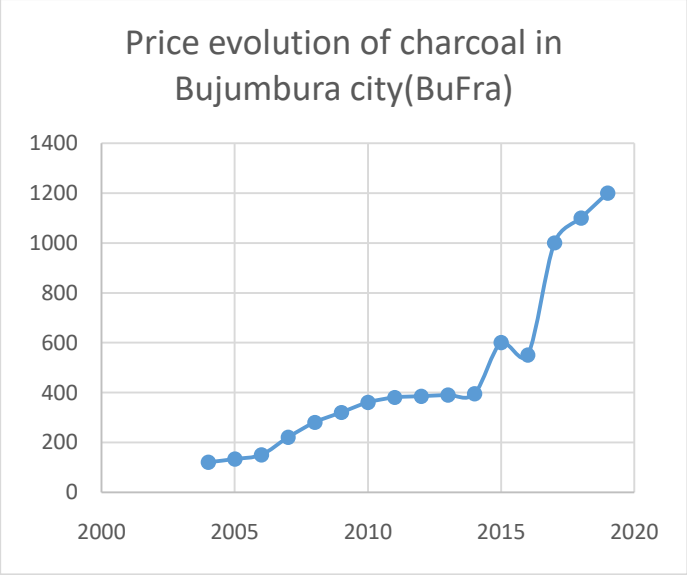
4. Evolution of the price of charcoal sold in Bujumbura

1. Results of analysis

Bujumbura, the capital of Burundi is the city that consumes more than 90% of the coal produced in the country. Gas and electricity are luxury energies reserved for a minority of wealthy people.

In response to the growing demand for this resource, coupled with a gradual decline in timber in the country, the price of a 40 kg bag of charcoal is steadily rising. For example, a bag of charcoal that costs Bujumbura 25000 FBU today, worth 15 000FBU in 2012. This enters the economic situation of the country where all the products have experienced a price surge. Even the prices of beans and rice, staple goods in Burundian society, have been multiplied by 15 in the market while the purchasing power of the population has been reduced by more than 300%.

The following figure shows the average current prices of one kilogram of charcoal for the period 2004 to 2019 in the city of Bujumbura among retailers.



Source: Survey done by author 2019

The high cost of transporting forest products as a result of soaring fuel prices (one liter of diesel fuel worth BuF 1500 in 2010 and BUF 2500 in 2019,Sibomana trader of charcoal in Bujumbura);the inaccessibility of certain places for reasons of insecurity; road infrastructures that do not facilitate transportation.Among other factors that influence the increase in the price of charcoal, it should be mentioned these important:

- Economic factors: These factors include poverty and hunger in families that lack alternative livelihoods. Producers produce charcoal to raise money for basic needs. Prices are low during the period of food insecurity because producers are forced to accept prices offered by buyers,
- Supply and demand: big cities offer better prices compared to small centers. This is due to the high concentration of demand in these big cities. Bulk buyers pay less than households who buy retail,
- Climatic factors: prices are generally higher during the rainy season compared to the dry season. During the rainy season, roads become impassable, making charcoal deliveries difficult and as a result supply becomes low. Also during the rainy season, carbonization lasts a long time and the producers return to land preparation for agriculture, which further reduces the supply thus increasing the prices,
- Political and institutional factors: the decision to increase fuels, strikes by carriers, harassment along the roads lead to higher prices for charcoal, the strict application of the traffic code for coal carriers. According to the carriers, they face two obstacles: the corruption of the tax policy and the tax rate that is not stable for this product. Note that the government has limited the number of charcoal bag to be carried by car.The truck is limited to transporting 150 bags

while it used to carry 210 bags thus suppliers deliver the product at a high cost.

III. CONCLUSION

The analysis shows that problems occur at all stages of the charcoal value chain (production, wood conditioning, transportation, and marketing). Accurate understanding at all stages is necessary to develop sound policy frameworks. This gives the opportunity to the different actors to enrich their knowledge, their innovations, and their capital to acquire the technology at each stage of the value chain. Good policy can serve as control and mitigation, creating more balance within and across sectors.

There must be an emphasis on sustainability. In environmental terms, this will mainly relate to the maintenance of the productive capacity of farms, especially taking into consideration the high levels of extraction of tree products, crop residues, and crops from the system. Agroforestry systems will be a basis for maintaining land health. Financial feasibility and stability will be a key factor. Capacity building and institutional development will help to support the social stability of these complex systems. Considerable policy support will be needed to develop integrated food-energy systems. Tree planting for fuelwood and the sustainable production of charcoal will require legislative and institutional reform, and financial incentives. There will need to be considerable attention paid to the development of markets and value chains from charcoal production to the most sophisticated systems of electricity and biofuel production.

The government will be able to encourage the production of charcoal while recognizing the tasks of each sector. This will be:

- The side of consumers: addressed the problem by using and an improved charcoal stove(bikigiti, Imbabura ntoya).
- Gas side: to help, with the help of a subsidy financed by the project and the taxes of the coal operators, a reduction of the price of the gas and the cooker to make them accessible to the greatest number of households.
- Production side:
    i. To encourage and facilitate the installation of old charcoal growers as agro foresters. It will have to train them in different agroforestry techniques to ensure the incompressible consumption of coal.
    ii. To help the gas industry to reduce gas production costs and thus be accessible at least to all city household.
- Marketing side: to help alleviate road hackers for traders and to find solutions to the constraints of this sector, to create on a periodic basis, shortages of coal. Indeed, that can cause supply deficits by a system of retention of a part of the quantity of coal put on sale on the markets. Put on page big trucks special only for charcoal transport so that they can carry enough quantities for the whole city. A private company could invest in this commerce by creating an enterprise in Bujumbura city which can profit on the whole operation of commercialization and charcoal packing as doing on peat biomasses.

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