Microanalysis of Consumer Behavior Using Rice and Beans at Panzi

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ABSTRACT— It was recorded in Bukavu since the end of 2008 higher prices of almost all goods; those of basic necessity, object of our study, included, yet real and nominal incomes of households consumers are very low. These households despite these constraints are condemned to consume these essential goods, and more specifically, to frame our work, beans and rice. This led us to conduct a study aimed at finding out about the behavior of households in Bukavu, the latter having assumed constant income to fluctuations in prices of beans and rice and also to know the impact of the change in bean prices on consumption and welfare of consumers. Being practically difficult to analyze the behavior of several households and starting from the premise that the utility function is individual, we analyzed the behavior of the average consumer. The surveys covered 362 households at Panzi. As consumer preferences are individual, we objectively transformed data to multiple consumers in individual data. Thus instead of that our analyzes cover all households surveyed, they focused on a representative household, namely the household or the average consumer; the latter being the household consuming the quantities of rice and beans corresponding to the average quantities and having an income equal to the average income. The methodological approach was, by classical microeconomic approach, to estimate the budget line of the average household and estimate its Cobb-Douglas utility function. These two elements have allowed us to determine the quantities maximizing the utility of the average household with graphics to support, to determine the individual demands functions of rice and beans with their respective graphs, plot the indifference map of this consumer, to calculate the income compensatory variation, income equivalent variation and the consumer surplus. Analyses showed that a household of Panzi, composed of an average of 7 people, consumes on average 24 kg of rice and 32 kg of beans per month. Our main results showed on one hand that a household in Panzi would be willing to exchange a kilogram of rice against 1.04 kilogram of bean and on the other hand an increase in the price of $ 1 would decrease the welfare about $ 17, money that the Congolese state, if it were a providential state, would allocate to the average household or each household at Panzi to compensate them for the change in price. Finally, we have seen that in case of a decrease in price, namely of $ 0.99 to $ 0.5; the welfare of the consumer or better consumer surplus increase of $ 16.4.

Keywords— Average consumer, rice, bean, price change, compensatory variation, equivalent variation, wellbeing

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1 INTRODUCTION

The primary role of households in an economy is consumption. It is the final objective of the economic activity, and it is to this fair title that Fourastié [6], wrote: "is called *economic* all human activities that have the object to make nature as well consumable by the man". Salles teaches that three factors affect the consumption and explain its evolution quantitatively and qualitatively: the revenue, the qualitative structure of needs and the price. - *income and its distribution ;* in this study, the income will be considered constant of the fact of economic growth standing in our country - the qualitative structure of the demand is the translation of the scales of the needs and habits of consumption which guide the individual choice; these choices are both the fruit of the calculations established by the individuals themselves, on the basis of expectations of the level of income and price, and the result of the pressures from the external environment On individuals, from their membership in social groups with structures of different consumption, according to their level of income [19]. For each income level momentarily reached by a unit of consumption, the household has a pattern of use which distributes income between the different types of goods of various positions… - The prices allow the satisfaction of the demand resulting from the qualitative structure.

In effect the use of the income, its adaptation to the qualitative structure of the demand may not take place, in practice, that by reference to the system of price. Households have the income to which they are paid by reason of their participation in the production and as a function of their status in society and their conditions of existence. These economic and social revenues form the income at the disposal of the households that serve, *ceteris paribus*, to the consumption [19].

Let us go back to Bukavu where it is observed, for years, a general increase in the level of prices of almost all goods; those of first necessity, the object of our study, included [21] and where, paradoxically, the real and the nominal income of households consumers are very low, and that worst is, evolve negatively. These households being despite these constraints sentenced to consume these goods of first necessity, and more specifically, to frame our work, beans and rice.

It is therefore relevant to conduct a study aimed to know the behavior of households in Bukavu, the latter having the income assumed to be constant, in the face of the price variations of the beans and rice and to know the impact of the change in the price of bean on the consumption of rice and vice versa.

Being practically difficult to analyze the behavior of several households and on the basis of the premise according to which the utility function is individual, we will analyze the behavior of the average consumer. By average consumer, the reader can sub-hear the consumer with an income equal to the average of the incomes of respondents, consuming quantities of rice and beans, equal to the average of the quantities consumed by the Panzi households,... It is the behavior of this consumer which will be analyzed in this paper.

The answer to the following questions will be the subject of the present study : - What is the rate a household of Panzi is ready to exchange a kilogram of rice against a kilogram of bean ? -What is the impact of the change in the price of goods considered on the well-being of the average household of Panzi? What income the state should it grant the average household to compensate for the variation in the price of rice or of bean?

By way of interim response to the above issues raised, we assume that: - the average consumer would be ready to exchange a kilogram of rice against a kilogram of Bean to retain his satisfaction - the variation in the price of rice and/or of bean would have a considerable impact on the well being of the average household;

This work has the following general objectives: - determine the preference of the households of Panzi between the two products studied, rice and beans - to determine the impact of the change in the price of rice and bean on their demand. From the general objectives derive the following specific objectives: - Determine the utility function of the household-type - Determine how to construct an indifference curve - Calculate the compensatory variation and the equivalent variation of income - Determine the indirect utility function of the average household and the demand functions that flow from - Show how to build a utility function, determine its equation and make its graphical representation.

The choice of the topic has been justified not by the ease of access to data (because it is the opposite that is true), less by the access to sources of documentation, but much more by the scientific curiosity and by our commitment to the microeconomics. This work has a triple interest: The state will find in the work indicators well defined that can help it in its economic policy. More specifically, he will know how long does it grant to households to compensate for the variation in the price of goods of first necessity - The governmental and non-governmental organizations (FAO, UNESCO, etc.), from the results of this work, will know better orient their policy of distribution of food, taking into account the preferences of consumers between different goods - Teachers of microeconomics and students will find in this work a methodological guide for the practical work of Microeconomics. This work puts at naked the estimation of a utility function and an indifference curve, the notions of individual demand property, the notions of compensatory and equivalent variation of the income.

In space, this work is done in Panzi quarter, located in the Ibanda commune, Bukavu city, South-Kivu province in the Democratic Republic of the Congo. In time, this study focuses on the year 2011, year of the survey.

2 METHODOLOGICAL APPROACH

2.1 Data Collection Techniques

A survey questionnaire has enabled us to reap all the useful data for this work. The questionnaire contained the information relating to the distribution of income by the surveyed households. It has in addition permitted us to estimate the monthly income of the surveyed households. It was a matter of asking how many households they spend monthly for the bean, for rice (and the respective quantities), for the clothing, housing, the schooling of children, transport, and other expenses.

Sampling

The size of the sample was originally calculated using the formula $n=N/(1+Nd^2)$ [5].

Where N=the size of the population , which, according to the census of the quarter done in 2008 is equal to 7,596 households, and d=the margin of error set at 5% in this study. Together these elements have given us a sample size of 380 households.

This initial size has been corrected using the formula

$$n_c = \frac{n_0 * N}{n_0 + N} = \frac{380*7596}{380+7596} \approx 362\, households$$

This sample was distributed by strata in the following manner:

Finally 362 households were investigated of which 84, 32, 39, 49, 63, 52 and 43 in the avenues of Major Vangu, Bizimana, Mbeki, Kazaroho, Mushununu, Mulengeza 1st and Mulengeza 2nd.

TABLE 1
DISTRIBUTION OF THE SAMPLE BY STRATUM

No.	The avenues	Number of households	%	Sample by avenue
1	Major vangu	1765	23	84
2	Bizimana	669	9	32
3	Mbeki	812	11	39
4	Kazaroho	1034	14	49
5	Mushununu	1315	17	63
6	Mulengeza 1	1094	14	52
7	Mulengeza 2	908	12	43
Total		7,596	100	362

Source: Archives of the neighborhood Panzi, First Census of 2008

2.2 Data Analysis

2.2.1 Measurement of welfare

In this section, we are interested in the concept of well-being and more particularly to the measurement of change in the well-being, taking as a point of departure the notion of utility. To this effect, we distinguish two approaches: The first focuses on the direct utility and considers the changes induced in the consumption and the nominal income of the population as a result of the changes to the environment or of the economic policy, as a measure of the variation in well-being. The second, that of the indirect utility, puts the emphasis on the changes in terms of the changes induced in the utility, comparing the level of utility of the population concerned, which corresponds to the prices of the quantities consumed of the products and to nominal income of the baseline situation, to that corresponding to the new situation. From this point of view, it is the variation of the utility that is regarded as a measure of the variation of the well-being [17]. In the framework of our work, it is this second approach which is retained as a measure of variation in wellbeing. As well, based on the concept of indirect utility, it is possible to construct measures of the variation in well-being expressed in monetary units. The most used of these measures are the equivalent variation (EV) and the Compensatory variation (CV), that we will use in this work.

It is possible to measure the variation in the well-being of consumers in two ways that is to say in terms of the equivalent variation and the Compensatory variation. However, which of these two measures retain in the case where the results of the simulation must be used for the purposes of economic policy?

This will depend on the [5]. In the case where there has been an increase in the relative price of a product in referring to the space to the two products, the price of the other product remaining unchanged, CV>0 will have a concrete meaning. It is the increase in income that will have to be granted by the State, in the form of transfer or in another form, to consumers affected by this policy, if it wishes the latter to retain their initial level of wellbeing. Thus, in this case CV will be preferred to EV [5].

In cases less circumscribed than above, C is often EV which has, in a general way, the preference as the standard against which to measure variations in the well-being and this, for two reasons. The first is the fact that EV is measured at the price of the reference situation unlike CV which it is measured to those of the new situation. However the decision maker of economic policy has knowledge of the prices of the reference situation since observable, whereas the new price generated by the simulation of the MEGC, remain hypothetical for him. The second reason is that, in the case of successive simulations giving each a new different situation, one obtains a set of new prices which also may be different. As well, this will be a problem in the comparison of the different CV which can be avoided if one uses EV, the price of the reference situation remaining constant through the successive simulations of the computable general equilibrium model [3], [17]. In the framework of our work and for the reasons outlined above, it is the equivalent variation which is retained as the standard against which to measure variations in the well-being of consumers.

2.2.2 Estimate of the Budget Line

The budget line of a consumer is classically given by the equation $p_1x_1 + p_2x_2 = \overline{m}$, where p_1= price of rice and p_2=price of bean, in the framework of this work; x_1 and x_2 the quantities of rice and beans, and m the income spent on the purchase of these two goods.

The table 1 shows that the prices respective means of a kg of rice and bean are **$ 0.99** and **$ 0.95**. It should be noted that the evolution of the price of goods studied have been given in Congolese francs but have been converted into US dollars, because the data relating to the expenditure of households have been provided in USD.

In addition, the average income m devoted to the purchase of these two goods in the 362 surveyed households is, seeing the 4th and 6th line of Table 1, $\$23.9 + \$30.6 = \$54.5$

We have thus easily the budget line of our households given by $0{,}99x_1 + 0{,}95x_2 = 54.5$ (1)

In explaining this equation by report to x_2, we have

$$x_2 = \frac{-0.99x_1 + 54.5}{0.95}$$

The angular coefficient or slope of this budget line is to **-1.04** and represents the marginal rate of substitution of the budget line or the marginal propensity to pay. At the balance of the consumer there must be equality between the MRS of the budget line and the MRS of the indifference curve [20].

2.2.3 Estimate of the Utility function

We wanted to make use of the Cobb-Douglas utility function because of its interesting mathematical properties. In fact, the indifference curves derived there from satisfy all the assumptions on the preferences, such are:

- Axiom 1. The relationship of preference is a complete relationship: the consumer is always able to compare two baskets of goods;
- Axiom 2. The relationship of preference is a reflexive relationship: all shopping cart is at least as desirable as itself;
- Axiom 3. The relationship of preference is a transitive relationship;
- Axiom 4. The relationship of preference is a continuing relationship;
- Axiom 5. The low monotonicity : a quantity greater than or equal to each property is at least as desirable;
- Axiom 6. The high monotonicity:
- Axiom 7. The convexity ;
- Axiom 8. The strict convexity: the convexity of preferences reflects taste pou the household of consumers (medium sized preferred to extremes). It implies that the whole of the baskets weakly favorites is a convex set. For convex baskets, the indifference curves may include segments of the line, while for baskets strictly convex, the indifference curves always have a curved pace [20].

As we have highlighted above, the utility function with which we are concerned is that of the form:

$$U(x_1, x_2) = x_1^{\alpha} x_2^{1-\alpha} \quad (2).$$

The parameters α and $1-\alpha$ are respectively the part of income m devoted to the good 1 and 2 [20].

$\alpha = p_1x_1/m$ and $1-\alpha = p_2x_2/m$

The reasoning, although a mathematical appearance complicated, is in fact simple.

The quantity of rice consumed monthly by households (represented by x_1) is in average of 24.17kg (see Table 1); The bean (represented by x_2) is in average of 32.15 .

In addition, income m is the sum of p_1x_1 and p_2x_2 and corresponds to $\$23.925 + \$30.5425 = \$54{,}5$

As well, the parameter α, the share of income spent on the purchase of the rice, is equal to $\frac{0.99 * 24.167}{54.5} = 0.44$.

The parameter β is equivalent to: $\frac{0.95 * 32.15}{54.5} = 0.56$

As well, the consumer-type devotes 56% of its income m to the consumption of beans and 44% to the consumption of rice. Its utility function is given by :

$$U(Rice = x_1, Beans = x_2) = x_1^{0.44} x_2^{0.56}$$

2.2.4 Maximizing the Utility Function

To find the demand functions for X_1 and for X_2 From the utility function $U(x_1, x_2) = x_1^{\alpha} x_2^{1-\alpha}$

$Or \ \ln U(x_1, x_2) = \alpha \ln x_1 + (1-\alpha)\ln x_2$, we must resolve the following problem:

$$Max_{x_1, x_2} .\alpha \ln x_1 + (1-\alpha)\ln x_2$$
$$S/C. p_1x_1 + p_2x_2 = m \quad (4)$$

The resolution of this problem gives us the optimum quantities

$$x_1 = \frac{\alpha}{\alpha+\beta} * \frac{m}{p_1}, \qquad x_2 = \frac{\beta}{\alpha+\beta} * \frac{m}{p_2} \quad (5)$$

In our analyzes, we will assume that the nominal income of households is constant and that it is equivalent to the average income devoted to the purchase of the rice and bean. Only the parameters prices and quantities consumed may vary.

3 THE MAIN RESULTS OF THE STUDY

3.2 Descriptive Analysis

TABLE 1
DESCRIPTIVE STATISTICS

	Min	Mean	Maxi	Standard deviation
Size of the household	2	**7.1**	13	2.89
Estimated Revenue in $	50	**250.5**	700	165,02
Rice in kg	0	**24.17**	50	13.57
Rice budget (in $)	0	**23,93**	49.5	13.44
Bean in kg	5	**32.15**	75	18.47
Bean budget (in $)	4.75	**30,54**	71,25	17.55
Expenditure on clothing	0	**37.83**	120	33,77

Housing expenses	0	**14.67**	100	28.13
Expenses of Schooling	0	**35,17**	100	29.86
Other expenses	19,15	**93,36**	287,75	66.84
Monthly Savings	0	**15**	150	33.88

Source: our surveys analyzes

The average consumer presents the following profile: his household contains 7 people, his monthly income is $250 per month, it consumes 24 kg of rice and 32 kg of beans per month, he spends $30.5 per month for the purchase of bean and $24 for the consumption of rice, its costs of clothing amounted to $37.8 per month and its expenditure on housing to approximately $15 per month. It savings in average $15 per month. It is the behavior of the consumer that will be analyzed throughout this work.

TABLE 2
ANALYSIS OF CORRELATION

	Size of household	*Income in$*	*Rice in kg*	*Rice budget*	*Bean in kg*	*Bean budget*
Size of the household	1,000					
Income In_ USD	0.093	1,000				
Rice Qty in kg	0.305	0,810*	1,000			
Rice budget	0.305	0,810*	1,000	1,000		
Bean Qty in kg	0.318	0.667*	0.745*	0.745*	1,000	
Bean budget	0.318	0.667*	0.745*	0.745*	1,000	1,000
Clothing	0.398	0.614*	0,851*	0,851*	0,592	0,592
Housing	-0,307	0.740*	0,518	0,518	0.219	0.219
Schooling	0,435	0,565	0.340	0.340	0.246	0.246
Other	-0,054	0.868*	0,574	0,574	0.519	0.519
Epargne	-0,252	0,767	0.450	0.450	0.420	0.420

Source: Our analyzes

The following variables are significantly related to income: the quantity consumed of the rice, the quantity consumed of bean, the expenses of clothing, other housing expenses and other expenses. As well, when the income increases, these expenses are increasing in their turn. Thus, rice and beans are "normal" goods, that means good which the demand increases when the income increases [13].

The correlation between the quantity consumed of bean and that of rice is 0.74; it simply means that when the consumption of beans increases, rice consumption increases by the same fact. We can therefore say, based on the statements of Silem [7] that the two goods are complementary.

Although the two goods are complementary, we assume in our analyzes that the increase in the price of a good implies a decrease in the demand of this good for the benefit of the good of which the price has not varied, because the nominal income devoted to the consumption of these two goods is assumed to be constant.

Graphically, the budget line (derived from equation 1) is :

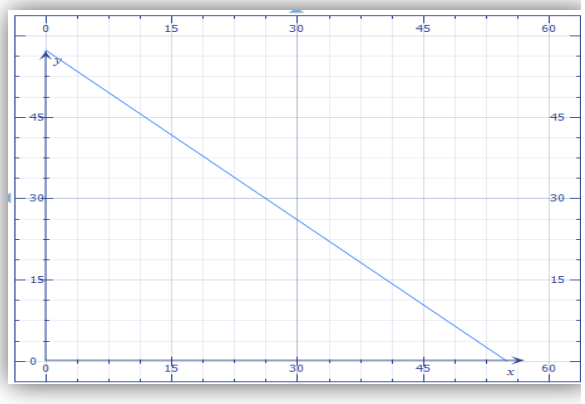

Fig. 1. Graphical representation of the budget line of the average consumer. The quantities are expressed here in kg and prices in $. The x-axis represents the quantity of rice and the Y axis that of bean.

The coordinates of this budget line are on the one hand $x_2 = 57.3342$ which is the intercept and $x_1 = 0$, and on the other hand $x_1 = 55.017$ and $x_2 = 0$; its slope is -1,042 : it represents the marginal rate of substitution of rice to the bean. Thus, the consumer is willing to substitute 1 kg of rice against 1,042 kg of beans to keep the same level of satisfaction.

3.3 Maximizing the utility of the average consumer

3.3.1 Maximizing the Utility and Construction of the Functions of Individual Demand of the Average Consumer

As we have set out above, this function of request is represented by the optimal quantities of rice and beans.

It is therefore appropriate to search these optimum quantities prior to analyze those functions. The demand functions of goods 1 and 2 are given by the equation N° (5) :

For this work, this problem is the following [13].

$$\begin{cases} Max\ 0.44\ln x_1 + 0.56\ln x_2 \\ x_1, x_2 \\ S/c : 0.99x_1 + 0.95x_2 = 54.4675 \\ x_1, x_2 \geq 0 \end{cases} \qquad (6)$$

After processing and multiplication, we get $\lambda = 0.018335$

$$x_1 = \frac{0.44}{1} * \frac{54.4675}{0.99} = 24.21kg \quad \text{and}$$

$$x_2 = \frac{0.56}{1} * \frac{54.4675}{0.95} = 32.11kg$$

The parameter λ represents the marginal utility of an additional unit of the income [10]. Thus, when the income of the household increase by $ 1, the utility of the average consumer increase by 0,018335.

As stressed Varian [20] at the level of the optimal choice (x_1^*, x_2^*), the marginal rate of substitution (MRS)

between two goods 1 and 2 must be equal to the ratio of the price, that is to say the MRS of the budget line must be equal to the MRS of the indifference curve; this law corresponds to the *second law of Gossen*.

The MRS of the budget line is $-\frac{p_1}{p_2} = \frac{0.99}{0.95} = -1.04210526$

That of the indifference curve is

$$MRS = \frac{\partial U(x_1, x_2)/\partial x_1}{\partial U(x_1, x_2)\partial x_2} = \frac{-\partial / x_1}{(1-\alpha)x_2} = -\frac{\alpha}{(1-\alpha)}\frac{x_2}{x_1} = \frac{0.44 * 32.107}{0.56 * 24.208} = -1{,}042$$

The quantities $x_1 = 24.21$ Kg and $x_2 = 32.11$ Kg are the quantities which maximize the utility of the households of Panzi while respecting the budget constraint; they are optimal.

We note that the quantities consumed monthly by our consumer-type, 24.1666667kg of rice (x_1) and 32.15 kg (x_2) of bean are very close to the optimum amounts.

The equilibrium of the average consumer is graphically as follow

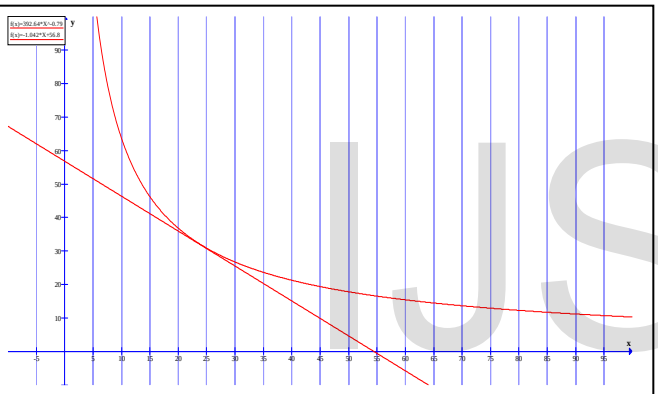

Fig.2. Graphical representation of the equilibrium of the consumer-type of rice and beans at Panzi. The equations of the budget line and of the indifference curve are respectively $f(x) = 1{,}042x + 56{,}8$ *and* $f(x) = 392{,}64x^{-0{,}79}$

The consumer maximizes its satisfaction for a level of utility of 28.3. To this level of utility corresponds the indifference curve drawn on the fig.2. The balance of our consumer is reached at the point of intersection between the indifference curve and the budget constraint.

2. 3.2 Analysis of the Individual Demand Functions

The functions of the demand of the rice and bean are given by: $x_1 = \frac{\alpha}{\alpha+\beta} * \frac{m}{p_1}$ and by $x_2 = \frac{\beta}{\alpha+\beta} * \frac{m}{p_2}$

The demand of the rice $x_1(^{-}p_1, ^{+}m)$ is an increasing function of income and decreasing function of the price of rice; that of bean $x_2(^{-}p_2, ^{+}m)$ is an increasing function of income and a decreasing function of the price of the bean.

By keeping constant the income *m* and by replacing α and β by their values, we get the functions of individual demand on the basis of the price :

$$x_1 = \frac{0.44}{0.44+0.56} * \frac{54.4675}{p_1}$$

$$x_2 = \frac{0.56}{0.44+0.56} * \frac{54.4675}{p_2}$$

Demand of bean : $Q_d(p_1) = \frac{23.9657}{p_1}$ *(7)*

Demand of the rice : $Q_d(p_2) = \frac{30.5018}{p_2}$ *(8)*

It can be demonstrated, for this type of demand function, that the price elasticity of demand is equal to the unit.

Graphically, we have the following situation :

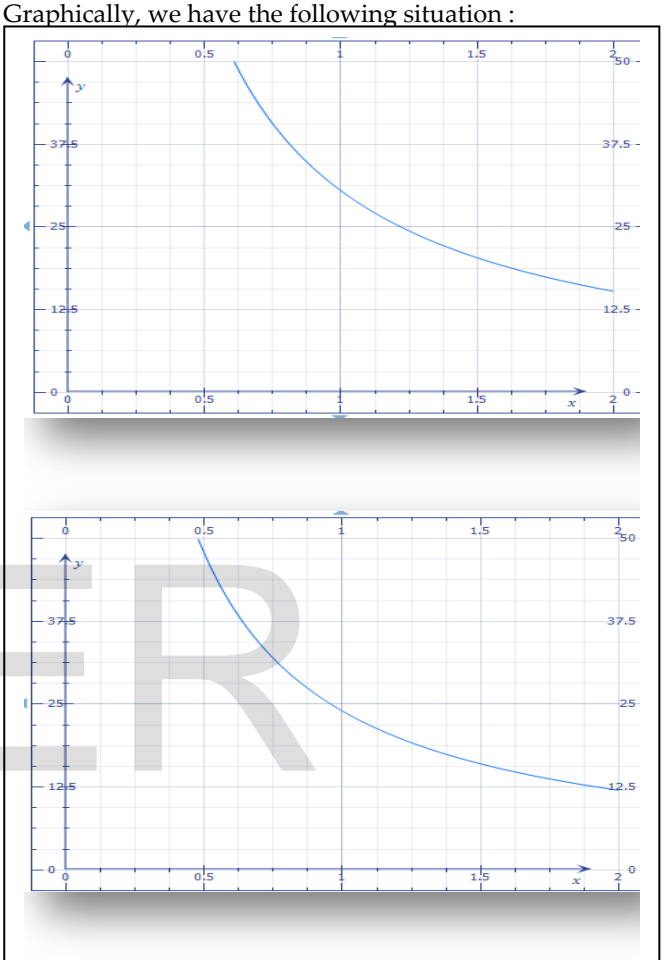

Fig.3. & Fig.4. Graphical representation of the individual demands functions of rice and bean. The Y axis represents the quantities requested, the x-axis represents the price.

Optimal Shopping Cart

The numeric value of the maximum utility of the average consumer is obtained by replacing the optimum quantities in the utility function. The optimum quantities are :

$x_1 = \frac{0.44}{1} * \frac{54.4675}{0.99} = 24.21kg$ and $x_1 = \frac{0.56}{1} * \frac{54.4675}{0.95} = 32.11kg$

By replacing X_1 and X_2 by their respective values in the utility function, we obtain :

$U(24.21,32.11) = (24.21)^{0.44}(32.11)^{0.56} = 4.064 * 6.977 = 28.35$

The equation of the indifference curve associated with these quantities is:

$$CI_1 \equiv x_1^{0.44}.x_2^{0.56} = 28.35 \quad (9)$$

To prove that these quantities are of utility greater than those in Table 1 , 24.17kg for the rice and 32.15 kg for the bean, we can calculate the utility for this shopping cart :

$U(24.17;32.15) = (24.17)^{0.44} * (32.15)^{0.56} = 28.3554$

We note that the optimum quantities provide higher level of utility than the average quantities.

These two quantities also respect the budget constraint, that is to say they are found on the line of the *fig.1*. To prove it, it is enough to replace them in the equation of the budget and see if it is checked:

The equation of the budget is $0{,}99x_1 + 0{,}95x_2 = 54.4675$

By replacing 24.1666667 (= x_1) and 32.15 (= x_2) in the expression $0{,}99x_1 + 0{,}95x_2$, we have

$0.99 * 24.16667 + 0.95 * 32.15 = 54.4675$.

By doing the same for 24.20777 and 32.10715789, we get

$0.99 * 24.20778 + 0.95 * 32.107 = 54.4675$

By explicating the equation $CI_1 \equiv x_1^{0.44} x_2^{0.56} = 28.555$ with respect to x_2 and by putting $x_2^{0.44}$ in the second member, we have: $x_2^{0.56} = 28.3555 x_1^{-0.44}$

In raising the two members to the exhibitor $1/0.56$, we have:

$x_2^{0.56/0.56} = (28.3555)^{1/1.56} x_1^{0.44/0.56}$

$x_2 = (28.3555)^{1.7857} x_1^{-0.79}$

$$\boxed{x_2 = 392.64 x_1^{-0.79}} \quad (10)$$

This is the equation of the indifference curve which contains the optimal shopping cart.

Other indifference curves can be obtained for any consumption basket (x_1, x_2) and thus obtain the ***indifference map***, for the average consumer.

For example, if a household of Panzi consumed 20 kg to \$0.95 of bean and 15 kg of rice to \$ 0.99 per month (assuming that its income is \$54.4675), its utility would be equal to $(15)^{0.44}(20)^{0.56} = 17.60$

Its indifference curve would be given by $x_1^{0.44} x_2^{0.56} = 17.62$

After transformation, we get:

CI $_2$:

$$\boxed{x_2 = 167.9 x_1^{-0.79}} \quad (11)$$

As said above, when the household consumes 24.17kg of rice and 32.15 kg of beans, it maximizes its satisfaction; and the level of utility on it is 28.3. No other quantities consumed will not be able to have a level of satisfaction higher than 28.3.

For example, if a household of Panzi consumed 20 kg to \$0.95 of bean and 15 kg of rice, its utility would be 17.6 <28.3.

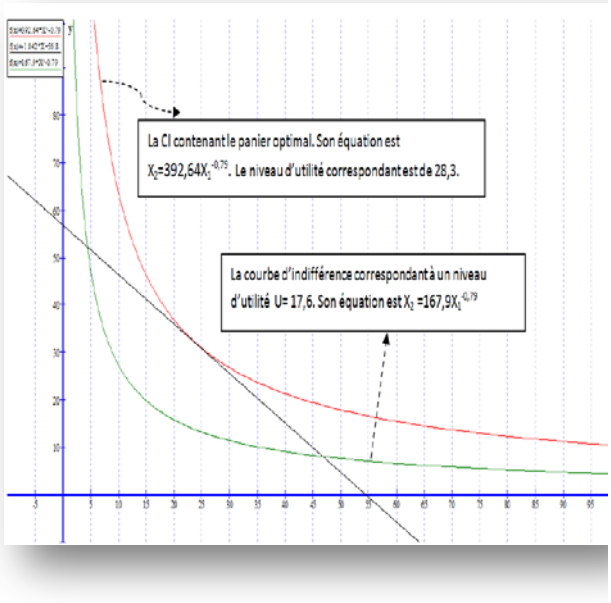

Fig.5. The indifference map and levels of utility of the average

The curve above trace with more precision, on the basis of their respective equations(10 & 11), the curves of indifference for each level of utility. The indifference curve in red color corresponds to a utility of 28.3 and that in green color corresponds to a utility of 17.6.

2.3.4 The Compensatory Variation, the Equivalent Variation of Income and the Consumer Surplus

In this paragraph, we seek to know the income needed by the average consumer to retain its utility when the price of one or the other good varies.

Having the utility function of the representative household $U(Rice = x_1, Bean = x_2) = x_1^{0.44} x_2^{0.56}$, and the price (\$0.99 ; \$ 0.95) to which it is initially faced, we can conveniently search for the compensatory and the equivalent variations when the price of a kg of rice goes from \$0.99 to \$2.

To initial prices, the request of the rice is: $Q_d(p_1) = \frac{23.9657}{p_1} = \frac{23.9657}{0.99} = 24.21kg$

and that of bean is:

$$Q_d(p_2) = \frac{30.5018}{p_2} = \frac{30.5018}{0.95} = 32.11kg$$

When the price of rice becomes 2\$, the request of the rice will be equal to :

$$Q_d(p_1) = \frac{23.9657}{p_1} = \frac{23.9657}{2} = 11.98kg \approx 12.kg$$

and that of bean 32.11 kg.

2.3.4.1 Compensatory Variation

To calculate the compensatory variation, we ask ourselves the following question : " *What income a household of Panzi need to price (\$2, \$0.95) to have the same level of satisfaction*

that he had in consuming 24.21kg of rice and 32.11 kg of beans (i.e. when their respective prices were at 0.99 and $ 0.95)".

To respond to this concern, we can substitute these values in the demand functions to determine the optimal shopping cart ($0.44 * m/p_1' = 0.44 * m/2 = 0.22m$; $0.56 * m/0.95 = 0.59m$) chosen by the consumer.

In equalizing the utility of the consumer before and after the increase in the price of rice, we have:

$$(0.22m)^{0.44}(0.59m)^{0.56} = (24.21)^{0.44}(32.11)^{0.56}$$

$$\Leftrightarrow 0.5136m^{0.44}\,0.744m^{0.56} = 28.3555$$

$$\Leftrightarrow 0.3822m^{0.44+0.56} = 28.3555$$

$$\Leftrightarrow m = \frac{28.3555}{0.3822} = \$74.19$$

Our consumer will need approximately (74.19 - 54.46) **19.7** additional USD if the price of rice reaches $2 to have the same level of satisfaction that before.

By way of interpretation, we will say that the variation of the income needed to bring our consumer-type on its indifference curve is $19.7. This amount also represents the variation in income which compensates exactly the price variation in the eyes of the consumer. It is in other words, the variation of the well-being of the consumer as a result of the variation in the price.

It is also the additional amount that the government should give the consumer to compensate exactly the variation in the price [20].

2.3.4.2 The equivalent Variation of Income

In order to calculate the equivalent variation, we ask ourselves the following question:

"What income a household of Panzi had it need to price (0.99$; 0.95$) to have the same level of satisfaction that in consuming the cart (12kg of rice; 32.11kg of bean)? "

$$(0.444m)^{0.44}(0.59m)^{0.56} = (12)^{0.44}(32.11)^{0.56}$$

$$\Leftrightarrow 0.7m^{0.44}\,0.744m^{0.56} = 2.98 * 6.98$$

$$\Leftrightarrow 0.521m^{0.44+0.56} = 20.79$$

$$\Leftrightarrow m = \frac{20.79}{0.521} = \$39.9 \approx \$40$$

If the income was $40 to initial prices, the household of Panzi would therefore have exactly the same level of satisfaction than that corresponding to the new prices and to an income of $54.47. The equivalent variation of income is approximately **$54. 5 - $40= $14.5**

It is the sum that it should withdraw to the consumer before the variation in price for that he retains its satisfaction that he would have after this [20]. It is to move toward the bottom the initial budget line for it becomes tangent to the indifference curve which passes by the new basket of consumption as we can view it on the following figure:

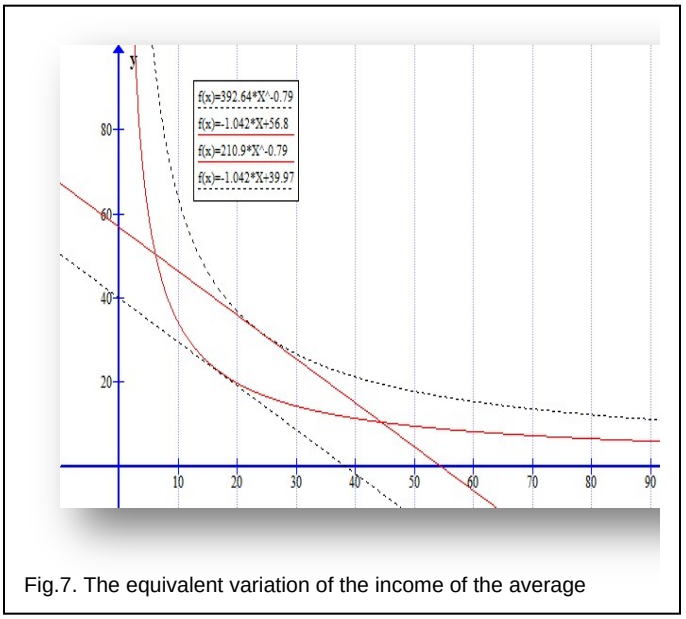

Fig.7. The equivalent variation of the income of the average

On the figure above, the equivalent variation corresponds to the surface between the two straight lines of the budget. This surface corresponds to an income of **$ 14.5.** The total surface area located under the first budget line being of $ 54,47 and the total surface area below the second budget line(the left) being of $54,47- $14.5= $ 39.97.

2.3.4.3 Impact of a Decrease in the Price of Rice on the Well-being of the Average Consumer : Consumer Surplus

The individual consumer surplus when the price is *p* is the absolute value of the difference between its *reserve price* and p. The net surplus of the aggregated consumer is the sum of the surpluses for individual consumers [13].

According to Varian [20] the consumer surplus is determined as follows :

$$\int_p^q f(p)dp = \int_p^q \frac{\alpha m}{p}dp = \alpha m[\ln p]_p^q = \alpha m(\ln q - \ln p)$$

Where q=reserve price and p=new price, f(p)=demand function of the rice. The consumer surplus is :

$$\Rightarrow \int_{0.95}^{0.99} \frac{0.44 * 54.4675}{p} = \int_{0.5}^{0,99} \frac{23.9657}{p}dp = 23.9657[\ln p]_{0,5}^{0.99}$$

$$\Rightarrow 23.9657(\ln 0,99 - \ln 0,5) = 23.9657(-0,010050335 + 0,69314718)$$

$$\Rightarrow 23.9657(0,6830968)$$

$$S.C. \approx 16,4\$$$

We can apply the same formula when the price of bean changes.

The sum that the consumer would require to renounce the consumption of rice is $ 16.4 [20]. It is also the excess of income which is a result of a decrease in the price.

Limitations of the Research and Further Research

The main limitation of the present study is the fact that it did not resort to econometrics. We should therefore, using the econometric approach, build two models: a demand

model for rice by price of rice, price of bean, income, quality, and a demand model for beans by the same variables, study that the future researchers can conduct.

The present study which had a pedagogical objective, that of serving as a guide for the practical work of microeconomics is limited to analyze the behavior of the average consumer, considered as representing a household type of Panzi. Another study may also complement us by integrating in the analyzes, the "Median Consumer " for example and developing other concepts not addressed by the present paper, including the effects of substitution and income, the curve of consumption-price, the curve of consumption-income.

CONCLUSION

The present work consisted in an analysis of the behavior of the average consumer of rice and bean in the neighborhood Panzi. It is proposed to issue the impact of the variation in the price rice and bean on the well-being of the average consumer and the marginal rate of substitution between two goods.

The assumptions of after which the household-type would be ready to exchange a unit of rice against a unit of bean and that the impact of the variation in the price would have a considerable effect on the well-being of the consumer served as the conductor wire.

The preferences of consumers being individual, we have objectively transformed the data relating to several consumers in individual data. It is, instead that our analyzes are based on the entire population of Panzi, they have focused on a representative household, namely the household or the average consumer; the latter being the household consuming the quantities of rice and bean corresponding to the average quantities and having an income equal to the average income.

In order to test these hypotheses, we proceeded by a methodological approach which was, first, to demonstrate how the variation in the price of goods has an impact on the well-being of consumers, then how to determine the budget line of the average consumer, and finally how to estimate a Cobb-Douglas preference function, a privileged functional form because of its interesting mathematical properties.

We have addressed the last point focused on the main results of the study. To do this, we began by presenting tables on the consumption of rice and bean in the 362 surveyed households. After analysis, it was revealed that a household of Panzi consumes on average 24 kg of rice and 32 kg of beans.

Our main results have shown, on the one hand, that a household of Panzi would be ready to exchange 1 kilogram of rice against 1.04 kilograms of beans and, on the other hand, that an increase in the price of $1 would reduce the well-being of about $17, the sum that the Congolese State, if it was a welfare state, would allocate to the average household or better to every household in Panzi to compensate for the variation in the price. Finally, we have seen that in the event of a decrease in the price, in this case from $0.99 to $ 0.5, the well-being of the consumer or better the consumer surplus would increase of $16.4.

This work is not a finished work but started. Several assumptions can be made in particular on the different variations of the price considered, which would lead to different results but which did not contradict the results found at present concerning the verification of assumptions.

Seen the results which are led our research, we suggest the following —To households : to have the habit to plan on a monthly basis their consumption to avoid the waste of their income —To the State : to strengthen the agricultural sector in order to substitute the exports by the imports for basic food products, including rice and beans, because the consumption of these goods is very low because of the lack of production and of the an insufficient income — To control the price of goods of first necessity to increase the purchasing power of households and thus the real GDP − to create socio-economic infrastructure (market, offices, businesses) to ensure that the inhabitants of Panzi benefit of externalities in order to increase their income which is up here too low;

In the scientific world : to deepen the concepts primers developed in this work.

To governmental and non-governmental organizations (FAO, WFP, etc.): to strengthen the gifts in food products at Panzi or better to popularize the culture of bean and especially of rice.

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