



Price of Basic Food Basket in Brazil and the World (2003-2017): Causes and Consequences

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Authors' contributions

This work was carried out in collaboration among all authors. Authors NJCM, GAM, JAM and LMG designed, performed a statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author PHSM managed the bibliographic research. Author TAA carried out the translation of the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Aims: Objective this work is to understand the price dynamics of foods basket products in Brazil and the world, based on multivariate analysis, for 14 years, with data from governmental and non-governmental organizations.

Methodology: Data used for world food prices were taken from official documents provided by governmental and non-governmental organizations. The data were submitted to statistical analysis by Microsoft Excel 2016® and Minitab 16®. The statistical model used in the work is multiple linear regression. When significant linear regression was found, the parameters were compared by means of simple linear regression analysis, a significance of 5% probability ($P < 0.05$) was considered.

Results: The results showed that the items that most cost the foods basket in the world are meat, fruits, and vegetables, and it was noticed that with each increase of 1 dollar in the price of these

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products, increased 2 dollars in the price food basket. And in Brazil it would not be different, these same products represented an increase in the price of the basic food basket in more than 300% (adding meat) and 110,67% (adding fruits and vegetables).

Conclusion: Concluding that the increase of the basic food basket in Brazil and in the World is directly correlated with meat, fruits, and vegetables. Being an added value caused by the high cost of investment in these sectors, which require very high investment.

Keywords: Meat; fruits; vegetables; price; basic food basket.

1. INTRODUCTION

Food is a vital need for living things and is made up of essential nutrients and vitamins for life. However, food affects a large portion of the individuals' monthly income, especially those whose salaries are referenced by the minimum wage [1]. Food basket stands out in the global socio-economic context because of their supply, so depending on supply, prices may rise or fall [2].

The price oscillation can be caused by several factors such as: climate, domestic and external product prices, changes in the exchange rate, seasonality of products, economic crisis, among others [3,4], leading to a change in the cost of the product influencing the purchasing power of the consumer. There is a consumer response to the price and quantity to be purchased, and the choice of the brand to buy, and the nature of these responses depends on the role of the price level, depends on the consumer's sensitivity to the price of the products [5]. In Brazil, the food consumption of low-income families is characterized by the high presence of cereals, oils and fats, sugars, fatty meats, and industrialized foods, with a high energy density, in parallel with the insufficient consumption of vegetables and fruits [6].

When compared to Brazilian families of higher social classes, lower-income families acquire less food considered healthy due to the price of food [7], so the basic food basket is composed of foods considered indispensable for human survival.

The basic food basket is considered as a set of foods considered indispensable for human survival, considering an adult's livelihood, and the amount for a family's livelihood [8]. Moreover, important instrument economic analysis providing relevant data on market practices regarding price policies, thus also serving as a preventive measure of inflation against the economic order [9].

This article proposes to analyze how high food prices can affect food security and, from the identification causes an increase in prices, propose policies that take advantage of opportunities to advance the fight against hunger and poverty. While high functional food prices are a real threat to the survival of very poor families, it is also an opportunity to stimulate the productive insertion of millions of small family farmers who live in poverty in rural areas of Brazil and world.

2. MATERIALS AND METHODS

Data used for world food prices were taken from official documents provided by FAO (Food and Agriculture Organization), and the data used for food prices in Brazil were extracted from the Inter-Union Department Statistics and Socioeconomic Studies (IUDSS), Brazilian Institute Geography and Statistics (IBGE), Brazilian Agricultural Company (BAC), Centre for Advanced Studies in Applied Economics (CASA), Brazilian Association Meat Exporters (BAME).

Parameters were defined to determine the indexes be used and facilitate data selection. The parameters analyzed were: Food price index (Y), Meat price index (X_1), Dairy price index (X_2), Cereal price index (X_3) and Fruit and vegetable price index (X_4). The data used are a space-a time of 14 years, from the period 2003 to 2017.

The statistical model used in the work is called multiple linear regression since it involves more than one regression coefficient. The adjective linear indicates that the model is linear with respect to the parameters $\beta = (\beta_0, \beta_1, \beta_2, \dots, \beta_k)$, not because y is a linear function of x's [10].

Multiple regression is one several causal explanatory statistical models concerning the treatment of time series of data. Its statistical base comes from linear regression, which is restricted to two variables and only one functional equation of the first degree ($Y = a + bX$) of adjustment. Its application is especially

important because it allows one to estimate the value of a variable based on a set another variable. The more significant the weight of an isolated variable, or a set of explanatory variables, but it can be said that some factors affect the behavior of one variable than others [11].

The data were submitted to statistical analysis variance through the Microsoft Excel 2016® and Minitab 16®. When significant linear regression was found, the parameters were compared by means of simple linear regression analysis and for the choice of the model, a significance of 5% ($P < 0.05$) was considered for the determination coefficients.

3. RESULTS AND DISCUSSION

Validation of the model in the multiple linear regression at 5% of significance for the two cases. For global data, the model presented a validation of 99,64% (Fig. 1). This means that 99,64% of the parameters directly interfere with the food price index, that is, what may be determining the rise in food prices may be all variables or only some of them.

From the multivariate analysis of the world data, it was possible to notice that the defined parameters, meat (X_1), dairy products (X_2) and fruits and vegetables (X_4) presented significance ($P < 0.05$), that is, these variables directly interfere in the increase of the price of food. However, cereals (X_3) was the only parameter that did not present significance ($P > 0.05$), that is, it is insignificant for the increase in the price of the basic food basket.

Exemplifying the general formula defined by the equation, where Y = food price index in the world in dollars (US\$) and X = unit price for each dollar variable (US\$). Thus, the food price index begins with the price of US\$ -11,2 and increases as the price of the parameters increases. If the price of meat, dairy products, cereals, fruits and vegetables is 15\$, 5\$, 10\$ and 8\$ (for example), respectively, the feed index would be $-11.2 + 0,628 \times 15 + 0,0967 \times 5 + 0,174 \times 10 + 0,233 \times 8 = 2,308$ dollars, that is, with each increase of one dollar in the price of food, increases approximately 2,308 dollars in the price of the basic food basket.

In recent years the increase in the price of food, and especially of basic food basket, can be linked to many factors, among them: several factors currently influence the increase in food prices, on the demand side, human consumption, the use of cereals for animal feed production [12]. The first thing to do is recognize that food supply has increased, but demand has grown even more. That is, in recent years we have consumed more than we produce [13].

The Universal Declaration of Human rights recognizes that food security is a citizen's right and a duty of the State. Food insecurity is not the lack of food but refers to the limitation or even uncertainty about adequate nutritional availability for people [14]. Around 792 million people are estimated to be food insecure in the world, representing 10.8% of the world's population [15]. This is the smallest estimate of the series presented by FAO [15], which already registered 18,7% of the world's population or 1 billion people in food insecurity in the 1990s [16].

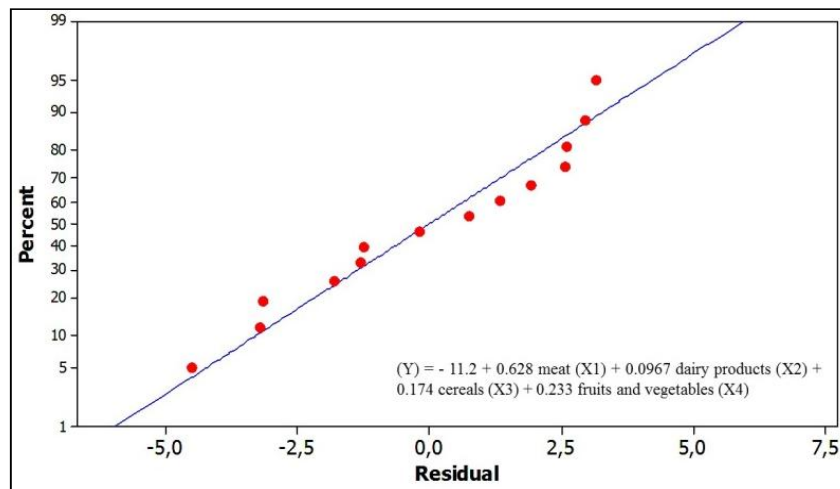


Fig. 1. Multiple linear regression graph for world food prices in dollars (US\$)

Parameters that had the greatest interference on the price of the basic food basket were meat, fruits, and vegetables, with the interference of 62,84% and 23,26%, respectively. Therefore, it is assumed that these foods are the most expensive in the world.

The increase in income and urbanization are manifested by accelerated changes in diet in recent years, with increased consumption of different meats, fruits, and vegetables [17]. Another important change was the increase in the consumption of proteins and fats, mainly of animal origin. The increase in demand for grains for animal feed is one of the factors that put pressure on agricultural commodity prices [16].

Some authors state that the population's concern is based only on the variation of food prices, and not in its quality for food nutrition, in its production and manufacturing modes [18,19].

Studies carried out in developed countries indicate that diets rich in vegetables are more expensive than the others [20] and leads to diets with low plant density and high energy density (mainly due to the high content of processed cereals, oil, and sugar) [21,22]. Evidence associates the insufficient consumption of fruits and vegetables with high risk for the occurrence of diseases, such as certain cancers and cardiovascular diseases [23].

Another study showed that the price of meat and vegetables are the products that most increase

the price of the basic food basket in the world and reaches around 80% [24]. Studying evaluating 837 adults in France, this study show that diets high in fat, sugar, and grains were associated with lower costs (0,05 euros/day). On the other hand, an additional 100 grams of fruits and vegetables were associated with an increase of 0,18 to 0,29 euros per day in costs [25].

There is a need to educate consumers about the importance of increasing their consumption of fruits and vegetables [26]. Families spend significantly less on food during a one-year period from a successful weight-loss diet. Public policies should consider strategies to reduce costs to comply with dietary guidelines [27].

After detailing food price indexes in the world, it is also important to know the real situation of food prices in the food basket in Brazil, so, after performing multiple linear regression of the data found in Brazil, the model presented a validation of the data of 90,3% (Fig. 2).

From the multivariate analysis of the data in Brazil, it was possible to perceive that the defined parameters, meat (X1) and fruits and vegetables (X4) presented significance ($P < 0.05$), that is, these variables directly interfere in the increase of food prices. However, cereals (X3) and dairy products (X2) did not present significant data ($P > 0.05$), stating that cereals and dairy products do not interfere in the food price index in Brazil.

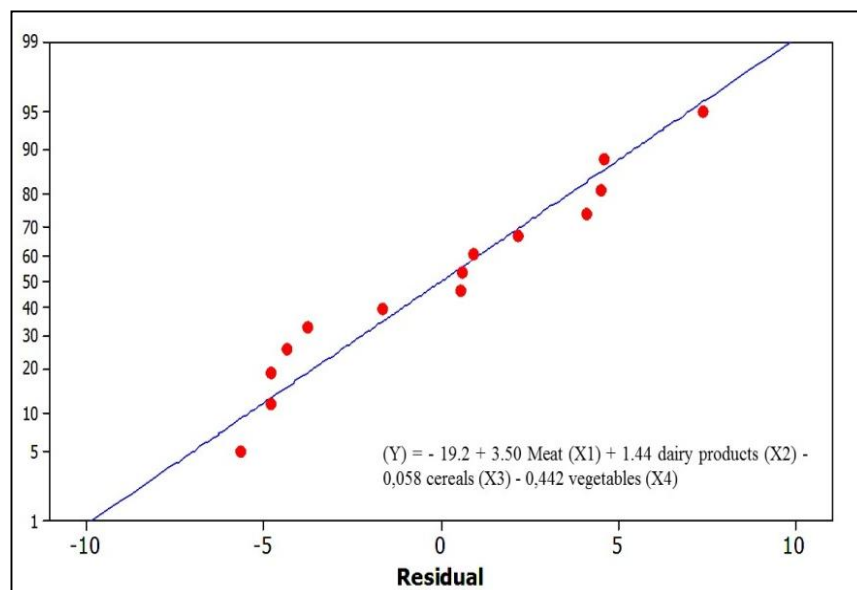


Fig. 2. Multiple linear regression graph for food prices in Brazil in reals (R\$)

Exemplifying the general formula of the variables, if you have food prices, which is defined by the equation $(Y) = -19,2 + 3,50 X_1 + 1,44 X_2 - 0,058 X_3 - 0,442 X_4$, where Y = index price of food in Brazil (R\$); X = unit price for each variable (R\$). Thus, the food price index begins with the price of R\$ -89,2 and increases as the price of the parameters increases.

If the price of meat, dairy products, cereals, and vegetables are respectively R\$15, R\$5, R\$10 and R\$8 (for example), the food index would be $Y = -19,2 + 3,5 \times 15 + 1,44 \times 5 - 0,058 \times 10 - 0,442 \times 8 = 36,384$ reais, that is, with each increase of a real in the price of food in Brazil, increases approximately 36,384 reais in the price of the basic food basket. That is, with each dollar increase in the price of food, the price of the basic food basket in Brazil rises to 145,90 dollars, quoted on October 1, 2018 (one dollar was equal to 4,01 reais).

In Brazil, there are several types of social classes, however, regardless of social class and cultural origins, the basic food basket remains the food base of the Brazilian population [28]. The basic food basket in Brazil is a combination of thirteen items: meat, milk, beans, rice, flour, potatoes, vegetables (tomatoes), French bread, coffee powder, fruits (banana), sugar, oil and butter [29].

The Brazilian population until the middle of the 20th century exercised rural and manual activities, demanding a diet rich in energy value

[30,31]. And already in the 21st century, based on the 2010 Census, it was recognized that 84% of Brazilians are already urban [32]. From the 2000s, there was a great industrial advance that replaced the human workforce by technological development, which reduced activities with high caloric expenditure and initiated changes in the nutritional profile of people [33].

The implementation of the basic food basket emerged with the discussion about nutritional problems in the country as food insecurity of the population [34]. Now, the problems of malnutrition are still important in the country, however, the Brazilian population no longer only fits this profile. With the technological advances and means of information (internet accessible for all), Brazilian society has gone from malnutrition to overweight and obesity, which now reaches 53,7% of the Brazilian population [35,36].

The Brazilian population is not limited only to the items in the basic food basket, it usually complements the feeding with other products. These products are often traded for industrialized foods, which are cheaper, but have a high caloric value and are poor in nutrients [36]. In the literature, there is much evidence that these industrialized products are the main causes of the increase of chronic noncommunicable diseases [37]. Other studies also indicate that the lower the social and financial condition of the individuals, the greater the consumption of foods rich in energy load and poor in nutritional value [4].

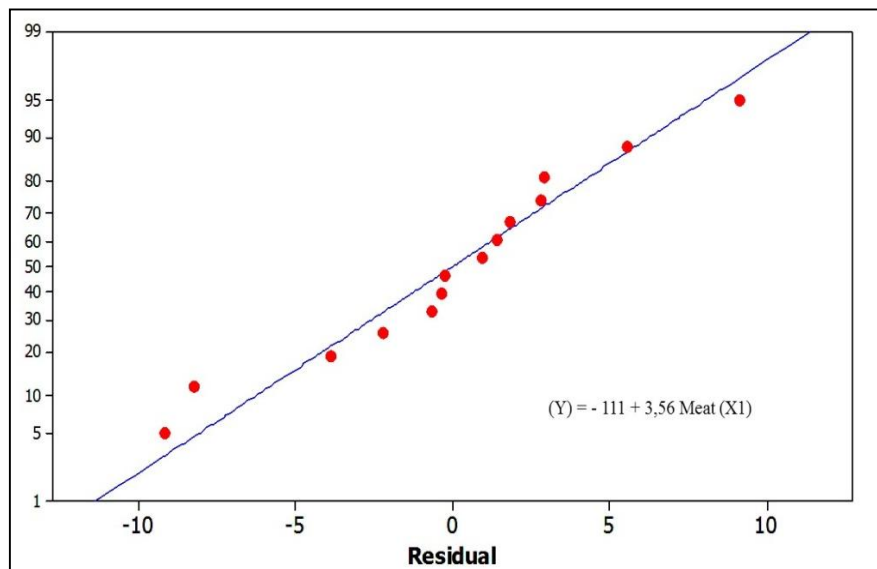


Fig. 3. Simple linear regression graph of meat price (X_1) in Brazil in reais (R\$)

Considering that meat and vegetables were more important in the increase in the price of the basic food basket in the world, in Brazil it would not be different. The model presented data validation of 90,39% (Fig. 3), with regression and statistical significance ($P<0.05$) on the increase of the index of the price of food in 355,67%, that is, the meat represents the increase of the price of the basic food basket in Brazil by 300%.

According to the last Family Budgeting Research (FBR) of 2008/2009 [38], the highest per capita consumption in Brazil is beef, followed by chicken meat, and pork. The good competitiveness of Brazilian beef is linked to low food costs (based on extensive breeding), animal genetics being improved by research agencies, combined with the increase in meat consumption both in the domestic market [39] and by the international consumers, since Brazil is among the main exporters [40].

Considering that maize and soybean meal are the main inputs in animal feed production and that these inputs account for 65% of the production costs of broiler chicken [41], there are strong reasons to believe that changes in the prices of these commodities changes in chicken prices [42].

Price estimates indicate that the demands for beef, pork and chicken are inelastic and confirm that meat is a substitute for gross and net substitutes [43]. These authors also concluded that the higher the income of Brazilian families, the less important is the consumption of meat,

and the greater will be the consumption of other consumer goods, confirming Engel's law for food.

Some authors indicate that animal confinement may make the supply and price of meat products more stable [44,45], and other authors have noticed that with the increase in per capita income there has been an increase in the consumption of meat [46], showing that there was a positive result in the acquisition of food in inclusion policies, such as the "Bolsa Família" [47,48].

A survey conducted in the United States [49] compared nutrient density and nutritional value of meat products and non-meat foods, concluded that it is necessary to consider the possibility of replacing meat with meat-free foods (legumes and oilseeds) in the diet, because most of these foods are found 20 to 60% protein density of meat. In addition, when protein cost was assessed, meat and non-meat foods had a similar cost when expressed in grams of protein per US dollar.

Nutrition and protein intake are linked in such a way that insufficient energy intake can be directly related to insufficient protein intake [12]. It is estimated that 16 to 28% of the population in developing countries are consuming insufficient protein [50]. In recent years there has been an increase in products that are inlaid and processed, poor in protein, and that their costs are cheaper compared to meat products and cause several noncommunicable diseases [51].

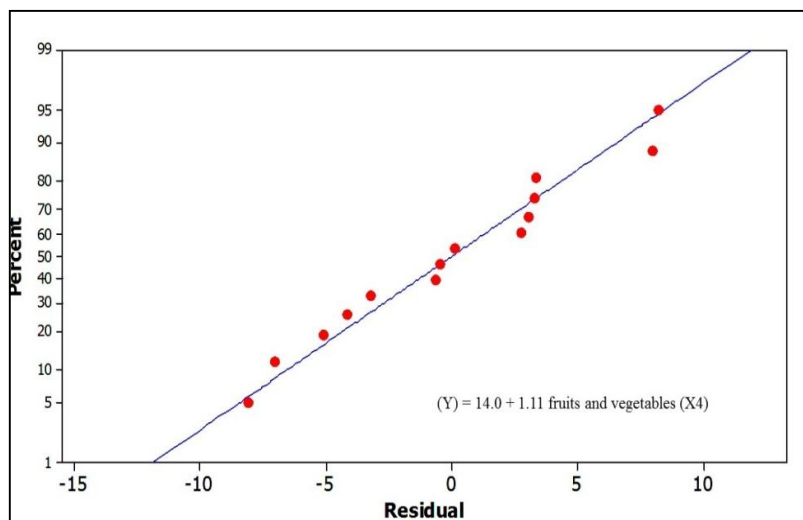


Fig. 4. Simple linear regression graph of the price of fruits and vegetables (X₄) in Brazil in reals (R\$)

In Brazil, as meat and fruits and vegetables were one of the major causes for the increase of the basic food basket, in this way, the simple parameters of fruit and vegetables (X_4) were also deployed and a validation of the model of 89,48% (Fig. 4), and there was a regression and significance ($P < 0.05$) in the increase of the food price index in Brazil by 110,67%.

According to the WHO, in Brazil, the consumption of fruits and vegetables is below recommended, which defends the daily consumption of at least 400 g, the equivalent of five portions [52]. The regular consumption of fruits and vegetables varied considerably among the regions of the Brazil country, being higher in the capitals of the South region (36,5%) and lower in the capitals of the North region (11,9%) [53]. Several studies show that inadequate diet, low in fruits and vegetables, contributes to increasing the prevalence of noncommunicable diseases such as obesity, cancer, cardiovascular diseases, diabetes mellitus, etc. [54,55].

There are large investments to store and transport [4], and they are highly wasteful because they are highly perishable [56]. While foods rich in fats, carbohydrates, and sources of minerals and proteins tend to have a longer shelf life [57], they are cheaper than foods with high nutrient concentrations [58].

In Brazil, despite the lack of monitoring of prices of basic food products, the country's government has announced that it will lower food taxes on the food basket and insert new foods with higher nutritional value [59]. But whoever says that this federal government action is a "shot in the foot" [60], because it is easy to dismiss an industrialized product, that everyone has control over prices. Another thing is to relieve food, a product with little elaboration, whose supply depends on the harvest, such as fruits and vegetables.

In this way, governments would need to encourage the commercial production of wild fruits and vegetables by farmers. And these seeds or seedlings would need to be made available and accessible to farmers, and added to that, quality technical assistance to accompany the entire production process. In poor regions, these "hidden treasures" could easily play a positive and immense role in promoting a balanced and healthy diet.

Fruits and vegetables (native to the country) are nutritionally rich in phytochemicals around the

world and can play a significant role in providing a healthy and balanced diet [61]. However, the biggest challenge is acceptability and accessibility, as well as the lack of interest in wild fruits and vegetables. People need to be educated using various forms of media about the nutritional and health benefits of these wild plants, with the goal of bringing them from the forest to the plate. Researchers need to channel more efforts to domesticate them to facilitate access, among other reasons.

It is important that family budget education and follow-up with consumers may be necessary to have a good diet, based on the items in the basic food basket. Several factors are important for a faster progress towards reducing undernutrition, which includes: greater political commitment of the government to promote food security; public subsidies to improve financial conditions; and larger and more efficient investments in agriculture and in the product processing sector.

4. CONCLUSION

The research carried out fulfills the assumption that the value of the basic basket varies according to the oscillation of the prices of the products, it was concluded that the foods that most affect the price of the basket are the meat, fruits and vegetables. This aspect was associated with the high cost of investment in these sectors as well as the seasonality of these products, it is stated that the reduction of the prices of these products can be realized through the incentive to family farmers.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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