

Review of ultra-processed food's price change effect on consumer demand

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Abstract:

In recent years, ultra-processed food has gradually become the main way of consuming food in many households or individuals, particularly for those who do not have enough time and money to buy fresh ingredients. However, eating too much dairy could trigger some negative effects owing to its making process and adding many additives. Consequently, obesity and other diseases may result. Therefore, the introduction firstly points out the wide distribution and its shortcomings, then this article the link between obesity and the price of ultra-processed foods. Secondly, two models, the Linear demand curve model, and the non-Linear demand model will be used to analyze the relationship between the price of ultra-processed food and consumer demand. Finally, introduce the concept of “elasticity” to determine the extent to which price causes a change in demand. Then it is pointed out which factors will affect the price of ultra-processed food, and thus indirectly cause the change in demand.

Keywords: : linear demand curve model, non-Linear demand model, ultra-processed food, obesity

1. Introduction

Processed food refers to food that has been processed and is ready for people to eat . Heating, pasteurizing, drying, and freezing food does not change the structure of the food[3]. However, ultra-processed foods are industrially made foods that contain at least five or more ingredients, such as various forms of sugar, junk fats (refined vegetable oils), chemicals, additives, and colors[1]. In May 2019, a study published in Cell Metabolism explained the relationship between ultra-processed foods and obesity[2]. The results showed that people who ate ultra-processed foods were more likely to overeat and gain weight than those who ate unprocessed foods or someone who has a good eating habits[2][15]. In addition, a 10 percent increase in consumption of ultra-processed foods was associated with a 12 percent increase in overall cancer risk[10]. In recent years, the amount of ultra-processed food consumed in Brazil has continued to grow, women and high-income people make up the majority[2][5]. Other European countries over the world also face the problem of obesity[13], such as Sweden[8] and Canada[12]. However, in most cases, the price fluctuation of ultra-processed food is small[9], that is, the price of ultra-processed food is relatively low most of the time, and food is easy to get and does not require too much time to cook, which also

increases the range of the consumers of ultra-processed food[4][11], but more eating of ultra-processed food will promote the development of diseases such as obesity[14]. Therefore, this article will explain the relationship between ultra-processed food prices and the prevalence of obesity in the world.

Because it is not certain that the effect of price changes on demand is fixed, that is, whether it is a constant, in the following papers, two models will be used to analyze how the changes in ultra-processed foods' price would affect the demand of consumers who purchase ultra-processed foods. The linear demand curve model is an economic model that describes the relationship between the demand for a good and its price, and there is a linear relationship between the quantity demanded of a good and the price of the good, e.g., an increase in the price of cornstarch will cause a decrease in its consumption, and vice versa, the consumer's demand for it will increase, and the two are linearly related. Secondly, non-linear demand curve model shows that the degree of the changes of demand varies depending on price changes, whereas the degree is not a constant, that is, for example, if a doubling of the price of chocolate leads to a doubling of consumer demand for it, it does not mean that a doubling of the price of chocolate will lead to a two-fold decrease in sales of chocolate.

2. Analysis and comparison

Linear demand curve model

Q represents the demand or volume of sales of a product, and P represents the price of that good. a is the intercept of the straight line representing the quantity demanded when the price is 0, and a response to the effect of factors other than the price on the quantity demanded. b is the slope, which indicates the extent to which the price of a good affects sales volume, if b is positive a price rise will lead to a fall in the quantity demanded, if b is negative a fall in price will lead to an increase in the quantity demanded.

Linear relationship The model assumes that the demand curve is a straight line, representing the existence of a linear relationship between the quantity demanded and the price of the good.

Constant slope The slope of the curve is constant, representing that the effect of price change on the quantity demanded is fixed.

Intercept Interpretation Represents the quantity demanded when the price is zero, explaining the potential quantity demanded in the market or the base level of demand.

The slope b is often used to measure the elasticity of demand. The elasticity of demand indicates the degree of sensitivity of quantity demanded to changes in price. When the elasticity of demand is greater than 1, it means that the quantity demanded is very sensitive to price changes. When the elasticity of demand is less than 1, it means that the quantity demanded is less sensitive to price changes.

The analysis of price elasticity often explores the sensitivity of the demand for a good to changes in price. Market forecasting Forecasting the demand for commodities at different price levels. Policy analysis Estimating the impact of different tax policies on commodity prices and demand. Market pricing Analyze price elasticity and cost structure to maximize market share and profit. Market regulation Formulate regulatory policies to maintain market order and fair competition

Non-linear model

Concave Demand Curve As prices rise, the decline in demand gradually slows down. The decrease in demand diminishes as the price rises. (i.e., in a logarithmic function, the image shows an upward concave shape, and the slope of the curve decreases as the independent variable increases).

X is the price, y is the quantity demanded, and a and b are parameters.

Convex demand curve As price rises, demand decreases at a gradually increasing rate. As price rises, demand de-

creases at a progressively greater rate. (Exponential function)

X is the price, y is the quantity demanded, and a and b are parameters.

S-shaped demand curve Within a certain price range, demand changes relatively slowly, while within another price range, demand changes relatively rapidly.

Two phases make up the curve

Initial Stage At lower price levels, the change in demand is relatively slow or stable. This may be because at the lower price level, consumers perceive the price of the good as more reasonable or there is some security of demand.

Transition Stage As prices rise to a certain level, the rate of change in demand suddenly accelerates, forming an inflection point in the S-shaped demand curve. Indicates that consumers become more sensitive to the demand for commodities, the price change has a more significant impact on demand.

General form: Logistic functional form is the price (there can also be other factors affecting demand). L represents the maximum or minimum value of demand, that is, the upper and lower limits of demand. k is the slope parameter of the curve, reacting to the degree of price sensitivity to changes in demand, the greater the, the steeper the curve, the more sensitive the response of demand to price changes. k represents the center of the curve, that is, the curve is more sensitive to changes in price. k is the slope parameter of the curve. represents the center of the curve, i.e. the turning point of the curve. The demand curve represents the critical point of the price. When the price is equal, the quantity demanded reaches the middle of the curve.

3. Results

First, the price elasticity of demand for a good measures the degree to which consumers respond to price changes [6]. In other words, an increase or decrease in the price of a product leads to an increase or decrease in demand. However, for some specific products, an increase in price does not significantly lead to a decrease in demand, such as luxury goods, which can be measured by other models [6]. The reason for this is that these types of products are considered essential. For example, if a person needs a specific drug to stay alive, that person will do whatever is necessary to get that drug regardless of whether or not the price has increased. When the quantity demanded of a product decreases as the price increases, it means that the quantity demanded of this product is relatively elastic or resilient.

On one hand, the models show that the price elasticity of

ultra-processed foods for overweight is -0.33 while the coefficient for obesity is -0.59[5]. This means that increasing the price of ultra-processed foods may be effective in reducing the proportion of the population that is overweight or obese. That is reasonable because in real life, if the price of ultra-processed foods rises due to some reasons, people are not willing to purchase these ultra-processed foods. Therefore, less eating means less possibility of overweight and obesity.

On the other hand, the income elasticity of ultra-processed foods for overweight and obese is 0.17 and 0.22 respectively[5], which means how much the income people gain is a direct ratio to the result of overweight and obesity. For example, the more disposable income people have, the stronger the power of purchasing they have. As a result, the more money they have, the easier for them to get overweight and obese.

First, when the price elasticity of demand is -0.33 and -0.59 [5], i.e., the percentage change in consumption is less than the percentage change in price, it indicates that the two goods are relatively inelastic [7]. In other words, the change in the price of the product has less impact on its consumption. The types of ultra-processed food are something like chicken nuggets, frozen meals, packaged soups, potato chips, and so on. These kinds of food are easy for consumers to gain because they can easily buy in supermarkets, convenience stores, or online shopping. They only need a very simple processing process, or even no processing can be eaten directly. So for people, these ultra-processed foods are essential. In addition, ultra-processed food does not have so many substitutes, because this kind of food is specific, they choose to eat ultra-processed food so that they have less chance to eat other food, because of time, and money.

Secondly, income elasticity of demand measures the extent to which consumers show a response to changes in their income, i.e., they decide how much to buy of a good based on their income level. When the coefficient of income elasticity is positive, demand increases as income increases. When the income elasticity is negative, as income decreases, the quantity demanded rises instead. Such goods are called normal or premium goods. Income elasticity coefficients of 0.17 and 0.22 [5] indicate that ultra-processed foods are premium goods. It is clear that when people's disposable income increases, meaning that they have more wealth the increasing purchase power will let them buy more ultra-processed food, which could cause the possibility of overweight and obesity. Thus, the price and income effect on the demand for ultra-processed food is the opposite. The former one shows a direct rela-

tionship while the second one indicates an inverse relationship.

4. Limit and Other discussions

This essay mainly studies the impact of commodity price changes on obesity, but it has certain limitations. Other factors contributing to obesity were not taken into account: whether consumers consumed other obesity-causing foods, such as fried food; whether everyone's constitution is different, or people's usual exercise. These variables are difficult to control in real life, so there is no guarantee that the data is completely accurate. What's more, in the process of research can be found that for the supplier of ultra-processed food, when demand is inelastic, if the price declines, the total revenue also would decrease, and rising prices will increase manufacturers' total revenue. This is due to the fact that when the seller lowers the price, the increase in demand is less than the rate of decrease in the price; rather, the decrease in price leads to a decrease in revenue, but this behavior does not significantly increase the quantity of goods sold. When the price is set at a higher level, although the quantity demanded decreases, the total revenue does not decrease as a result. Therefore, sellers tend to set prices at relatively high levels.

5. Conclusion and future work

In conclusion, this paper investigates the changes in the quantity demanded of goods caused by changes in the price of ultra-processed foods by comparing two models, the linear demand curve and the non-linear demand curve. Ultimately, it can be concluded that the higher the price of ultra-processed foods, the lower the prevalence of diseases such as overweight and obesity in the population, and on the contrary, a decrease in the price of ultra-processed foods is associated with an increase in the prevalence of obesity and other related diseases in the population. In addition, this paper also investigates some other models related to price elasticity, such as the income commodity demand model, the substitution model as well.

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