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EMPIRICAL TESTING OF THE NON-SATIATION AXIOM IN THE CONSUMER CHOICE THEORY

The aim of this study is to test the empirical validity of the non-satiation axiom in the consumer choice theory. And to achieve this aim, we decide to use statistical data providing information about the average amount of expenditure per capita in the USA for the consumption of several goods and services that we selected for this study throughout the period 1959-2016, and statistical data providing information about the level of the real disposable income per capita in the USA for the same period. Then, we build up a theoretical model that is based on the Engel curves presented in Luigi Pasinetti with three different shapes, each displaying satiation in the form of zero or even negative slope from a certain level of income onwards. We use this theoretical model as the methodology by which to conduct our empirical study and to obtain the best as possible results from it. And particularly in our empirical study, we conduct a non-linear regression curve fitting analysis between the independent variable level of real disposable income and the dependent variable amount of expenditure for the consumption of a particular good or service. The results from this study show empirical evidence that there is an upper limit on the amount of expenditure that is allocated by a consumer to anyone particular good or service, regardless of how much his income grows. Finally, we reach to the conclusion that this empirical study produces evidence which rejects the validity of the non-satiation axiom in the neoclassical consumer choice theory.
JEL: D11; D12

1. Introduction

The general concept in the theory of consumer choice is that the purpose of each consumer is to maximize utility. And according to the theory of consumer choice, people maximize utility when they choose the maximum quantity of all goods and services that they can

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afford. That is, if there was no budget constraint in the consumer choice, then the theory assumes that an individual would maximize utility from the consumption of unlimited quantities of all goods and services that the individual wants to consume. Exactly this assumption about the non-satiation of the consumer wants is one of the five most important axioms in the theory of consumer choice. The other four fundamental axioms in the theory of consumer choice assume that the consumer preferences are stable, complete, transitive, and reflexive.

First, the axiom of stable preferences assumes that the preferences of the consumer are given and cannot change or evolve throughout time. Second, the axiom of complete preferences assumes that for any pair of bundles, for example, x-bundle and y-bundle are given, either (x_1, y_1) is preferred to (x_2, y_2), or (x_2, y_2) is preferred to (x_1, y_1), or else the consumer is indifferent as between (x_1, y_1) and (x_2, y_2). Third, the axiom of transitive preferences assumes that if (x_1, y_1) is preferred to (x_2, y_2), and (x_2, y_2) is preferred to (x_3, y_3), then (x_1, y_1) is preferred to (x_3, y_3). Fourth, the axiom of reflexive preferences assumes that any bundle is as good as itself which means that the consumer is indifferent as between (x_1, y_1) and (x_1, y_1). These are the four fundamental axioms of consumer choice theory, though, as Deaton and Muellbauer (1980, pp. 26-29) point out, they are generally supplemented by the additional axiom of non-satiation of the consumer wants. And from a theoretical point of view, without any of these five axioms, the consumer choice theory would not work which means that each of them is equally important. But in our study, we focus particularly on the non-satiation axiom.

It turns out that the whole theory of consumer choice can be formulated in terms of preferences that satisfy the five axioms described above. Also, the consumer choice theory can describe preferences and graphically by using a coordinate geometric construction known as indifference curves map. On this map, each indifference curve includes multiple bundles of two goods (x, y) among which the consumer is completely indifferent. That is, each bundle lying on an indifference curve brings the same utility to the consumer. And taking into consideration the non-satiation axiom, it follows that any bundle lying on a higher indifference curve is strictly preferred to any other bundle lying on a lower indifference curve. This means that if there was no budget constraint, the consumer will always want to choose a bundle from the highest possible indifference curve which is equal to infinity. But because there is a budget constraint, the theory states that the optimal choice of the consumer is the bundle (x*, y*) lying on the highest possible indifference curve tangent to the budget line. And the budget line includes those bundles that the consumer can afford. This means that the optimal choice of the consumer (x*, y*) is the best one that he can afford (Barten & Böhm, 1982).

Figure 1

The consumer choice theory graphically described by using indifference curves map
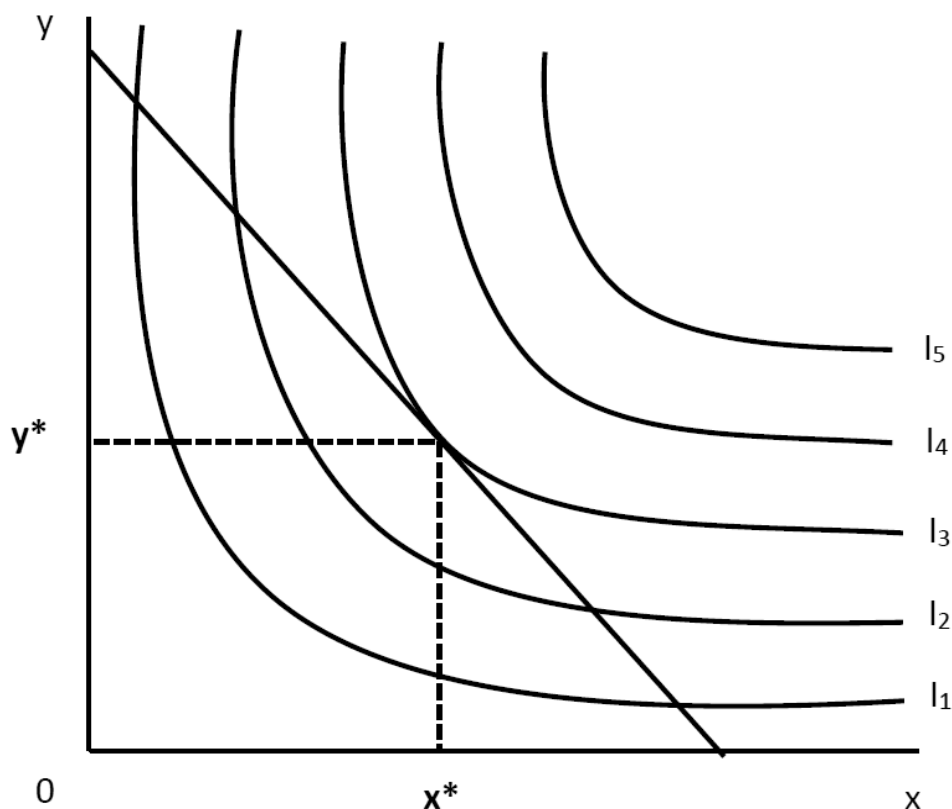
As seen above, the non-satiation axiom is probably the most important axiom in the theory of consumer choice because exactly this axiom makes the theory to describe the consumer behaviour and choice as simple as possible. If the non-satiation axiom is empirically valid, it follows that when the income increases, the consumer increases the quantities of the goods and services that he is consuming because that is how the consumer maximizes utility. And since the consumer maximizes utility when his income increases because that allows him to purchase higher quantities of the goods and services that he is consuming, it follows that the level of income determines the welfare of the consumer. That is, the level of income determines the quantity of goods and services the consumer can afford, and the quantity of goods and services the consumer can afford determines the ordinal scale of utility that the consumer obtains.

The aim of this study is to test the empirical validity of the non-satiation axiom in the consumer choice theory. The working hypothesis that is being raised in this study argues that when the level of income increases which allows the amount of expenditure to increase for the consumption of higher quantities of the same goods and services, at some point the consumer wants to satiate. The methodology that is being used in this study is the conduction of non-linear regression curve fitting analysis between the independent variable level of real disposable income and the dependent variable amount of expenditure for the consumption of a particular good or service. And the structure of this study is the following. First, in section 2 we make a literature review on alternative consumer choice theories assuming that the consumer wants to satiate. Then, the methodology for the conduction of this study is discussed in section 3. In section 4, we outline the range of the study so that will produce the most reliable results. Then, in section 5 we introduce the empirical data that is being used for the conduction of this study. Section 6 presents the obtained empirical results from the study. And finally, in section 7 we make an analysis on the empirical results and then we reach to a conclusion whether the hypothesis is being confirmed or rejected.

2. Literature Review

Frank Knight (1944) argues that the consumer choice theory attempts to explain the consumer behaviour and choices in a relativistic way which loses touch with reality. And that relativistic interpretation of consumption is adopted in the theory for the sake of greater objectivity. But here comes the first problem with this theory and it is because the consumer choice theory relies more on objectivity at the expense of realism, actually the theory is able only to describe the consumer behaviour and choices, but the theory is unable to explain that consumer behaviour and choices.

The lack of realism in the modern theory of consumer choice stems from its axioms which were never empirically tested and proven as valid. These axioms are made in the theory so far as to retain its simplicity and mostly its systematic assertion that the consumer maximizes utility from the consumption of larger quantities of the same goods and services that he has been consuming so far. However, the question that immediately arises here is whether the consumer wants are always insatiable if the consumer continues to increase the quantities of the same goods and services that he has been consuming so far. And actually, if a consumer continues to increase the consumption of larger and larger quantities of the same goods and services, will the consumer soon or later reach either to physiological or to emotional satiation of his wants and preferences?

The modern theory of consumer choice developed in its simplistic model during the first half of the twentieth century assumes that the only constraint for a consumer striving to maximize utility is the level of his income. Besides the consumer income, there are some other constraints which the simplistic model of consumer choice ignores. In practice, it is reasonable to think that the consumer wants can be satiated at some point. And one of these other constraints is the physiological capacity of an individual who is unable to consume an unlimited quantity of goods satisfying his physiological needs. For example, from a

realistic point of view, it is impossible for a consumer to eat an unlimited quantity of food without his hunger to be satiated at least for some short period. Even in this occasion, if we assume that the non-satiation axiom is valid, it is still impossible for a consumer to eat an unlimited quantity of food because the capacity of his biological body will not allow him to eat an unlimited quantity of food. Another constraint is the satiation of the consumer wants related with the emotional needs of an individual. From a realistic point of view, if an individual continues to increase the quantities of the goods and services that satisfy his emotional needs, soon or later his consumer wants become satiated as well.

Frank Knight (1944) argues that Vilfredo Pareto (1906), William Earnest Johnson (1913), Eugen Slutsky (1915), and John Hicks and Roy Allen (1934) developed a very unrealistic consumer choice theory which relies on many empirically unproven axioms. And if these axioms are put under empirical validation, we cannot say whether the modern consumer choice theory will still work. The modern theory of consumer choice assumes that the consumer wants are non-satiated and will never be satiated in future time. But the truth is that the non-satiation axiom is a necessary condition for preserving the theory systematic in its explanation that a consumer maximizes utility from consumption of larger quantities. And if the non-satiation axiom is empirically proven as invalid, then the modern theory of consumer choice should be rejected as false. For this reason, Frink Knight (1944) holds the opinion that the modern consumer choice theory, which was developed during the first half of the twentieth century, constitutes a movement in a backward direction. However, during the second half of the twentieth century many alternative models were developed in the consumer choice theory making the realistic assumption that the consumer wants is possible to be satiated.

For example, Robert Bishop (1946) developed a model of the consumer choice theory including the realistic assumption that the consumer wants can be satiated at some point while the consumer increases the consumption of the same goods and services. Robert Bishop (1946) developed his model of the consumer choice theory by using a coordinate geometric indifference curves map. In this model, we assume that the economic system consists of only two goods "X" and "Y', but it is also possible good "Y" to represent a composite good which consists of all other goods except good "X" in that economic system. Actually, the latter option for good "Y" as a composite good, we can say that good "Y" is the income of the consumer who has to make choices between different bundles of good "X" and good "Y" based on his preferences. And we know from the theory that there will be some bundles among which the consumer will be indifferent as well as there will be other bundles which will be strictly preferred by the consumer. However, the indifference curves map of Robert Bishop (1946) is formulated in the form of concentric circles. That is, each indifference curve initially decreases until it becomes horizontal at some point, then it rises until it becomes vertical at some point, and finally, the curve bends back toward its starting point. And since all indifference curves are in the form of concentric circles, this implies that there is a limited number of indifference curves.

Figure 2

An alternative model of the consumer choice theory including satiation of consumer wants
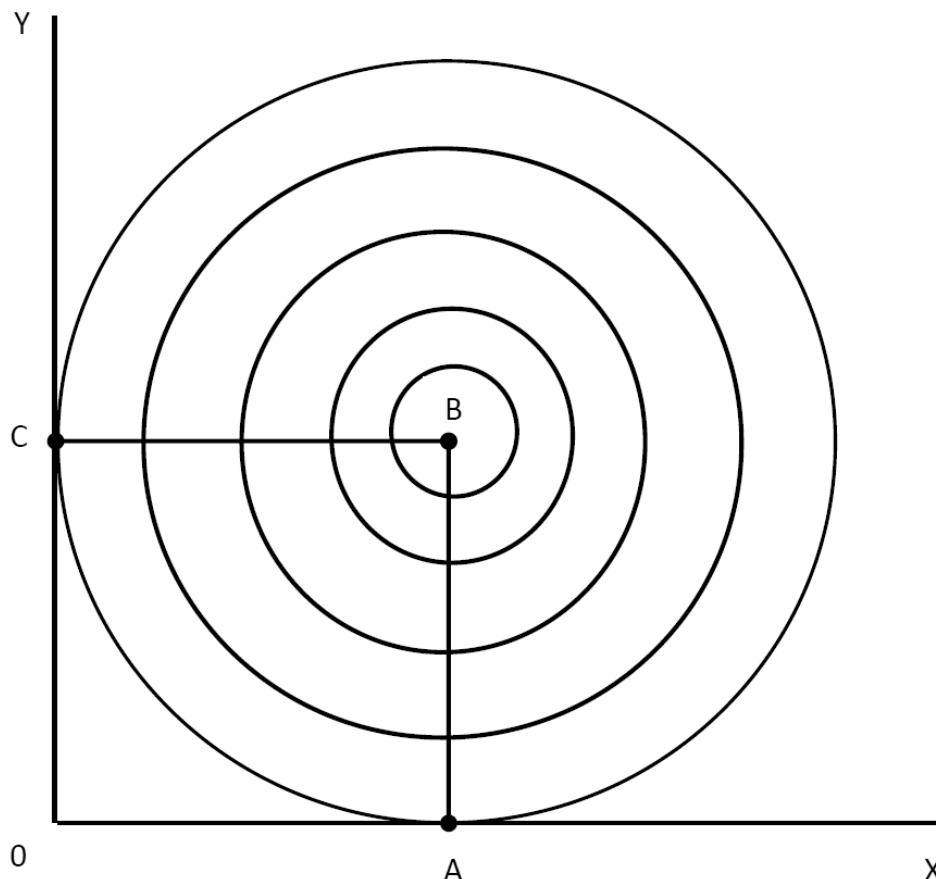
Source: Robert Bishop, 1946.

In the above model developed by Robert Bishop (1946) on Figure 2, the points on the indifference curves map of greatest interest for our study are those points lying on AB and CB as well as point B which intersects AB and CB. All points on AB represent the maximum quantity that an individual is willing to consume before reaching absolute satiation with good "X". In the same way, all points on CB represent the maximum quantity that an individual is willing to consume before reaching absolute satiation with good "Y". And the point B represents the maximum quantity that an individual is willing to consume before reaching absolute satiation with both goods at the same time. The area of OABC consists of all bundles that an individual is willing to consume while his consumer wants are still non-satiated. Once, he gets to some point on AB or CB, his consumer wants are absolutely satiated either to good "X", or to good "Y", or to both. Outside the area of

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OABC, the consumer will be unwilling voluntarily to consume larger quantities of the both goods.

Stanley Lebergott (1993) asked the rhetoric question: "is the pure imperturbable belief that consumer wants are insatiable, which many economists seem to hold, really acceptable? He adds: "Obviously, the growth of (real) consumption expenditures is not simply a matter of multiplying the items consumed – eating ten hamburgers per day rather than two, using two hundred pairs of shoes rather than twenty, playing on five pianos rather than one. Although multiplicative growth of this kind occurs to a certain extent, it cannot exclusively explain the growth of per capita consumption" (Stanley Lebergott, 1993, p.69). As Stanley Lebergott refers to an empirical study based on the Engel's Law that was conducted by Samuel Houthakker (1957). In that study, Houthakker proves that the demand for many consumption items can reach to a point of satiation.

Ulrich Witt (2001) also criticized the simplistic model of consumer choice theory. Witt argues that the neoclassical economic theory is implicitly biased towards the supply side. Research is mainly concerned with the question of how production grows. And it matters less what companies produce or how they go about selling it. As Ulrich Witt, himself puts it: "a sustained growth of per capita consumption is explained by a continued relaxation of the budget constraint, i.e. by rising real income, explicitly or implicitly assuming that the demand for at least some of the consumption items on which the preference ordering is defined has not yet been satiated by current consumption or is not satiable in general" (Witt, 2001, p. 24).

To assume that satiation of the consumer wants plays a crucial role in the consumer choice theory, first the theory must determine which are the motivational factors causing a change in the state of the consumer wants. However, the modern neoclassical theory of the consumer choice does not give an explanation on the motivational factors that are responsible for the state of the consumer wants. And the reason for this ignorance of the motivational factors is because the model of the neoclassical consumer choice theory is built on simplistic axioms which were never empirically proven as valid. As two of the axioms state that the consumer wants are given, cannot evolve throughout time, and cannot satiate. Hence, the potential ability of consumer wants and preferences to change and satiate remain outside of the neoclassical paradigm.

However, over the past decades, a number of economists have argued for an introduction to the theory of consumer choice of those missing motivational factors which better explain the behaviour and choice of the consumer rather the level of income alone. One of these economists who insisted for a theoretical revolution in the consumer choice theory is Ulrich Witt (2001). Witt suggested an alternative motivation-based theory of the consumer choice arguing that utility is derived from the satisfaction of human needs. The general concept in this motivation-based theory of consumer choice is that with increasing the satisfaction of a human need through consumption of larger quantities of a particular good, the motivation for further consumption of the same good starts gradually to vanish, which implies that consumer wants to satiate at some point. This alternative theory of the consumer choice tackles the motivational basis of consumer behaviour from which depends the evolution and satiation of the consumer wants. In this way, the theory of Ulrich Witt (2001) directly relates the consumer behaviour and choice with the ability of the consumer preferences to

change throughout time. Hence, the motivational-based theory of consumer choice succeeds to depart from two of the axioms in the neoclassical theory of consumer choice which assume that consumer preferences are stable and cannot satiate.

The motivation-based theory of consumer choice suggested by Ulrich Witt (2001) maintains some basic concepts drawn from motivational psychology that need deprivation and reinforcement are important principles driving the consumer behaviour and choice. Within the motivation-based theory of consumer choice, a need is defined as a behavioral disposition resulting from a state of deprivation in an individual, i.e. a deficiency, imbalance, or psychic or physic strain impeding the maintenance of basic metabolic processes, and thus threatening the well-being and eventually the survival of the individual (Ulrich Witt, 2001). A state of deprivation instinctively motivates the consumer to perform actions that end deficiency and relieve strain. Thereby the satisfaction of a particular consumer want creates a rewarding and pleasant experience which can be defined as a utility. In this sense, the motivation driving an individual to consume larger quantities of a particular good will be present as long as the underlying need is in a state of deprivation, implying that with increasing satiation this motivation vanishes, and the individual will stop consuming further quantities of the particular good. Thus, the consumer wants towards a particular good will naturally be limited by the satiation of the need driving an individual to consume larger quantities of the particular good. And if until a particular moment an individual is constrained by the level of his income which does not allow him to reach a satiation point, once budget constraint is sufficiently lax in the next moment and the individual is able to reach the satiation limit in the consumption of a particular good, further relaxing the budget constraint will not yield additional increases in the consumption of the particular good (Volland, 2012).

So, we can infer that at low levels of income, each successive increases of the income will be accompanied by an increase in the expenditure for the consumption of a particular good. And actually, that is the general concept in the neoclassical theory of consumer choice. However, the alternative motivation-based theory of consumer choice developed by Ulrich Witt (2001) states that once income has reached a level sufficient for consumption to satisfy motivating needs, expenditure levels should dissociate from income levels in a way that further income growth does not lead to further growth in expenditure.

Also, Ulrich Witt (2010) argues that motivating needs and respectively consumer wants to differ in the ease with which a consumer can attain satiation. For example, the physiological needs for caloric intake, which is a central motivation for the purchase of food, can be satiated at comparatively low levels of income. And the further increase of the income will not lead to further increase in the expenditure for the purchase of food because the physiological needs for caloric intake have already been satiated. Instead, there are some psychological needs which deprivation lasts a longer time and respectively the satiation of consumer wants towards the goods and services satisfying these psychological needs takes longer time and requires higher levels of income that will allow an individual to purchase high enough quantities of the goods and services satisfying his psychological needs. Here, under psychological needs, we mean the satisfaction of those needs that cause improvement in the standard of living of an individual. Whereas, the satisfaction of the physiological needs is crucial for the survival of an individual.

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3. Theoretical Model

The purpose of this empirical study is to prove that expenditure for the consumption of a particular good or service has a satiation point. That is, there is an upper limit on the amount of expenditure that is allocated by a consumer to any one particular good or service, regardless of how much his income grows. In order to attain this purpose, we decide to build up a theoretical model that is based on the Engel curves presented in Luigi Pasinetti (1981, p. 73). The general concept of the Engel curves in Luigi Pasinetti (1981, p. 73) is that at some point Engel curves satiate. Also, we decide to build up our theoretical model by exploiting the Engel curves in Luigi Pasinetti (1981, p. 73) because the neoclassical consumer choice theory states that an individual maximizes utility by increasing the quantity of the goods and services that he is consuming which occurs as a result of income growth. That is, the neoclassical consumer choice theory assumes that for any normal good there is always a positive relationship between the level of income and the amount of expenditure to that normal good. Consequently, in our theoretical model – the independent variable will be the level of the real disposable income, and the dependent variable will be the amount of expenditure for the consumption of a particular good or service.

We expect in this study to reach to an empirical evidence that Engel curves display satiation of the consumer wants in the form of zero or even negative slope from a certain level of income onwards. Yet in other studies, relatively little has been done to empirically validate how general this property is (Andreas Chai and Alessio Moneta, 2008). But in this study, we examine the extent to which Engel curves across a wide variety of goods and services display satiation of the consumer wants.

Rather than assuming that consumption increases uniformly across all goods and services as income grows what the neoclassical consumer choice theory states, Luigi Pasinetti (1981) recognizes that consumption fundamentally changes as income increases. Specifically, Luigi Pasinetti (1981) argues that there is always an upper limit on how much an individual is willing to spend on any good or service as income increases and above that limit his consumer wants are already satiated, and respectively the individual is unwilling to spend more to the consumption of further quantities of that good or service. In his own words, Pasinetti argues that "there is no commodity for which any individual's consumption can be increased indefinitely. An upper saturation level is inevitable and exists for all types of goods and services although at different levels of real income" (Pasinetti, 1981, p. 77).

In his famous study, Engel (1857) produced empirical evidence that the richer a consumer is, the less percentage of his income will be devoted to food expenditure which today is known as the Engel's law. The empirical evidence produced in the study of Engel (1857) does not necessarily imply the existence of a satiation point. In his book, Luigi Pasinetti (1981, p. 73) argues that an Engel curve relative to any good or service possess one of the shapes displayed in Figure 3 which display satiation in the form of zero or even negative slope from a certain level of income onwards.

Figure 3

x = expenditure
y = real income
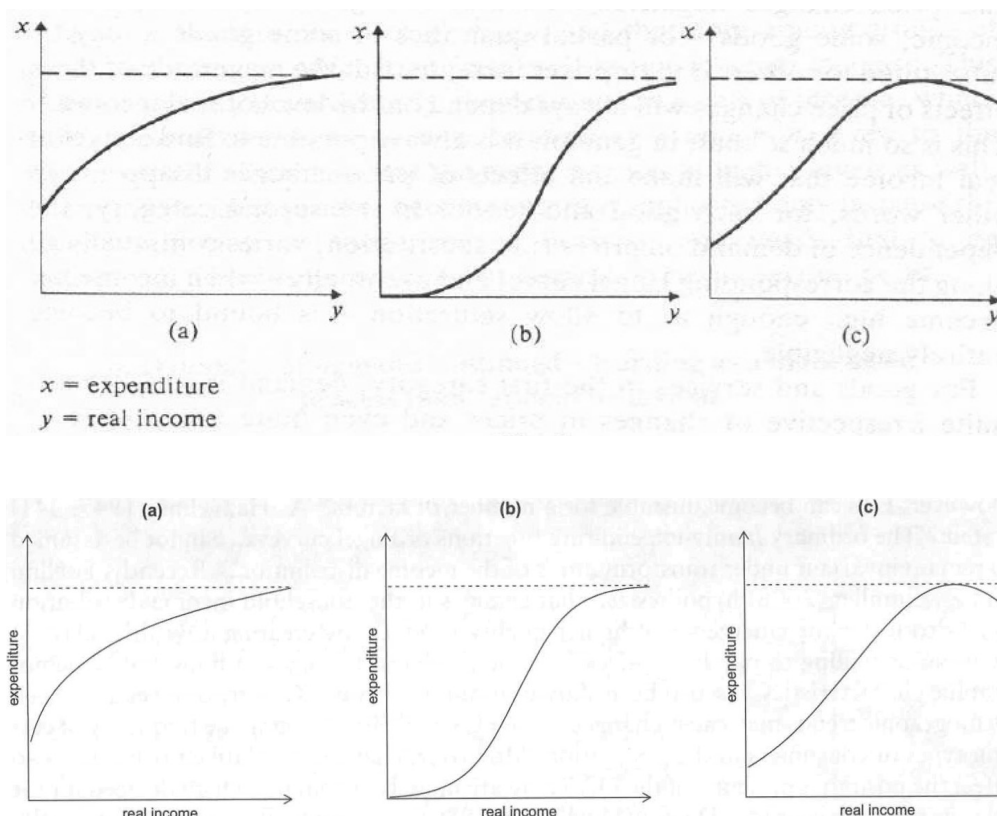
Source: Luigi Pasinetti (1981: 73)

Luigi Pasinetti (1981, p. 73) argues that "curves of type (a) are likely to fit the cases of goods which are absolutely necessary for physiological reasons (e.g. food), and curves of type (b) are likely to fit almost all other cases; while curves of type (c) represents the typical behavior of inferior goods."

Based on this theoretical model suggested in Luigi Pasinetti (1981, p. 73) which includes Engel curves with three different shapes, each displaying satiation in the form of zero or even negative slope from a certain level of income onwards, in our empirical study we expect to reach to the following results – a logarithmic relationship between the independent variable real disposable income and the dependent variable expenditure for the consumption of a necessity good, a logistic (sigmoid) relationship between the independent variable real disposable income and the dependent variable expenditure for the consumption of a normal good other than an absolute necessity, and a quadratic relationship between the independent variable real disposable income and the dependent variable expenditure for the consumption of an inferior good. As the purpose of our empirical study

is to confirm the statistical significance on each of these three kinds of relationships between the two variables.

The theoretical model that we use in this empirical study has the following algebraic expressions –

1. For the necessity goods, there is a logarithmic Engel curve in the form of zero slope from a certain level of income onwards which is converted into the following algebraic expression:

$$x = a * log_b(y) + c \tag{1}$$

2. For all normal goods except the necessity goods, there is a sigmoid Engel curve in the form of zero slope in the initial levels of income, and a zero slope from a certain level of income onwards which is converted into the following algebraic expression:

$$x = \frac{a}{1 + exp(-by + c)} \tag{2}$$

3. And for the inferior goods, there is a quadratic Engel curve in the form of negative slope from a certain level of income onwards which is converted into the following algebraic expression:

$$x = ay - by^2 + c \tag{3}$$

Where in the equations (1), (2), and (3), 'x' represents the amount of the average expenditure per capita for the consumption of good 'X', and 'y' represents the level of the average real disposable income per capita.

4. Limitations of the Study

A very important requirement for increasing the reliability of the results in our empirical study is first to restrict the influence on the consumer behaviour and choice of the factor – low levels of income. As we already mentioned, the general concept of the consumer choice theory states that a consumer maximize utility, if the quantities of the goods and services that he is consuming are increased, assuming that his consumer wants are non-satiated and will never become satiated. This statement is actually true but only to the point that the consumer is significantly constrained by the level of his income. That is, if the level of income is low enough, the consumer wants are impossible to become satiated because the consumer is unable to reach to the optimal quantities of the goods and services that will satiate his consumer wants. Consequently, at low levels of income, increasing the quantities of the goods and services that have been consumed does not lead necessarily to satiation.

But the purpose of our empirical study is to prove exactly the opposite statement that increasing the quantities of the goods and services that have been consumed leads to satiation of the consumer wants. Hence, if this empirical study is conducted among people with low levels of income, the empirical study will not produce reliable enough results

which to confirm our hypothesis because the low levels of income represent a crucial factor that constraints the satiation of the consumer wants. For this reason, it is a very important requirement to restrict the influence of the factor low levels of income, if we want our empirical study to be objective and to produce reliable enough results that will confirm our hypothesis. Thereby, the conduction of our empirical study is applicable only to such nations which experience abundance and high standard of living. And these are the nations in which the average income per capita can afford the average consumer to purchase almost any good in the market in high enough quantities. In order to determine who are those wealthy nations that we can use for the conduction of our empirical study, first we need to find statistical data ranking the all countries in the world by the amount of GDP per capita, converted to international dollars by using purchasing power parity rates.

The top 10 wealthiest countries in the World with the highest standard of living ranked by the indicator GDP per capita, converted to international dollars by using purchasing power parity rates, are presented on Table 1 (according to statistical data provided by the World Bank).

Table 1

Ranking of the countries by GDP per capita, converted to international dollars by using purchasing power parity rates

№	Country	International Dollars
1.	Qatar	141 543
2.	Luxembourg	101 926
3.	Singapore	85 382
4.	Brunei	78 369
5.	Kuwait	74 646
6.	United Arab Emirates	69 971
7.	Ireland	65 144
8.	Norway	61 197
9.	Switzerland	61 086
10.	United States of America	56 116

Source: The World Bank (http://data.worldbank.org/).

Additionally, we need to limit the influence of the factors culture as an informal institution and the institutional organization of the economic system which indirectly influence the consumer behaviour and choice. For example, if our empirical study is conducted in a country with Muslim culture or in a country with a socialistic economic system, the results will not be as objective and reliable as if the empirical study is conducted in a country with a capitalistic free market economy. For this reason, we need to limit the list with potential countries for the conduction of our empirical study only to the following countries – Luxembourg, Ireland, Norway, Switzerland, and the United States of America.

5. Empirical Data

5.1 Data Source

For the purpose of our empirical study, we need to obtain the following three types of data – first, we need data showing information for the amount of the personal consumer spending on wide range of goods and services for a specific time period in one of the five selected countries; second, we need data showing information for the number of population for the same specific time period and for the same country in order to estimate the average consumer spending per capita; and third, we need data showing information for the level of real disposable income for the same specific time period and for the same country in order to analyze the relationship between the amount of expenditure on specific goods and services and the level of real disposable income.

We can extract data for the amount of personal consumer spending on a wide range of goods and services from the following three sources – Eurostat[2], the Organization of Economic Cooperation and Development (OECD)[3], and the U.S. Bureau of Economic Analysis (BEA)[4]. If we use the data provided by Eurostat, we can have information about the consumption expenditure of private households for Luxembourg, Ireland, Norway, and Switzerland in the period between 1988 and 2010. On the other hand, if we use the data provided by the OECD, we can have information about the final consumption expenditures of households for the all five countries Luxembourg, Ireland, Norway, Switzerland, and the United States of America, and furthermore this information covers the period between 1950 and 2016. This means that so far, the data provided by the OECD is preferred rather than the data of Eurostat. However, the problem with the both sources is that the data provides information about the amount of personal consumption expenditure on goods and services which are aggregated into groups, as each group comprises of several different goods or services. But, we need information about the personal consumption expenditure on wide range of goods and services which data to be disaggregated as much as possible to the lowest microeconomic level.

For this reason, for our empirical study we decide to use the data provided by the U.S. Bureau of Economic Analysis (BEA) because their data comprises of information about the amount of personal consumption expenditure on a wide range of goods and services which data is disaggregated to the lowest possible microeconomic level. Furthermore, the range of data covers the period between 1959 and 2016. And this means that our final choice of country for the conduction of this empirical study is the United States of America because for this country we have the best possible data which will produce the most reliable results.

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[2] Data comprising information about the consumption expenditure of private households for the countries in the European Union – http://ec.europa.eu/eurostat/web/household-budget-surveys/database.
[3] Data comprising information about the final consumption expenditures of households for the member countries of the OECD – https://stats.oecd.org/Index.aspx?DataSetCode=SNA_TABLE5.
[4] Data comprising information about the personal consumption expenditures only for the United States – https://www.bea.gov/national/consumer_spending.htm.

Second, we decide to use the data giving information about the number of the U.S. population for every single year in the period between 1959 and 2016 that is provided by the OECD because their population statistics is the best structured one in comparison to other potential data sources. We need these data in order to calculate the average consumption expenditure per capita and the average real disposable income per capita.

And third, we decide to use the data giving information about the level of the real disposable income for the United States in chained 2009 U.S. dollars for each single year in the period between 1959 and 2016 that is provided by the U.S. Bureau of Economic Analysis. The reason to choose this data source is because their data is the most accurate, and we used the same data source to extract information about the personal consumption expenditure.

5.2 Data Description

The purpose of our empirical study is to prove that there is an upper limit on the amount of expenditure for the consumption of any particular good or service which represents satiation of the consumer wants. In order to attain this purpose, we decided to examine the relationship of an Engel curve between the level of the real disposable income as an independent variable and the amount of expenditure for the consumption of a particular good or service as an dependent variable. In this model, the Engel curve displays satiation of the consumer wants, if from a certain level of income onwards, the slope becomes zero or negative. The method that we decide to use to attain this purpose is the conduction of nonlinear regression curve fitting analysis on SPSS Statistics. And according to Luigi Pasinetti (1981, p. 73), the Engel curves displaying satiation have three different shapes based on the type of good, whether it is necessity, normal, or inferior. This means that we need to select for our empirical study different types of goods and services which are necessity, normal, and inferior, and then to conduct the nonlinear regression curve fitting analysis between the level of the real disposable income as independent variable and the amount of expenditure as dependent variable for each single good or service considering its type. That is, the curve fitting analysis should produce logarithmic relationships for the necessity goods and services, logistic (sigmoid) relationships for the normal goods and services, and quadratic relationships for the inferior goods and services.

For our empirical study, we decide to use the following variety of goods and services:

1. Necessity goods – poultry meat; cosmetics, perfumery, and bath preparations.

2. Normal goods – televisions; video equipment (VHS players and DVD players); video cassettes and discs; audio equipment (audio players, CD players, and MP3 players); major household appliances; and motorcycles.

3. Inferior goods – pork meat as an inferior unhealthy alternative to the poultry meat; newspapers and magazines as an inferior alternative to the Internet sites; and land-line telephone services as an inferior alternative to the cellular telephone services.

Table 2 provides macroeconomic data (in brief version) on the aggregate amount of expenditure in million U.S. dollars for the consumption of the selected goods and services in the USA for the period between 1959 and 2016. Then, the same macroeconomic data in detailed version is provided by the figures 4-7.

Table 2

Aggregate amount of expenditure in million U.S. dollars for the consumption of selected goods and services in the USA for the period 1959-2016 (brief version) (USD)

Goods and Services:	1959	1969	1979	1989	1999	2009	2016
Major household appliances	4,113	5,923	12,464	21,671	27,600	36,135	41,729
Televisions	1,577	4,040	6,465	12,530	14,139	36,562	37,533
Video equipment (VHS players and DVD players)	453	1,133	3,560	8,324	13,404	18,297	21,129
Audio equipment (audio players, CD players, and MP3 players)	626	1,564	4,470	9,203	16,277	18,179	20,028
Video cassettes and discs	.....	.....	687	5,930	10,636	13,120	12,712
Motorcycles	75	516	2,936	2,049	6,329	9,269	13,333
Pork meat	2,581	4,149	9,841	15,971	18,219	25,799	29,950
Poultry meat	1,695	2,865	7,858	16,330	30,724	43,263	50,225
Cosmetics, perfumery, and bath preparations	1,477	3,351	9,710	20,073	26,171	39,587	54,089
Newspapers and Magazines	2,133	3,692	10,881	20,056	32,981	35,429	68,017
Land-line telephones services	2,151	4,773	13,218	28,313	48,632	40,447	28,380

Source: U.S. Bureau of Economic Analysis, "Table 2.4.5U. Personal Consumption Expenditures by Type of Product",
https://www.bea.gov/iTable/iTable.cfm?reqid=12&step=1&acrdn=2#reqid=12&step=3&isuri=1&1204=1959&1203=2017&1206=a&1205=1000&1210=x&1211=0.

Figure 4

Aggregate amount of expenditure for the consumption of the following goods and services
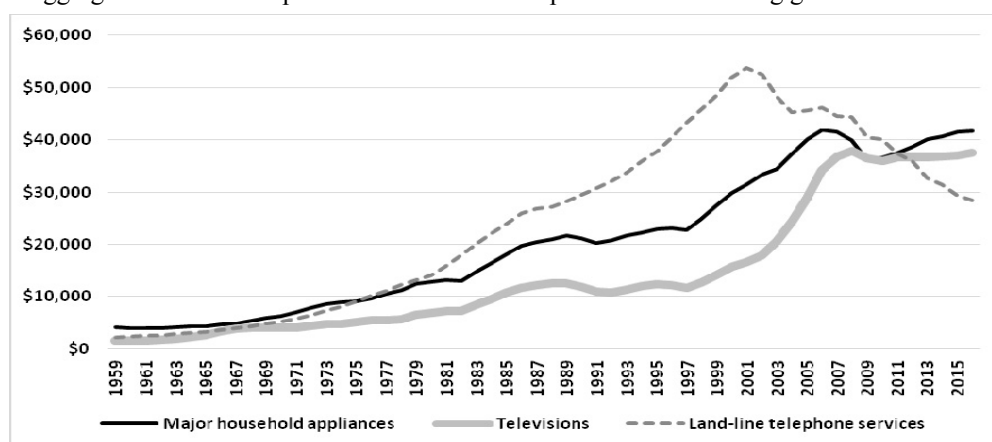
Figure 5

Aggregate amount of expenditure for the consumption of the following goods
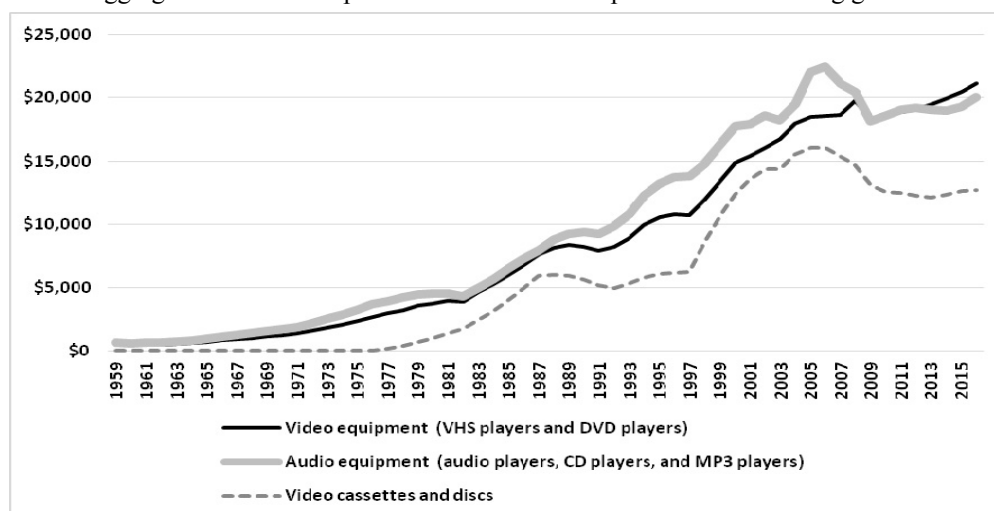

Figure 6

Aggregate amount of expenditure for the consumption of the following goods
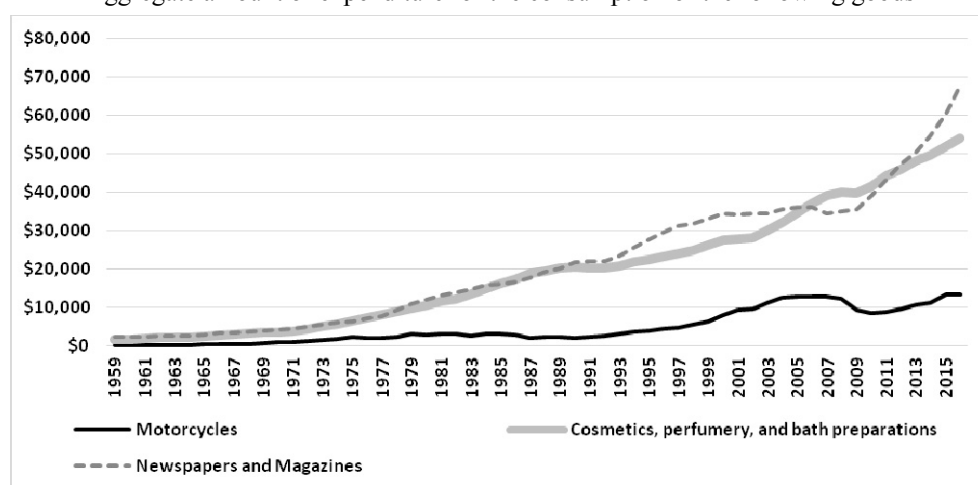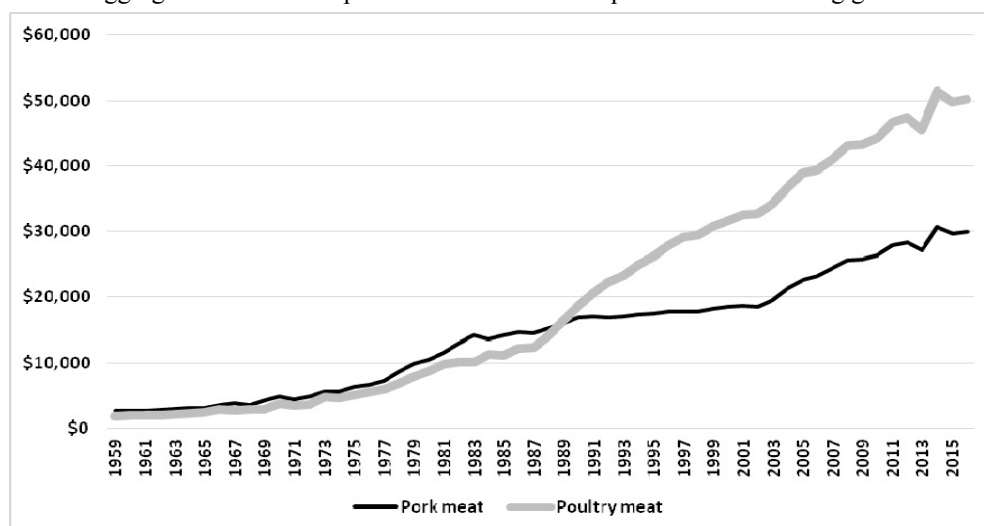
Figure 7

Aggregate amount of expenditure for the consumption of the following goods

Figures 4-7 illustrates that the amount of expenditure for the consumption of some goods and services increases while the amount of expenditure for the consumption of other goods and services decreases during the chosen period. But at a macroeconomic level, these observed changes in the aggregate amount of expenditure can be caused by the factor population growth. And for the purpose of our empirical study, we need to convert these macroeconomic data into microeconomic data by estimating the average amount of expenditure per capita for the consumption of the selected goods and services for every single year of the whole period. In this way, we isolate one of the factors which affect the change in the amount of expenditure, the rate of population growth.

Table 3

Number of the U.S. Population for each single year between 1959 and 2016

Year	Number	Year	Number	Year	Number	Year	Number	Year	Number	Year	Number
1959	177,829,600	1969	202,677,000	1979	225,055,500	1989	246,819,200	1999	279,040,200	2009	306,771,500
1960	180,671,200	1970	205,052,200	1980	227,224,700	1990	249,622,800	2000	282,162,400	2010	309,347,100
1961	183,691,500	1971	207,660,700	1981	229,465,700	1991	252,980,900	2001	284,969,000	2011	311,721,600
1962	186,537,700	1972	209,896,000	1982	231,664,500	1992	256,514,200	2002	287,625,200	2012	314,112,100
1963	189,241,800	1973	211,908,800	1983	233,792,000	1993	259,918,600	2003	290,107,900	2013	316,497,500
1964	191,888,800	1974	213,853,900	1984	235,824,900	1994	263,125,800	2004	292,805,300	2014	318,857,100
1965	194,303,000	1975	215,973,200	1985	237,923,800	1995	266,278,400	2005	295,516,600	2015	321,362,800
1966	196,560,300	1976	218,035,200	1986	240,132,900	1996	269,394,300	2006	298,379,900	2016	323,848,700
1967	198,712,100	1977	220,239,400	1987	242,288,900	1997	272,646,900	2007	301,231,200		
1968	200,706,000	1978	222,584,500	1988	244,499,000	1998	275,854,100	2008	304,094,000		

Source: Organization of Economic Cooperation and Development (OECD),
https://stats.oecd.org/Index.aspx?DataSetCode=SNA_TABLE5.

Table 3 provides statistical data for the number of the U.S. population for the same time period for which we already have data about the aggregate amount of expenditure for the consumption of our selected goods and services. Having these statistical data, we can already estimate the average amount of expenditure per capita for the consumption of the selected goods and services. We need this further estimation for two reasons. First, we need to isolate the factor population because we already mentioned that the aggregate consumption can increase or decrease as a result of changes in the number of the population. By estimating the average amount of expenditure per capita for each single year of the whole period, we keep the factor population as a constant value which already is impossible to affect the results of our empirical study. But the second and more important reason to estimate the average amount of expenditure per capita is to obtain information for the average consumption at individual level because that is the main object of this empirical study.

Table 4

Average amount of expenditure per capita for the consumption of selected goods and services in the USA for the period 1959-2016 (brief version) (USD)

Goods and Services	1959	1969	1979	1989	1999	2009	2016
Major household appliances	23.13	29.22	55.38	87.80	98.91	117.79	128.85
Televisions	8.87	19.93	28.73	50.77	50.67	119.18	115.90
Video equipment (VHS players and DVD players)	2.55	5.59	15.82	33.73	48.04	59.64	65.24
Audio equipment (audio players, CD players, and MP3 players)	3.52	7.72	19.86	37.29	58.33	59.26	61.84
Video cassettes and discs	.....	.....	3.05	24.03	38.12	42.77	39.25
Motorcycles	0.42	2.55	13.05	8.30	22.68	30.21	41.17
Pork meat	14.51	20.47	43.73	64.71	65.29	84.10	92.48
Poultry meat	9.53	14.14	34.92	66.16	110.11	141.03	155.09
Cosmetics, perfumery, and bath preparations	8.31	16.53	43.14	81.33	93.79	129.04	167.02
Newspapers and Magazines	11.99	18.22	48.35	81.26	118.19	115.49	210.03
Land-line telephones services	12.10	23.55	58.73	114.71	174.28	131.85	87.63

Source: Author's calculations based on the data–U.S. Bureau of Economic Analysis, "Table 2.4.5U. Personal Consumption Expenditures by Type of Product",
https://www.bea.gov/iTable/iTable.cfm?reqid=12&step=1&acrdn=2#reqid=12&step=3&isuri=1&1 204=1959&1203=2017&1206=a&1205=1000&1210=x&1211=0.

Figure 8
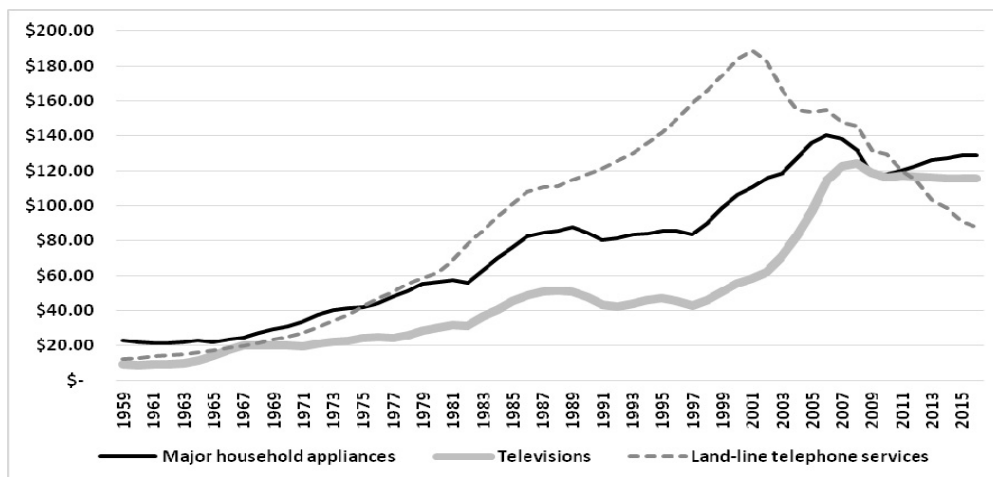Average amount of expenditure per capita for the consumption of the following goods and services

Figure 9
Average amount of expenditure per capita for the consumption of the following goods
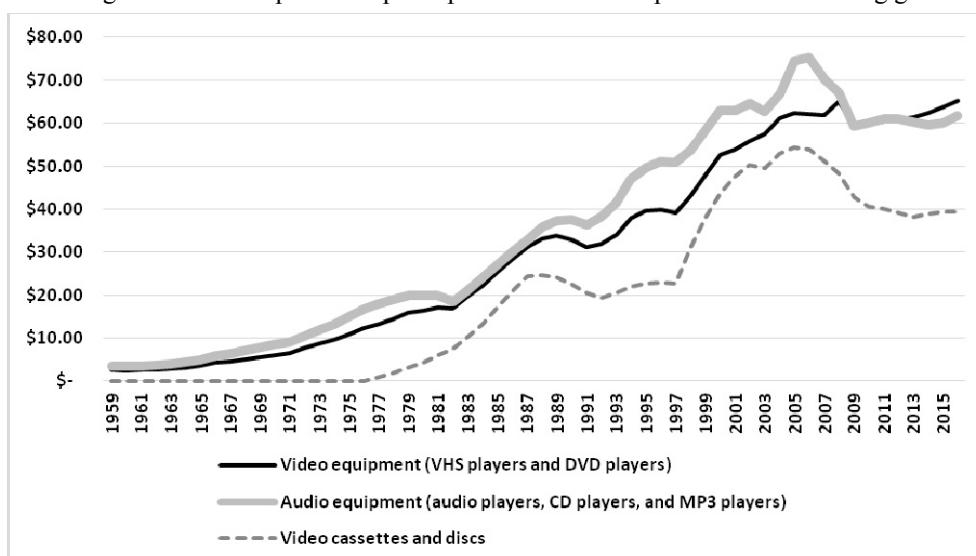
Figure 10
Average amount of expenditure per capita for the consumption of the following goods
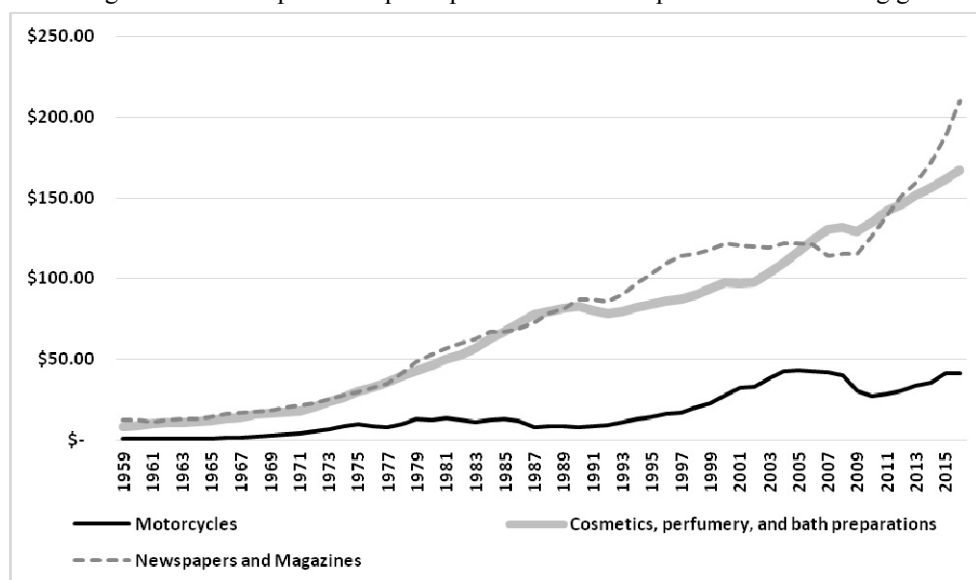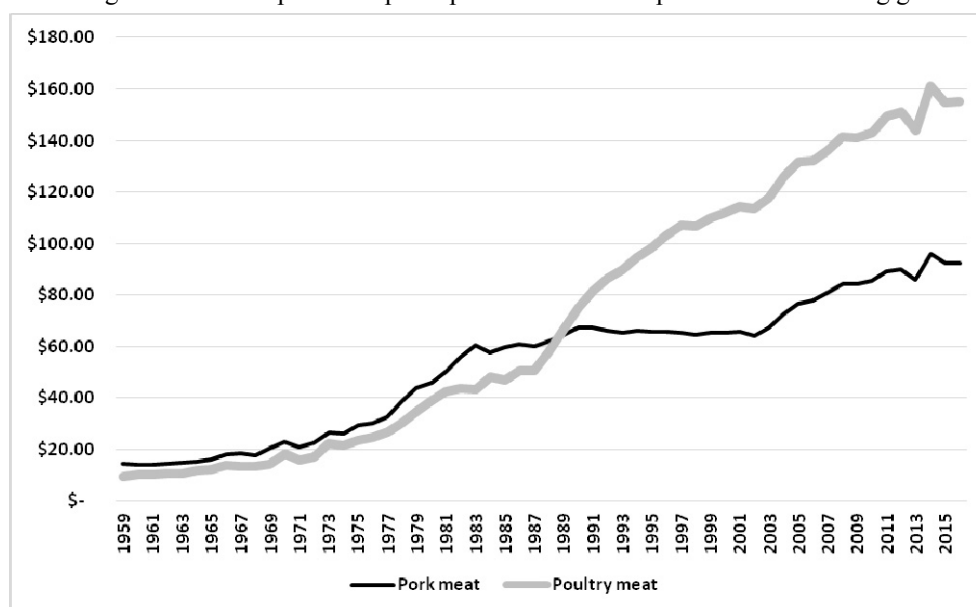

Figure 11
Average amount of expenditure per capita for the consumption of the following goods

What is clearly seen on Figures 8-11 is that on microeconomic level, the average amount of expenditure per capita for the consumption of major household appliances, televisions, land-line telephone services, VHS players and DVD players, audio players, CD players, and MP3 players, video cassettes and discs, motorcycles, and pork meat either decrease or at least remain constant after some point of the whole period between 1959 and 2016. Of course, it is not excluded the observed stagnations and decreases in the consumption of these goods and services to be as a result of the factor income. That is, the level of income may also have undergone the same reduction periods as those in which we observe reduction or stagnation in the consumption of the several goods and services illustrated on Figures 8-11. However, if we want to prove that the observed reduction or stagnation in the consumption is caused by satiation of the consumer wants, we have to examine only those intervals in which the level of income is continuously increasing.

Table 5

Real Gross Disposable Income (after-tax) in chained 2009 U.S. dollars

Year	Income	Year	Income	Year	Income
1959	2,092,100,000,000	1979	4,557,800,000,000	1999	8,477,700,000,000
1960	2,146,900,000,000	1980	4,590,500,000,000	2000	8,902,200,000,000
1961	2,222,700,000,000	1981	4,705,600,000,000	2001	9,148,700,000,000
1962	2,328,900,000,000	1982	4,803,300,000,000	2002	9,431,600,000,000
1963	2,416,500,000,000	1983	4,971,000,000,000	2003	9,690,100,000,000
1964	2,588,100,000,000	1984	5,314,000,000,000	2004	10,035,700,000,000
1965	2,748,900,000,000	1985	5,476,200,000,000	2005	10,189,400,000,000
1966	2,895,000,000,000	1986	5,687,800,000,000	2006	10,595,400,000,000
1967	3,020,600,000,000	1987	5,811,000,000,000	2007	10,820,600,000,000
1968	3,157,400,000,000	1988	6,083,900,000,000	2008	10,987,300,000,000
1969	3,264,400,000,000	1989	6,268,700,000,000	2009	10,942,500,000,000
1970	3,413,200,000,000	1990	6,393,500,000,000	2010	11,055,100,000,000
1971	3,570,400,000,000	1991	6,438,400,000,000	2011	11,331,200,000,000
1972	3,741,200,000,000	1992	6,714,200,000,000	2012	11,688,300,000,000
1973	3,968,600,000,000	1993	6,823,600,000,000	2013	11,527,600,000,000
1974	3,923,600,000,000	1994	7,010,700,000,000	2014	11,931,000,000,000
1975	4,020,000,000,000	1995	7,245,800,000,000	2015	12,343,300,000,000
1976	4,144,000,000,000	1996	7,476,100,000,000	2016	12,677,400,000,000
1977	4,274,800,000,000	1997	7,751,300,000,000		
1978	4,470,500,000,000	1998	8,208,100,000,000		

Source: U.S. Bureau of Economic Analysis, "Table 1.17.6. Real Gross Domestic Income, Real Disposable Personal Income in chained 2009 U.S. Dollars",
https://www.bea.gov/iTable/iTable.cfm?reqid=9&step=1&acrdn=2#reqid=9&step=3&isuri=1&904=1959&903=318&906=a&905=1000&910=x&911=0.

Table 6

Real Average Disposable Personal Income (after-tax) per capita in chained 2009 U.S. dollars

Year	Income	Year	Income	Year	Income	Year	Income	Year	Income	Year	Income
1959	11,765	1969	16,106	1979	20,252	1989	25,398	1999	30,382	2009	35,670
1960	11,883	1970	16,646	1980	20,202	1990	25,613	2000	31,550	2010	35,737
1961	12,100	1971	17,193	1981	20,507	1991	25,450	2001	32,104	2011	36,350
1962	12,485	1972	17,824	1982	20,734	1992	26,175	2002	32,791	2012	37,211
1963	12,769	1973	18,728	1983	21,262	1993	26,253	2003	33,402	2013	36,422
1964	13,487	1974	18,347	1984	22,534	1994	26,644	2004	34,274	2014	37,418
1965	14,147	1975	18,613	1985	23,017	1995	27,211	2005	34,480	2015	38,409
1966	14,728	1976	19,006	1986	23,686	1996	27,752	2006	35,510	2016	39,146
1967	15,201	1977	19,410	1987	23,984	1997	28,430	2007	35,921		
1968	15,731	1978	20,085	1988	24,883	1998	29,755	2008	36,131		

Source: Author's calculations based on the data–U.S. Bureau of Economic Analysis, "Table 1.17.6.
Real Gross Domestic Income, Real Disposable Personal Income in chained 2009 U.S. Dollars",
https://www.bea.gov/iTable/iTable.cfm?reqid=9&step=1&acrdn=2#reqid=9&step=3&isuri=1&904
=1959&903=318&906=a&905=1000&910=x&911=0

Table 7

Annual Growth of the Real Average Disposable Personal Income (after-tax) per capita in chained 2009 U.S. dollars

Year	Growth	Year	Growth	Year	Growth	Year	Growth	Year	Growth	Year	Growth
1959	0	1969	375	1979	167	1989	515	1999	626	2009	-461
1960	118	1970	539	1980	-49	1990	215	2000	1,168	2010	67
1961	217	1971	548	1981	304	1991	-163	2001	554	2011	614
1962	385	1972	631	1982	227	1992	725	2002	687	2012	860
1963	285	1973	904	1983	529	1993	78	2003	610	2013	-788
1964	718	1974	-381	1984	1,271	1994	391	2004	873	2014	996
1965	660	1975	266	1985	483	1995	567	2005	206	2015	991
1966	581	1976	393	1986	669	1996	540	2006	1,030	2016	737
1967	473	1977	404	1987	298	1997	678	2007	411		
1968	531	1978	675	1988	899	1998	1,325	2008	210		

Source: Author's calculations based on the data–U.S. Bureau of Economic Analysis, "Table 1.17.6.
Real Gross Domestic Income, Real Disposable Personal Income in chained 2009 U.S. Dollars",
https://www.bea.gov/iTable/iTable.cfm?reqid=9&step=1&acrdn=2#reqid=9&step=3&isuri=1&904
=1959&903=318&906=a&905=1000&910=x&911=0

Table 8

Years with negative income growth

Years with negative income growth				
1974	1980	1991	2009	2013

Intervals with continuously increasing level of income

Intervals with continuously increasing level of income			
№	since	to	duration
1.	1959 –	1973	15 years
2.	1975 –	1979	5 years
3.	1981 –	1990	10 years
4.	1992 –	2008	17 years
5.	2010 –	2012	3 years
6.	2014 –	2016	3 years

Table 5 provides statistical data for the real gross disposable income (after-tax) in chained 2009 U.S. dollars for the whole period since 1959 through 2016. And having already access to the statistical data in Table 3 for the number of the U.S. population for the same period between 1959 and 2016, in Table 6 we calculate the real average disposable personal income (after-tax) per capita in chained 2009 U.S. dollars. Based on the derived data for the real average disposable personal income (after-tax) per capita in chained 2009 U.S. dollars, we calculate in Table 7 the annual growth of the income which gives us information for the intervals with continuously increasing level of income in Table 8. And exactly these are the separate intervals that we need in order to conduct appropriately our empirical study.

The purpose of this study is to examine among a wide range of goods and services whether the Engel curve displays satiation of the consumer wants in the form of zero or even negative slope from a certain level of income onwards. To achieve this purpose in our empirical study, we decide to conduct a non-linear regression curve fitting analysis between the independent variable real disposable income and the dependent variable amount of expenditure for the consumption of a particular good or service. As the results of the study should confirm the statistical significance of a logarithmic, logistic (sigmoid), or quadratic relationship between the two variables depending on whether the good is respectively either a necessity, normal, or an inferior good. And exactly these three kinds of non-linear relationships between the two variables reproduce Engel curves displaying satiation of the consumer wants in the form of zero or negative slope from a certain level of income onwards. The non-linear regression curve fitting analysis between the independent variable real disposable income and the dependent variable amount of expenditure for the consumption of a particular good or service will be conducted only for those intervals with continuously increasing level of income.

According to the law of demand however, the quantity demanded for a particular good or service is determined by the factor price. That is, a change in the factor price causes a change in the quantity demanded, all other things equal. This means, that if we want in our empirical study to examine the relationship between the factor income and the demand for a particular good or service at each price, first we need to isolate the factor price as a

constant. For example, if we conduct regression analysis between the independent variable income and the dependent variable nominal amount of expenditure for the consumption of a particular good or service, this study will not produce reliable results because the change in the nominal amount of expenditure for the consumption of any good or service can be caused not only by the factor income but also by the factor price of that good or service. For this reason, in order to isolate the factor price as constant, it is required in our empirical study to conduct the non-linear regression curve fitting analysis between the level of the real disposable income per capita in chained dollars and the inflation-adjusted amount of expenditure for the consumption of the particular good or service in the same chained dollars. We already have statistical data with the real average disposable personal income (after-tax) per capita in chained 2009 U.S. dollars, and now we need only to calculate and the inflation-adjusted amount of expenditure for the consumption of our selected goods and services in chained 2009 U.S. dollars for each single year since 1959 through 2016.

Table 9

Price Indexes for personal consumption expenditures of selected goods and services in the USA for the period 1959-2016 (brief version), Index Numbers: 2009 = 100

Goods and Services	1959	1969	1979	1989	1999	2009	2016
Major household appliances	60.911	55.927	83.307	99.850	96.123	100.000	81.386
Televisions	1,268.737	1,000.867	1,034.472	754.490	521.893	100.000	25.876
Video equipment (VHS players and DVD players)	1,351.102	1,351.102	1,358.674	896.999	430.138	100.000	55.188
Audio equipment (audio players, CD players, and MP3 players)	240.985	187.351	210.779	201.367	166.820	100.000	69.762
Video cassettes and discs	.....	.....	431.842	285.077	155.421	100.000	69.886
Motorcycles	26.571	26.192	41.661	64.649	94.438	100.000	111.078
Pork meat	20.499	27.201	53.127	66.208	80.486	100.000	116.033
Poultry meat	29.480	30.538	50.134	68.916	77.291	100.000	113.012
Cosmetics, perfumery, and bath preparations	23.966	26.095	45.280	71.462	90.027	100.000	102.826
Newspapers and Magazines	10.528	15.834	30.332	52.604	78.311	100.000	124.566
Land-line telephones services	22.449	22.688	29.705	62.012	71.337	100.000	115.775

Source: U.S. Bureau of Economic Analysis, "Table 2.4.4U. Price Indexes for Personal Consumption Expenditures by Type of Product",
https://www.bea.gov/iTable/iTable.cfm?reqid=12&step=1&acrdn=2#reqid=12&step=3&isuri=1&1 204=1959&1203=2016&1206=a&1205=1000&1210=x&1211=0.

Table 10

Average inflation-adjusted amount of expenditure per capita for the consumption of
selected goods and services in the USA for the period 1959-2016 (brief version) (USD)

Goods and Services	1959	1969	1979	1989	1999	2009	2016
Major household appliances	37.97	52.25	66.48	87.93	102.90	117.79	158.32
Televisions	0.70	1.99	2.78	6.73	9.71	119.18	447.89
Video equipment (VHS players and DVD players)	0.19	0.41	1.16	3.76	11.17	59.64	118.22
Audio equipment (audio players, CD players, and MP3 players)	1.46	4.12	9.42	18.52	34.97	59.26	88.65
Video cassettes and discs	.....	.....	0.71	8.43	24.52	42.77	56.17
Motorcycles	1.59	9.72	31.31	12.84	24.02	30.21	37.06
Pork meat	70.80	75.26	82.31	97.73	81.12	84.10	79.70
Poultry meat	32.33	46.29	69.65	96.00	142.46	141.03	137.23
Cosmetics, perfumery, and bath preparations	34.66	63.36	95.28	113.80	104.18	129.04	162.43
Newspapers and Magazines	113.93	115.04	159.40	154.47	150.93	115.49	168.61
Land-line telephones services	53.88	103.80	197.72	184.98	244.31	131.85	75.69

Source: Author's calculations based on the data in Table 4 and Table 9.

Now, we already have the all necessary statistical data for the conduction of the non-linear regression curve fitting analysis between the independent variable real average disposable personal income (after-tax) per capita in chained 2009 U.S. dollars in Table 6 and the dependent variable inflation-adjusted average amount of expenditure per capita for the consumption of the selected goods and services in chained 2009 U.S. dollars in Table 10. As we expect the results of this empirical study to confirm the statistical significance of a logarithmic, logistic (sigmoid), or quadratic relationship between the two variables depending on whether the good is respectively either necessity, normal, or inferior. And these three kinds of relationships between the two variables reproduce Engel curves displaying satiation of the consumer wants in the form of zero or negative slope from a certain level of income onwards.

6. Empirical Results

We conduct the non-linear regression curve fitting analysis between the independent variable real disposable income per capita and the dependent variable inflation-adjusted average amount of expenditure per capita for the consumption of the selected goods and services by using the assistance of the software IBM SPSS Statistics 24.0. And to interpret the results from this analysis, we are using the following indicators.

First, the value of the correlation coefficient r explains the strength of the relationship between the two variables examined. When the absolute value of the correlation coefficient r is in the range between 0 and 0.3, it is assumed that the relationship between the two variables is weak, between 0.3 and 0.7 – the relationship is average, and in the range between 0.7 and 1 – the relationship is strong. Second, the value of the determination

coefficient r^2 (R Squared) shows what percentage of the scattering of the dependent variable is the result of the action of the independent variable. As in our case, the dependent variable is the average amount of expenditure per capita for the consumption of good 'X', and the independent variable is the real disposable income per capita. Third, the significance level of the F criterion denoted as Sig. F indicates whether the examined model is statistically adequate or inadequate. When the significance level of the F criterion denoted as Sig. F has a value less than the error $\alpha = 0.05$, it is assumed that the model satisfactorily represents the relationship between the two variables and therefore we can assume that the examined model is statistically adequate.

In our empirical study, the confirmation of a logarithmic, logistic (sigmoid), or quadratic relationship between the two variables depending on whether the good is respectively either a necessity, normal, or an inferior good, would be statistically adequate provided that the values of the correlation coefficient r and the determination coefficient r^2 (R Squared) are closer to 1, and also the significance level of the F criterion denoted as Sig. F has a value less than the error $\alpha = 0.05$.

1. Necessity goods – for the selected necessity goods, the results in Figures 12-14 show that we have statistical confirmation of a logarithmic relationship between the independent variable real disposable income per capita and the dependent variable inflation-adjusted average amount of expenditure per capita for the consumption of poultry meat during the interval 1962-1973, and for the consumption of cosmetics, perfumery, and bath preparations during two separate intervals, respectively 1959-1971, and 1982-1990.

Figure 12
Consumption of cosmetics, perfumery, and bath preparations during the interval 1959-1971
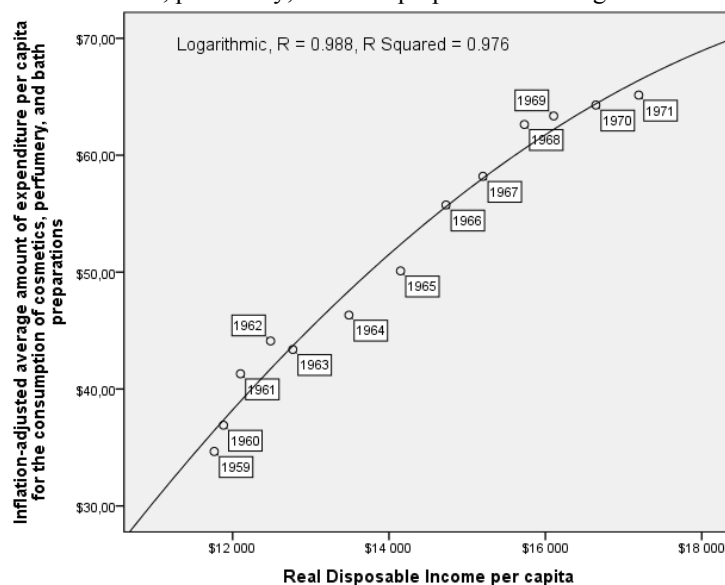
The logarithmic relationship is statically adequate when the correlation coefficient r and the determination coefficient r^2 (R Squared) are closer to 1.000.
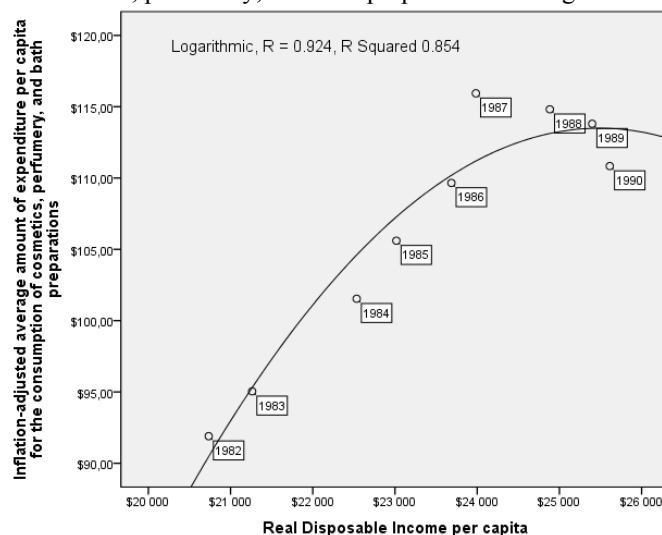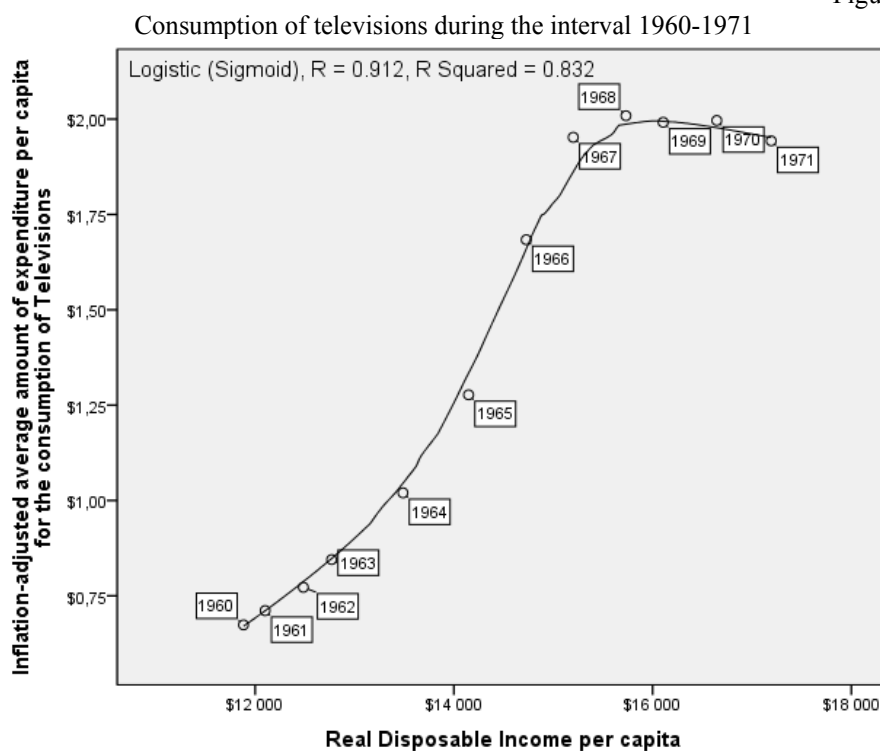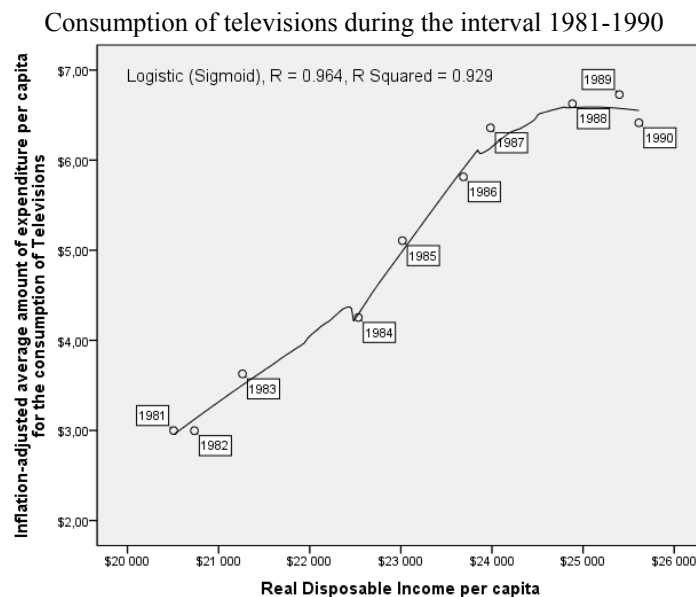
Figure 13
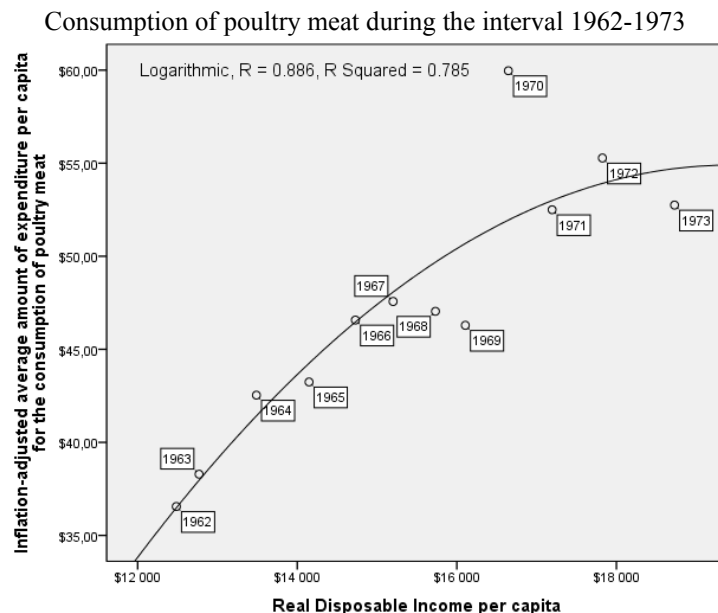
Consumption of poultry meat during the interval 1962-1973

The logarithmic relationship is statically adequate when the correlation coefficient r and the determination coefficient r^2 (R Squared) are closer to 1.000.

Figure 14

Consumption of cosmetics, perfumery, and bath preparations during the interval 1982-1990

29

The logarithmic relationship is statically adequate when the correlation coefficient r and the determination coefficient r^2 (R Squared) are closer to 1.000.

2. Normal goods – for the selected normal goods, the results in Figures 15-23 show that we have statistical confirmation of a logistic (sigmoid) relationship between the independent variable real disposable income per capita and the dependent variable inflation-adjusted average amount of expenditure per capita for the consumption of televisions during two separate intervals, respectively 1960-1971, and 1981-1990, for the consumption of VHS players during the interval 1981-1990, for the consumption of video cassettes during the same interval 1981-1990, for the consumption of audio players during the interval 1982-1990, for the consumption of major household appliances during two separate intervals, respectively 1982-1990, and 1992-2008, for the consumption of video cassettes and discs during the interval 1992-2007, and for the consumption of motorcycles during the interval 1992-2008.

Figure 15

Consumption of televisions during the interval 1960-1971

The sigmoid relationship is statically adequate when the correlation coefficient r and the determination coefficient r^2 (R Squared) are closer to 1.000.

Figure 16

Consumption of televisions during the interval 1981-1990

The sigmoid relationship is statically adequate when the correlation coefficient r and the determination coefficient r² (R Squared) are closer to 1.000.
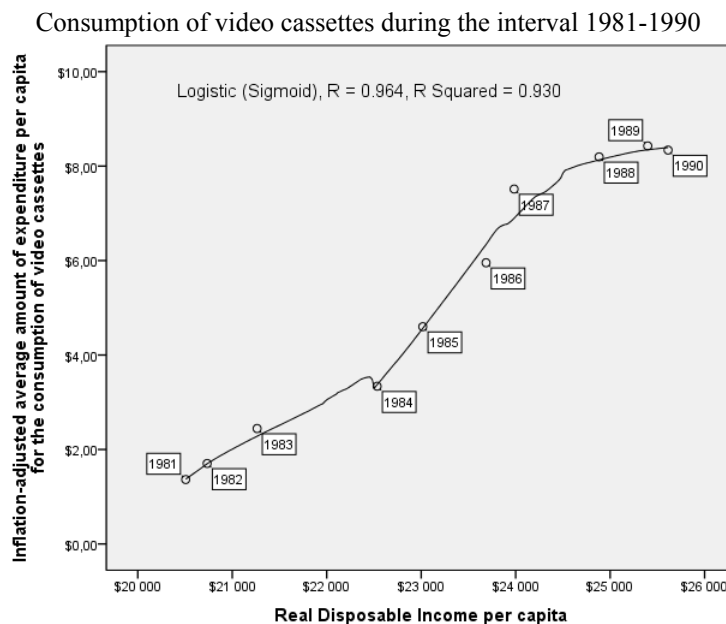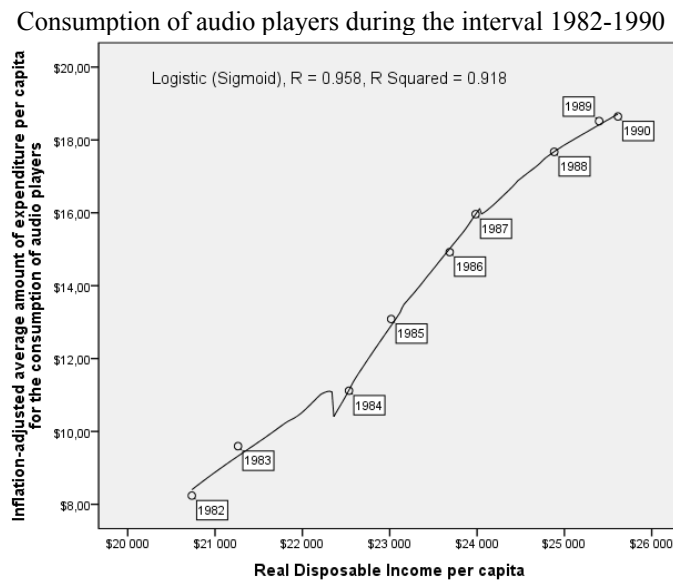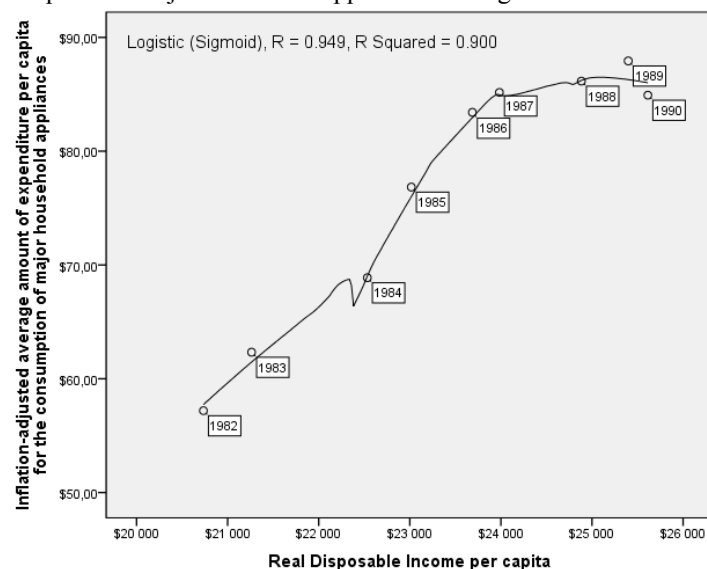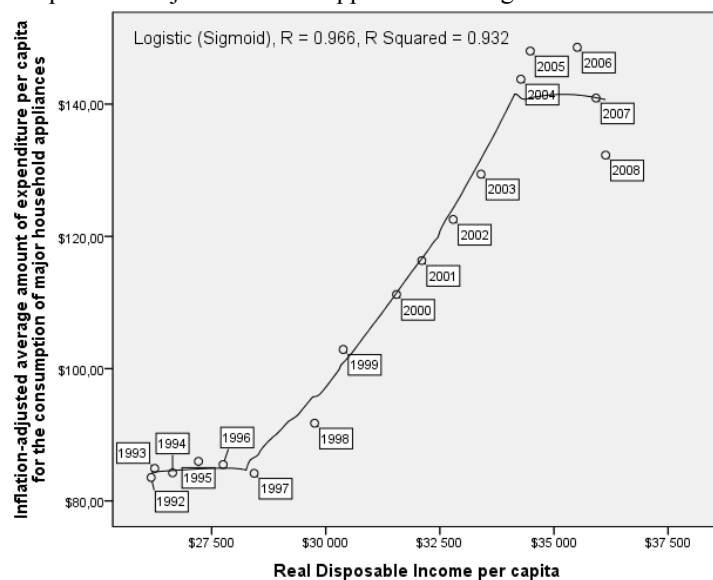
Figure 17

Consumption of VHS players during the interval 1981-1990
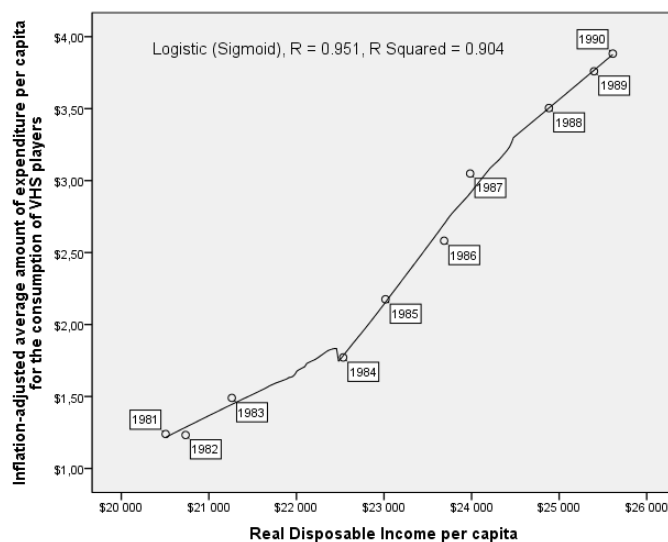
The sigmoid relationship is statically adequate when the correlation coefficient r and the determination coefficient r² (R Squared) are closer to 1.000.

Figure 18

Consumption of video cassettes during the interval 1981-1990

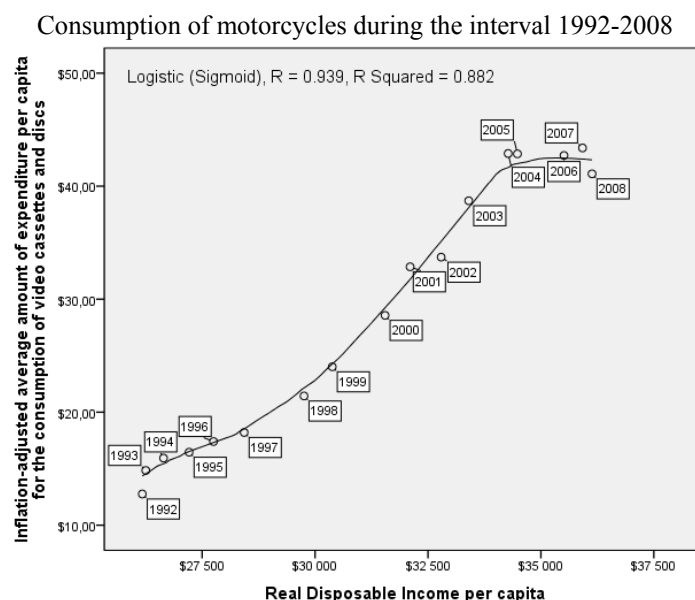*The sigmoid relationship is statically adequate when the correlation coefficient r and the determination coefficient r^2 (R Squared) are closer to 1.000.*

Figure 19

Consumption of audio players during the interval 1982-1990

The sigmoid relationship is statically adequate when the correlation coefficient r and the determination coefficient r^2 (R Squared) are closer to 1.000.

Figure 20

Consumption of major household appliances during the interval 1982-1990

The sigmoid relationship is statically adequate when the correlation coefficient r and the determination coefficient r^2 (R Squared) are closer to 1.000.
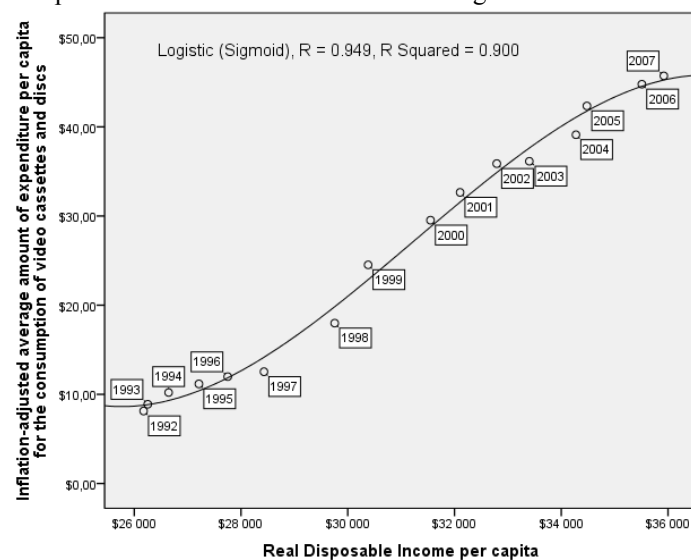
Figure 21

Consumption of major household appliances during the interval 1992-2008

The sigmoid relationship is statically adequate when the correlation coefficient r and the determination coefficient r^2 (R Squared) are closer to 1.000.

Figure 22

Consumption of motorcycles during the interval 1992-2008

The sigmoid relationship is statically adequate when the correlation coefficient r and the determination coefficient r[2] (R Squared) are closer to 1.000.
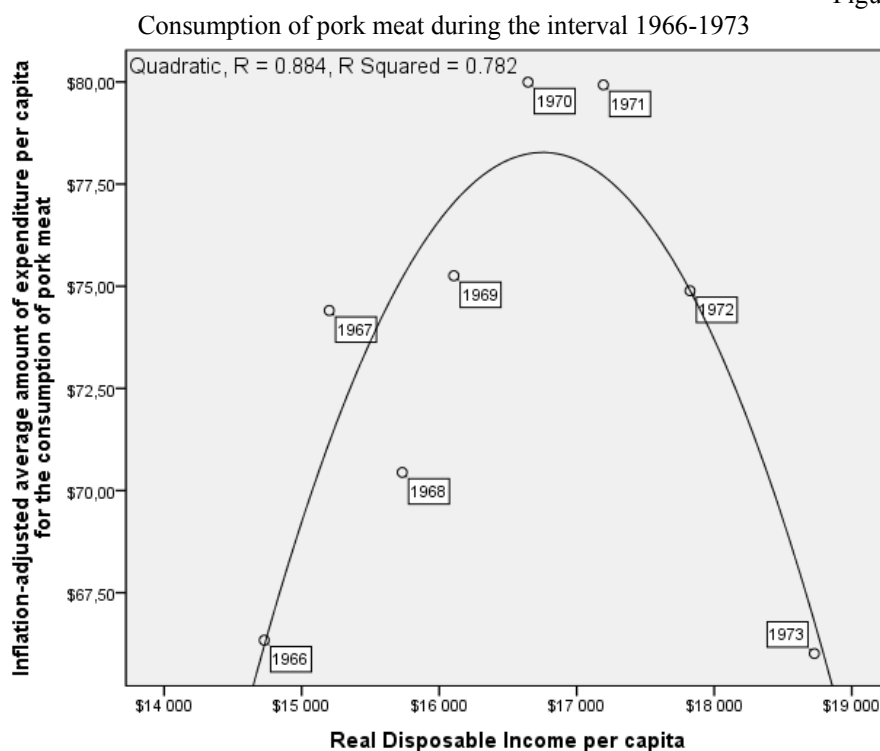
Figure 23

Consumption of video cassettes and discs during the interval 1992-2007

The sigmoid relationship is statically adequate when the correlation coefficient r and the determination coefficient r[2] (R Squared) are closer to 1.000.

3. Inferior goods – for the selected inferior goods, the results in Figures 24-26 show that we have statistical confirmation of a quadratic relationship between the independent variable real disposable income per capita and the dependent variable inflation-adjusted average amount of expenditure per capita for the consumption of pork meat during the interval 1966 – 1973, for the consumption of newspapers and magazines during the interval 1992 – 2008, and for the consumption of land-line telephone services during the same interval 1992 – 2008.
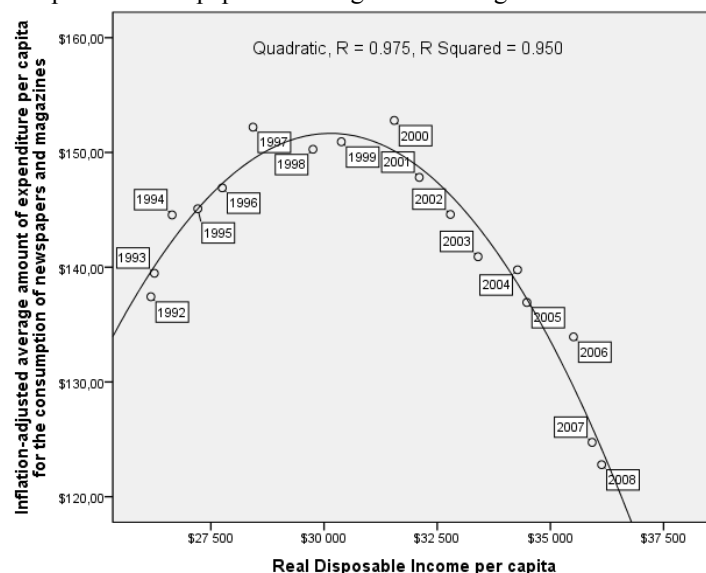
Figure 24

Consumption of pork meat during the interval 1966-1973

The quadratic relationship is statically adequate when the correlation coefficient r and the determination coefficient r^2 (R Squared) are closer to 1.000.
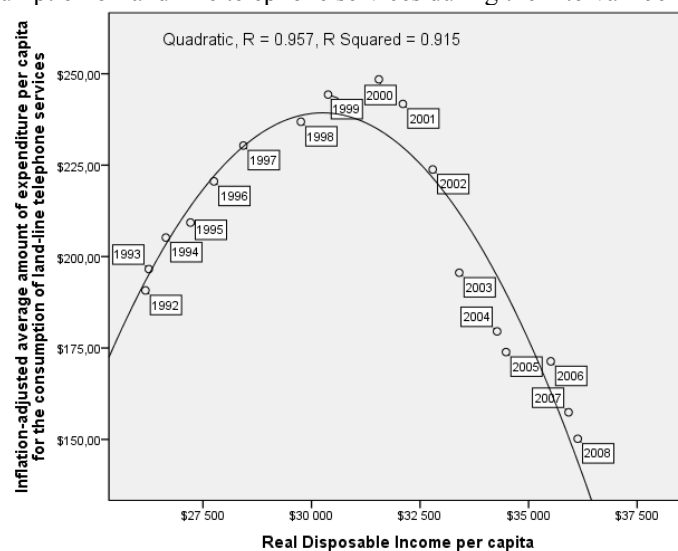
Figure 25

Consumption of newspapers and magazines during the interval 1992-2008

The quadratic relationship is statically adequate when the correlation coefficient r and the determination coefficient r^2 (R Squared) are closer to 1.000.

Figure 26

Consumption of land-line telephone services during the interval 1992-2008

The quadratic relationship is statically adequate when the correlation coefficient r and the determination coefficient r^2 (R Squared) are closer to 1.000.

7. Conclusion

The results from the conducted study empirically confirm that there is indeed satiation of the consumer wants represented by the Engel curves theoretically described in Luigi Pasinetti (1981: 73) which display an upper limit on the average amount of expenditure per capita that is allocated by a consumer to any one of the selected goods and services in our study, regardless of how much his income grows. And furthermore, our empirical results confirm that there is satiation of the consumer wants for all three types of goods, as their Engel curves display satiation of the consumer wants in the form of zero slope for the necessities and normal goods and in the form of negative slope for the inferior goods from a certain level of income onwards.

First, our analysis on the obtained results from the empirical study starts with the selected necessity goods. The observed slowdown in the consumption of poultry meat during the examined 1962 – 1973 interval actually reproduces the empirical evidence of the Engel (1857) study which empirically confirmed that the richer a consumer becomes, he will spend less percentage of his income on food. While a good explanation for the slowdown in the consumption of cosmetics, perfumery, and bath preparations during the two separate intervals, respectively 1959 – 1971, and 1982 – 1990, could be explained with the fact that the richer a consumer becomes, he will prefer to spend greater proportion of his income not on necessities but on other normal goods which are luxuries.

Then, our analysis on the obtained results from the empirical study continues with the selected normal goods. The analysis shows that while the income of the consumer was growing permanently during the two intervals 1960 – 1971, and 1981 – 1990, we observe in our empirical study that at some point there is a slowdown in the consumption of televisions. The former slowdown in the consumption of televisions can be explained with the fact that until the end of the 1960 – 1971 interval a vast majority of the consumers had already possessed black-and-white televisions, and only a small percentage of them wanted to replace their old black-and-white televisions for new black-and-white televisions. But after, the advent of the coloured televisions in the early 1980s, we observe a new rapid growth in the purchase of new televisions, this time coloured televisions, which growth was again followed by a slowdown in the consumption of televisions until the end of the 1981 – 1990 interval. And, again this slowdown in the consumption of televisions can be explained for the same reasons like the first slowdown that the vast majority of the consumers had already possessed coloured televisions and there was no further need to replace them. Also, we can use exactly the same reasons in order to explain the slowdown in the consumption of such normal goods as VHS players and their complementary goods video cassettes during the interval 1981 – 1990, audio players and major household appliances during the interval 1982 – 1990. Actually, all these normal goods that we listed so far are the perfect examples that there is always a satiation of the consumer wants when a product enters the maturity stage of its life cycle.

And finally, our analysis on the obtained results from the empirical study ends with the selected inferior goods. In our empirical study, we observe that while the income of the consumers was continuously growing during the interval 1966 – 1973, at the same time there was a decline in the consumption of pork meat which can be explained with the fact

that in terms of healthy food, the pork meat is an inferior substitute to the poultry meat which consumption was growing during the same interval. The decline in the consumption of newspapers and magazines, and land-line telephone services during the 1992 – 2008 interval when the income of the consumers was also continuously growing can be explained with the advent of the electronic media on Internet which caused decline in the consumption of newspapers and magazines, and with the advent of the mobile telephone services which caused decline in the consumption of land-line telephone services.

Based on the results from this empirical study, we reach to the conclusion that the validity of the non-satiation axiom in the neoclassical consumer choice theory is being rejected.

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