GASOLINE AND DIESEL PRICE AND INCOME ELASTICITIES

UDK: <338.5:665.733>:330.564.26 / JEL: Q48 ; R48 ; E24 / PRELIMINARY COMMUNICATION

IVO DRUŽIĆ
PROFESSOR
UNIVERSITY OF ZAGREB
FACULTY OF ECONOMICS AND BUSINESS
ZAGREB, CROATIA
idruzic@efzg.hr

TOMISLAV GELO
ASSISTANT PROFESSOR
UNIVERSITY OF ZAGREB
FACULTY OF ECONOMICS AND BUSINESS
ZAGREB, CROATIA
tgelo@efzg.hr

IVAN ŠUŠNJAR
PRVO PLINARSKO DRUŠTVO
ZAGREB, CROATIA
ivan.susnjar@ppd.hr

ABSTRACT

The paper analyzes the price and income elasticity of demand for petroleum products, gasoline and diesel. With regard to the share of petroleum products in the structure of household expenses, as well as the share in the government budget revenues, the elasticities of demand for petroleum products are one of the essential elements for the implementation of the economic policy. The paper provides a theoretical overview of elasticities. The price, income and cross-elasticity of demand and their application to petroleum products are presented. The difference between the short-run and long-run effects on the elasticity of demand for petroleum products is emphasized. The influence of fiscal policy on the elasticity of demand, with regard to both price and income, is analyzed. The conclusion is that the elasticity of demand for petroleum products (price and income) has decreased over time.

KEY WORDS: demand, gasoline, price, income, elasticity, transport.

1. INTRODUCTION

The price and income elasticity of demand for petroleum products is important for the economic policy of any country. The income elasticity of demand for petroleum products can offer insight into the extent to which the demand for petroleum products shall increase if the income of the population increases and what direct or indirect implications it shall have on the economy (e.g. whether income growth increases the consumption of petroleum products, which in turn increases budget revenue, i.e. what is the extent of adverse effects on the environment). On the other hand, price elasticity facilitates insight into the effect additional taxation of petroleum products and filling of the budget shall have with regard to the fact that the demand for petroleum products is non-elastic. The basic characteristic of the elasticity of demand for petroleum products, both price and income, shall not be equal in higher and lower income groups, both at higher and lower prices. According to the economic theory, if the prices of petroleum products are increasing, the demand for them shall decrease, with the ceteris paribus assumption, indicating that the price and the required quantity are always negatively correlated. Income elasticity of demand for petroleum products signifies the response strength of the demand for petroleum products in relation to income change.

2. PRICE ELASTICITY OF DEMAND

With regard to statistical data processing methods, the demand for petroleum products can generally be divided into static and dynamic models. Since consumption, prices and income are mostly non-stationary variables, cointegration for the non-stationary variables is often used in analyzes to determine the long-run and short-run relations between petroleum product consumption and their price in the error correction model. The simplest static model for determining the demand for derivatives is reduced to the following equation (Dahl and Sterner, 1991):

G=f (P,Y,V, CHAR),

where

G is the petroleum product consumption,

P is the real petroleum product price,

Y is real income,

V is the vehicle number, and CHAR indicates the fleet characteristics.

The static[1] model of price elasticity of demand is most often expressed using a double log model:

$$\ln D_t = \beta_0 + \beta_1 \ln P_t + \beta_2 \ln Y_t + \varepsilon_t,$$

[1] An economic model showing a set of interdependencies between economic system variables that are in a state of equilibrium at a given time or time period.

where

D_t is the average demand for petroleum products at time t,

P_t is the real gasoline price at time t,

Y_t is real income at time t,

while ε_t is a standard error.

$$\frac{\delta \ln Dt}{\delta \ln Pt} = \beta 1$$

$$\frac{\delta \ln Dt}{\delta \ln Yt} = \beta 2$$

The dynamic[2] model provides a better understanding of the driver's reaction to short-run and long-run price changes, and unlike the static model, it also enables the determination of shifts in the driver's response to the price changes. The subject shift is manifested through increases in response possibilities, such as transferring to public transport or using more fuel-efficient vehicles. By using the dynamic model, it is possible to determine the consumption of petroleum products as a function of current prices, income, but also the function of previous consumption, as well as income and prices from earlier periods.

Dahl (Dahl and Sterner, 1991) indicated the demand for gasoline as a function of current gasoline prices (P_{gas}), current prices of other forms of transport (P_{trans}), current income (Y), gasoline price from the previous period (P_{gast}, -1), income from the previous period (Y_{t-1}) and the demand for gasoline in the previous period (G_{t-1})

$$G = f(P_{gas}, P_{trans}, Y, P_{veh}, P_{gast,-1}, Y_{t-1}\ G_{t-1})$$

The most commonly used approach refers to the use of a partial adaptation model (PAM) for processing de-trended variables:

$$\ln Dt = \beta_0 + \beta_1 \ln P_t + \beta_2 \ln Y_t + \beta_3 \ln Y_{t-1} + \varepsilon_t$$

In this case, the β_1 coefficient indicates the coefficient of short-run elasticity of demand, and the coefficient of long-run elasticity of demand is calculated using the formula $\beta_1/1- \beta_3$. The adjustment time is calculated using the formula $1/1-\beta_3$. In addition to this model, another model with variable rotations (Dahl and Sterner, 1991) is used:

$$\ln D_t = \beta_0 + \sum_{i=0}^{m} \beta_{Pi} \ln P_{t-1} + \sum_{i=0}^{n} \beta_{Yi} \ln Y_{t-1} + \sum_{i=0}^{q} \beta_{Di} \ln D_{t-1} + \varepsilon_t$$

Common to most models is the fact that demand for petroleum products is conditioned by disposable income, product price, cost of car ownership and use (insurance, maintenance, etc.), car technology, urban structure, i.e. population density and the development of the public transport infrastructure.

Using price elasticity data collected on a sample of more than a hundred countries, Dahl (2012) found that price elasticity was the higher elasticity at high price levels for both gasoline and diesel fuel, higher for countries with higher per capita income for gasoline, while it was lower for diesel on the sample of countries belonging to higher income classes. The price elasticities for gasoline defined based on historical studies ranged between -0.11 and -0.33, while those for diesel fuel ranged between -0.13 and -0.38.

Certain studies show that price elasticity shall not be the same for certain income classes. Table 1 presents the study of price elasticity in terms of belonging to a certain income class. It is evident that there are large differences in elasticity with regard to the country and observation period.

Table 1. Overview of the current price elasticity studies with regard to income

Author	Change in price elasticity with regard to income classes	Analyzed countries	Study period
Archibald and Gillingham	Reduces in higher income classes for households that own one car and is statistically insignificant for households with more than one car	USA	1980
Archibald and Gillingham	Statistically insignificant connection between price and income	USA	1981
Kayser	Continuously increases with increasing household income	USA	2000
West and Williams	Decreases with higher income classes, for the middle and lowest income level it statistically does not differ from zero	USA	2004
West	Decreases with higher income classes, but indicates a reverse character in the two highest	USA	2004
Blow and Crawford	Decreases with higher income classes	Great Britain	1987
Yatchew and No	Statistically insignificant connection between price and income	Canada	2001
Santos and Catchesides	Decreases, but very little with an increase in income classes	Great Britain	2004

Source: Wadud Z., Graham, D.J., Noland, R.B. (2009) Modelling fuel demand for different socio-economic groups, Applied Energy, 86, p. 2740–2749

[2] Dynamic models include the time line and the process of changing a single equilibrium state in time and the process of transformation from the initial to the final state

The price elasticity of demand for petroleum products is generally negative and may vary between different values. The elasticities shall vary depending on the type of travel (commercial, business, recreational, etc.), type of driver (rich, poor, young, old, etc.), travel conditions (rural, urban, congested), and the observed period (short-run, mid-run and long-run) (Litman, 2013). There are several manners in which prices can affect driver behavior and their driving decisions. The number of vehicles purchased and the type of vehicle itself are affected by the fixed car price, i.e. registration costs. The type of car chosen is largely determined by fuel prices and excise duties that are directly related to harmful gas emissions. Toll collection can affect the change in route and travel destination, while congestion can change the time of travel, as well as the travel model selected.

With regard to price elasticity of demand for petroleum products, it is usually very low, and the first response to an increase in fuel prices shall be a reduction in travels that take place for the purposes of relaxation, rest, shopping, etc. So far, several studies have been conducted on price elasticity of demand for petroleum products and all studies have in common the fact that elasticities are very low, but differ depending on the country. The most interesting is the study conducted by the American scientist Espey (1996) who used a meta-analysis to compile 101 different studies and found that in the short-run (defined as 1 year or shorter), the average price elasticity of demand for petroleum products was -0.26, meaning that a 10% increase in gasoline prices reduced the fuel demand by 2.6%. In the long-run (defined as more than 1 year), the price elasticity of demand was -0.58, meaning that a 10% increase in gasoline prices caused a reduction in gasoline demand of 5.8%.

An interesting hypothesis was elaborated by Kayser (2000), who argues that an increase in travels occurs if individual income increases, emphasizing that the largest number of car travels are discretionary travels[3]. Alternatively, at lower income levels, the number of travels is already reduced to a minimum, leaving little room for adaptation to higher prices.

Another possible explanation is that the vehicle number per household increases with income. If households own two or more vehicles, there is a possibility that the drivers are shifting the demand towards more fuel-efficient vehicles when fuel prices increase.

3. INCOME ELASTICITY OF DEMAND

Income elasticity depends on the type of product consumed. Given the value of the income elasticity coefficient, there are normal goods and inferior goods. For normal goods, the elasticity coefficient is higher than zero, i.e. positive because the quantity of required goods increases as the income increases. For inferior goods, the elasticity coefficient is below zero, i.e. negative because the required quantity decreases as the income increases. With regard to coefficient value, normal goods are further divided into necessity and luxury goods. Necessity goods are goods with a lower income elasticity coefficient between 0 and 1 since these are items necessary for functioning that people buy regardless of the income level, while luxury goods are goods whose elasticity coefficient is greater than 1, that is, people do not consume them in case of a low income level. At low levels of economic development, most goods and services are a luxury compared to basic foodstuffs. In the case of a growth in income, except for basic foodstuffs, demand for all goods and services increases more than proportionally. If income continues to grow, a saturation effect occurs, whereby the growth in demand for luxury goods shall be lower than income growth. Applied to the transport sector, this means that, as the economy develops and income grows, the income travel elasticity shall decrease, however not necessarily to zero (Moneta and Chai, 2010).

The gross domestic product (GDP) and gross domestic income per capita are most commonly used in models, depending on whether the total consumption of the products or the consumption per capita is analyzed.

Among recent studies into the subject topic (Dahl, 2012), the median value of income elasticity for gasoline was 0.57 and 50% of the value ranged between 0.25 and 0.99. Most of the studies were conducted using a model that included a car stock variable. It is assumed that, in the event that the car stock is kept constant, gasoline consumption would decrease due to income growth, suggesting that certain countries become richer and own increasingly newer and more fuel-efficient vehicles. The median value of income elasticity for diesel fuel is approximately 1, while 50% of the value ranged between 0.85 and 1.31. Given that income elasticity for gasoline is low, in some countries even negative, while it increases for diesel fuel, it is assumed that the measures of the policy aimed at stimulating the consumption of certain types of fuel can be implemented through the application of income elasticity of demand for petroleum products. In the OECD countries in Europe, the estimated income elasticity of demand for diesel fuel in the period from 1990 to 2007 amounted to 1.79. Such high elasticity reflects the policy and technology stimulating consumption in favor of diesel vehicles.

The simplest model for the presentation of the income elasticity coefficient is expressed by the formula:

$$\varepsilon_y = \frac{\Delta E}{\Delta Y} = \frac{\delta E}{\delta Y} * \frac{Y}{E},$$

where

Y is the income level,

E is the amount of petroleum products in demand,

and is explained by the percentage change in the demand for petroleum products resulting from a 1% increase in income, ceteri paribus.

[3] This term refers to travels due to various forms of leisure, which are only taken when an individual has a surplus of funds (money) remaining after paying for basic travelling connected to making a living, such as traveling to work and other basic costs of living.

If it is assumed that the demand is a log linear function in the form:

$$Q = a + bY,$$

then the income elasticity is calculated using the following equation:

$$\varepsilon_y = \frac{dQ}{dY} * \frac{Y}{Q} = b * \frac{Y}{Q} = \frac{bY}{a+bY}$$

The following equation is derived from the aforementioned:

$$\ln(Q)=\beta_1+\beta_2 \ln(P)+\beta_3 \ln(Y)+\beta_4 Y,$$

based on which the income elasticity is:

$$\frac{\delta Q}{dY} * \frac{Y}{Q} = \beta 3 + \beta 4Y$$

Both in the case of price elasticity and income elasticity, a static and dynamic model of defining income elasticity is used. Unlike the dynamic model, only the long-run and not short-run income elasticity can be established in the static model, although there is criticism of such a stipulation because the elasticity determined by the static model generally results in lower values than the dynamic models, so the elasticity determined in such a manner should be considered medium-run (Espey, 1998).

In addition to income elasticity of demand for petroleum products, income elasticity of demand for car ownership that also indirectly defines the demand for petroleum products should also be considered. It is assumed that households with higher income shall have more than one vehicle and that households shall therefore have higher price elasticity of demand than the poorer households with only one vehicle. In addition, the influence of the location is very important and the elasticity depends on the distance from the urban and regional centers.

4. CROSS ELASTICITY

Determining cross elasticity between fuel prices and demand for other goods is important since fuel demand is mostly non-elastic, so any increase in fuel prices leads to a reduction in disposable income that would be spent elsewhere, leading to a reduction in expenditure in all other categories.

Cross elasticity of demand refers to a measure that determines changes in demand for one good in response to a change in the price of another good. With regard to the obtained values of cross elasticity coefficients, there are substitutes, complementary and neutral goods. Substitutes are in question if the cross elasticity coefficient is positive - an increase in the price of a good causes an increase in the demand for another good, while complements are in question if it is negative - an increase in the price of one good causes a decrease in the demand for another good.

Neutral goods are goods for which a change in the price of one good does not affect the demand for another, which results in their cross elasticity coefficient being equal to zero.

The simplest calculation of the cross elasticity coefficient is provided in the following formula:

$$E_{A,B} = \frac{P_{B1}+P_{B2}}{Q_{A1}+Q_{A2}} * \frac{\Delta QA}{\Delta PB} = \frac{\delta Q_A P_B}{\delta P_B Q_A}$$

where

$E_{A,B}$ is the cross elasticity coefficient,
P_B is the price of good B,
P_A is the price of good A,
Q_A is the quantity of good A in demand,
Q_B is the quantity of good B in demand,
and is explained by a percentage change in the quantity of good A in demand due to a percentage change in the price of good B.

A study conducted by a group of authors (Blum et al., 1988) found interesting results, and these authors were the first to identify a connection between the increase in fuel prices compared to the price of public transport. Cross elasticity of demand for gasoline in relation to the price of public transport amounted to 0.39, which means that a 10% increase in fuel price leads to a 3.9% increase in passengers using public transport. In the same study, the authors indicate that the accessibility of the transport infrastructure and its quality is crucial to fuel demand. In addition, they determined the influence of weather conditions, but in very low values. To determine the cross elasticity of demand between an increase in gasoline prices and the demand for public transport, it is important to determine short-run and long-run responses. If gasoline prices are expected to be high, and if there is an increase in the number of people in urban environments who decide to use public transport, the elasticity shall also increase. The opposite situation occurs when we expect the price increase to be short-run, and thus the cross elasticity lower.

The most important form of cross elasticity from this aspect is the one involving an increase in fuel prices and vehicle demand, which should be observed through its values, i.e. through the positive and negative value of cross elasticity coefficients. The nature of the impact of a fuel price increase on car demand is reflected in the cross elasticity of demand between more and less fuel-efficient vehicles. If we observe the impact of increasing fuel prices on the demand for more fuel-efficient vehicles, we notice that the demand is increasing and that the cross elasticity coefficient shall be positive, i.e. increasing fuel prices shall cause the demand for vehicles that are more fuel-efficient to rise. In the case of vehicles with a high level of fuel consumption, the increase in gasoline price shall lead to a decrease in their demand, meaning that the cross elasticity coefficient shall be negative, which is a common case in the relation between fuel price and less fuel-efficient vehicles since they present a vehicle segment with a demand most responsive to changes in fuel price.

There is a large number of studies dealing with cross elasticity research, i.e. establishing a link between fuel prices and public transport. The most significant among them is the study conducted by Blanchard (2009) on a sample of 218 American cities in the period from 2002 to 2008, during which price cross elasticity between four forms of public transport and gasoline price was established. Cross elasticity of demand for transport with regard to gasoline prices ranged from -0.012 to 0.213 for suburban railways, from -0.377 to 0.137 for heavy rail, from -0.103 to 0.507 for light rail, and from 0.047 to 0.121 for buses. He also found that cross elasticity increases over time, especially for buses and suburban railways, meaning that drivers became more sensitive to increases in fuel prices in the second part of the observed period. A similar study was conducted by Haire and Machemehl (2007), who found that each increase in gasoline prices of 1% leads to an increase in demand for public transport by an average of 0.24% on a sample of five major American cities. Currie and Phung (2007) established cross elasticity between public transport in the amount of 0.12 for all forms of transport, 0.33 for the railway and 0.04 for buses. Another interesting fact about this study is reflected in the observation of the influence of famous world events in order to prove a change in cross elasticity following them. Thus, the demand for suburban railways after the last Iraqi war increased by only 0.01% due to a 1% increase in gasoline price, which corresponds to scientific references claiming that the consumer response shall be weaker with regard to a short-run price increase, i.e. when the consumer does not expect that the price increase shall continue for a long time. A similar study in Europe was conducted by de Jong and Gun (2001), who established short-run and long-run cross elasticity for EU countries. They established a difference in cross elasticity due to an increase in prices in relation to the number of trips by public transport and the mileage traveled by public transport. Short-run elasticity for the number of trips is 0.33, the long-run is 0.07, while the short-run for the mileage traveled by public transport is 0.07, and the long-run is 0.10.

In their study, Nowak and Savage (2013) came to the conclusion that cross elasticity of demand between fuel prices and the demand for public transport depends on fuel price levels. Therefore, it varied in the period from 1999 to 2010, so when the gasoline price was less than $ 3 per gallon, cross elasticity was also low and ranged from 0.02 to 0.05. When the gasoline prices were from $ 3 to $ 3.99 per gallon, cross elasticity also increased from 0.12 to 0.14. The peak in gasoline prices in 2008, when the gasoline prices were above $ 4 per gallon, also caused the highest values in cross elasticity estimated at very high values of 0.28 to 0.30 for bus lines and 0.37 for suburban railway.

In addition to the fuel price and the demand for public transport, models also include other variables that may be affected by the fuel price, but are present to a lesser extent. The most interesting study was the study in which a negative correlation between gasoline price and body weight of the American population was established. Namely, any increase in fuel prices causes an increase in walks or bike rides, and decreases the frequency with which people eat at restaurants, thus affecting the weight of individuals. A study (Courtemanche, 2008) showed that an increase in gasoline price by one dollar reduced overweight and obesity in the USA by 7% and 10%, while the 8% increase in obesity between 1979 and 2004 was the result of a decrease in real gasoline prices in the USA.

An increase in fuel prices also affects turnover in supermarkets whereby the turnover increases between 15 and 17% over a decrease in restaurant turnover by 45-56% since consumers respond by adjusting to a reduction in their real income due to increasing fuel prices by eating at home more frequently than they did before the increase in fuel prices (Gicheva and Hastings, 2007).

5. SHORT-RUN AND LONG-RUN EFFECTS

In order to differentiate between the driver response and the time for their adjustment, a distinction shall be made between short-run and long-run demand elasticity. Short-run elasticity measures the adjustment process during the first month, quarter or year, depending on the periodicity of the data, while long-run elasticity measures the overall adjustment that can refer to several years (Dahl and Sterner, 1991). Any period in which something remains fixed is considered short-run. In this sense, highway capacity, the efficiency of fleet fuel consumption, the location of employment, or anything else that slowly changes over time is considered fixed. Sufficient time for these features to change is considered long-run. In transportation planning, a term of approximately one year is usually considered short-run, however, the practical context in which the subject term is determined is much more important for such planning.

In the short-run, most consumers consider the goods they own as fixed and their replacement cannot be affected in the short-run. The increase in the price of petroleum products and energy certainly contributes greatly to the decision made by the drivers or the consumers to replace their vehicle with a new, more fuel-efficient model. In this case, the response time plays a crucial role in the flexibility of the consumer's decision. The longer the time, i.e. the greater the flexibility, the higher the likelihood of a response, i.e. the greater the demand elasticity. From the subject standpoint, the demand for petroleum products is the most striking example of driver response in the short and long-run. Namely, in the short-run the driver can change their driving habits, drive slower, avoid congestion, use public transport, carpooling, etc. due to an increase in petroleum product prices. However, if the increase in the prices of petroleum products is permanent, the driver shall react differently and replace the inefficient vehicle with a more fuel-efficient vehicle. This is referred to as the most important form of response to an increase in the prices of petroleum products in the long-run. Another form of response in the long-run is relocating to a place closer to the workplace to reduce travel distances. If the price remains high, vehicle manufacturers shall develop and produce more fuel-efficient vehicles. It is therefore considered that driver responses in the short-run are mainly changes of behavioral nature, while substitutes in the long-run are of a material, tangible nature. Behavioral changes cannot be maintained in the mid and long-run. In this context, it is considered that price elasticity of demand is not the same when fuel prices increase or decrease, i.e. in case of a decrease in petroleum product prices, the consumers shall not sell more fuel-efficient vehicles and purchase less fuel-efficient ones. Consumers make their decisions on purchasing a vehicle based on predicting future energy, i.e. fuel prices.

Furthermore, if consumers were able to own fuel reserves and in the short-run decide to add fuel to the reserve or use fuel from the reserve in response to price changes, their response would be even more significant, but drivers have small gasoline reserves in their vehicle tanks, so this behavior is possible to a limited extent. Likewise, consumers may have the ability to postpone (or expedite) certain necessary trips in response to a temporary increase (or decrease) in the price. These types of behavior mean that the current fuel demand is determined by the price of gasoline today, but also by the price of gasoline a few days or weeks ago. Only when there is a reduction in the price of petroleum products, the drivers shall take these trips so that there is a shift in time, meaning that the current travel demand is also determined by gasoline prices in the past.

The results of an American study (Levin et al., 2013) indicate that the amount of gasoline purchased at a gas station one day after a 1% price increase is generally 1.45% lower than it would be without the price increase. Over the following three to four days, the consumption returns to its initial level, and the response is still visible after ten to twenty days after the price increase. Consumer behavior therefore significantly changes in the first days following a change in the prices, i.e. they purchase more gasoline during the first few days after a decrease in prices, ensuring themselves against another increase in prices, while they purchase less during the first few days after an increase in the prices and they wait to see if it the prices decrease again before they make another purchase.

6. THE IMPACT OF FISCAL POLICY ON THE ELASTICITY OF DEMAND

With the aim of collecting as much tax revenue as possible, all governments impose the most tax on goods with a relatively non-elastic demand, since any increase in the price of such good shall not lead to a large decrease in customer demand. There is a difference between the taxation of fuel consumption by imposing certain standards that shall be followed when selling vehicles and the simple taxation of petroleum products.

The taxation of petroleum products is performed in order to reduce carbon dioxide emissions, climate change, insecurity due to oil supply and similar. The efficiency in implementing such tax policies depends on the reduction in the consumption of petroleum products, i.e. the elasticity of demand. The extent of such elasticity depends on geographic, income and other factors. It has been proven that the rural population uses vehicles more than the urban because of the lack of alternative forms of transport, and the tax policy shall therefore have a different impact with regard to the location of the population. Due to an increase in the prices, households that own several vehicles use the more fuel-efficient vehicles, so the tax burden is not the same in that sense. Therefore, according to a study (Spiller and Stephens, 2012), it has been determined that the efficiency of implementation shall differ depending on the elasticity of demand that in turn varies with regard to several characteristics and demographic conditioning, including household income, number of vehicles owned, average annual mileage, distance from urban areas. It was thus established that a 10 percent increase in gasoline prices would have a 30 percent higher negative impact on the welfare of the rural population compared to the urban population. Given the high correlation between the quantity of driving and the distance, tax shall have a greater effect on people who live in distant areas and travel longer to work, which is generally a characteristic of rural households.

The justification for the taxation of petroleum products is often examined, since people with lower income also purchase fuel. According to Sterner (1990), petroleum product tax, although having certain characteristics of regressive tax especially in higher income countries, is progressive especially in lower income countries. Rich countries can compensate for the regressive effects of taxation of petroleum products by reducing other taxes affecting the poor or providing subsidies to low income groups. It is a well-known fact that low-income households spend a very small share of their money on fuel for transport. The problem occurs when increasing fuel prices cause an increase in public transport prices and transport costs that in turn increase the price of food.

According to the latest study (Li et al., 2012), in which the effect of fuel tax impact on gasoline consumption, the mileage traveled, choice of vehicle with regard to fuel-efficiency were analyzed in the short-run, a conclusion was reached that small changes in gasoline taxation could affect consumer behavior and that fuel taxes have an even greater impact on behavior than a proportional increase in gasoline prices resulting from an increase in oil prices. Accordingly, a five percent increase in retail gasoline prices by increasing taxes leads to a 1.3 percent decrease in consumption, which is more than the decrease in demand caused by increasing gasoline prices due to increasing oil prices amounting to only 0.16 percent. The reasons why consumers respond more to an increase in prices due to taxes than due to an increase in oil prices are as follows:

Consumer expectations on future petroleum product prices largely determine the consumer response to an increase in oil prices. The longer the period during which the consumers consider that the prices shall be high, the greater their response by reducing the mileage, using public transport more frequently and selecting more fuel-efficient vehicles.

Any change in taxes, especially petroleum product tax, attracts a lot of public attention and is subject to public discussions.

Precisely this could contribute to greater attention from the media posing a condition that a 5 percent increase in petroleum product tax shall receive more attention in the media and from the consumers than a regular increase in the petroleum product price in the same ratio.

With regard to determining whether the taxation of petroleum products has a progressive or regressive character, there is no unified standpoint in the references. Certain authors assume that the tax on the petroleum product consumption is progressive in the lower income population with a greater response to an increase in the prices, while the tax on the motor size or the subsidies for new vehicles are much more than regressive compared to the tax on the petroleum product consumption, while it has also been established that fuel tax is regressive only in households that belong to upper income classes (West, 2004). It is assumed that the reason for the aforementioned is the fact that a large proportion of lower income households do not own a vehicle and thus do not spend money on fuel, and lower income households are more sensitive to price changes than high-income households.

Other authors believe that lower-income households spend less of their income on gasoline than middle-income households, but that middle-income households spend more on fuel than households with the highest levels of income. Consequently, it is concluded that the tax on gasoline is less regressive than other analyzes indicated (Poterba, 1991).

7. CONCLUSION

With regard to the share of petroleum products in the structure of household expenses, as well as the share in the government budget revenues, the elasticities of demand for petroleum products are one of the essential elements for the implementation of the economic policy. The income elasticity of demand for petroleum products can offer insight into the extent to which the demand for petroleum products shall increase if the income of the population increases and what direct or indirect implications it shall have on the economy. On the other hand, price elasticity facilitates insight into the effect additional taxation of petroleum products and filling of the budget shall have with regard to the fact that the demand for petroleum products is non-elastic. In order to differentiate between the driver response and the time for their adjustment, a distinction shall be made between short-run and long-run demand elasticity. Short-run elasticity measures the adjustment process during the first month, quarter or year, depending on the periodicity of the data, while long-run elasticity measures the overall adjustment that can refer to several years. The taxation of petroleum products is performed in order to reduce carbon dioxide emissions, climate change, insecurity due to oil supply and similar. The efficiency in implementing such tax policies depends on the reduction in the consumption of petroleum products, i.e. the elasticity of demand. The conclusion that can be drawn from all the analyzed studies is that the elasticity of demand for petroleum products (price and income) has decreased over time.

REFERENCES

1. Blanchard, C. (2009) The Impact of Rising Gasoline Prices on US Public Transit Ridership. Duke University, pp.25-26.
2. Blum U., Foos G. and Guadry M. (1988) Aggregate time series gasoline demand models: review of the literature and new evidence for West Germany. *Transportation Research,*, 22A, pp.75-88.
3. Courtemanche,C. (2008) A Silver Lining? The Connection Between Gasoline Prices and Obesity, Department of Economics, Bryan School of Business and Economics, University of North Carolina, pp. 20.
4. Currie, G., Phung, J. (2007) Transit Ridership, Auto Gas Price, and World Events: New Drivers of Change? Transportation Research Record. *Journal of the Transportation Research Board*, 1992, pp.3-10.
5. Dahl, C. A. (2012) Measuring global gasoline and diesel price and income elasticities. *Energy Policy,* 41, pp. 2-13.
6. Dahl, C., Sterner, T., (1991) A survey of econometric gasoline demand elasticities. *International Journal of Energy Systems*, Vol 1 I, No 2.
7. Dahl, C., Sterner, T. (1991) Analysing gasoline demand elasticities: a survey. *Energy Economics*, Volume 13, Issue 3, pp.203-210.
8. de Jong, G. and Gunn, H. (2001) Recent Evidence on Car Cost and Time Elasticities of Travel Demand in Europe. *Journal of Transport Economics and Policy* 35.2 pp.137-160.
9. Espey, M. (1998) Gasoline Demand Revisited: An International Meta-Analysis of Elasticies. *Energy Economics*, 20, 273-295
10. Espey., M. (1996) Explaining the Variation in Elasticity Estimates of Gasoline Demand in the United States: A Meta-Analysis. *The Energy Journal*, vol. Volume17, issue Number 3, pp. 49-60.
11. Gicheva, D., Hastings, J. (2007) Villas-Boas, S., Revisiting the Income Effect: Gasoline Prices and Grocery Purchases. *NBER Working Paper* No. 13614 pp. 24.
12. Graham, D., Gleister S. (2001) The demand for automobile fuel: a survey of elasticities. Department of Civil Engineering Imperial College of Science, Technology and Medicine, London.
13. Haire, A., Machemehl, R. (2007) Impact of Rising Fuel Prices on U.S. Transit Ridership, Transportation Research Record. *Journal of the Transportation Research Board*, 1992, pp. 11-19.
14. Kayser, H. A. (2000) Gasoline Demand and Car Choice: Estimating Gasoline Demand Using Household Information. *Energy Economics* 22(3): pp. 331-348.
15. Levin, L., Lewis, L.S., Wolak, L.A., (2013) High frequency evidence on the demand for gasoline, Department of Economics. Stanford University, Stanford, pp.20.
16. Litman, T. (2013) Understanding Transport Demands and Elasticities, How Prices and Other Factors Affect Travel Behavior. Victoria Transport Policy Institute, pp.18.
17. Moneta, A. and Chai, A. (2010) The evolution of Engel curves and its implications for structural change. Discussion Papers in Economics 201009. Griffith University, Department of Accounting, Finance and Economics.
18. Nowak, W.P., Savage, I. (2013) The cross elasticity between gasoline prices and transit use: Evidence from Chicago. Department of Economics, Northwestern University,pp. 11-12.
19. Poterba, J. M. (1991) Is the Gasoline Tax Regressive? In: Bradford, D. (Ed.). Tax Policy and the Economy 5. MIT Press, Boston, pp. 145-164.
20. Spiller, E., Stephens, H. M. (2012) The Heterogeneous Effects of Gasoline Taxes: Why Where We Live Matters. Department of Economics, California State University, pp.29.
21. Sterner T. (1990) The Pricing of and Demand for Gasoline, edish Transport Research Board: Stockholm.
22. Wadud Z., Graham, D.J. Noland, R.B. (2009) Modelling fuel demand for different socio-economic groups. *Applied Energy* 86, pp. 2740–2749.
23. West, S.E., (2004), Distributional Effects of Alternative Vehicle Pollution Control Policies. *Journal of Public Economics*, 88: pp.735-575.