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DEMAND ELASTICITY ON THE TRANSPORT MARKET

ABSTRACT

The elasticity of demand for traffic services is the adaptation of traffic supply to traffic demand. The elasticity of such demand is low which is specific of the transport market, especially from the aspect of designing traffic demand.

The essence of the problem of low elasticity can be noticed in three basic properties:

First, in the change of place which determines the traffic demand or traffic relation.

Second is the continuity of the need to transport goods and passengers.

Third, the needs for transport may vary according to the changes in society and economy, and they also change the sources of traffic demand. Therefore, the elasticity of demand for traffic services is relatively low.

KEY WORDS

transport market, demand elasticity, supply and demand,

1. INTRODUCTION

Market is every organised connection of supply and demand of goods, or it is a form of connection of supply and demand of transport and other services which is in a certain sense true since transport service as goods has a specific characteristic. It has no physical form. The process of its generation and consumption is very unique. Such goods cannot be stored, neither realised on other markets, in the sphere of consumption, which obviously renders special characteristic to the transportation service market.

Traffic companies do not offer ready-made goods on the market, rather a working process, during which the service is produced (consumed). At the beginning of the work process the transport companies will recognise whether they will sell the supplied services or whether the traffic means will operate empty. It is only during the working process that the transport service users will find out what is the quality of the service, since the goods cannot be inspected in advance. Transport companies cannot change the market, since they cannot store their services in order to sell them later on some other market. On the contrary, they may come into position to invest their work in the transportation process, without realising their services.

Traffic demand has its laws, which are based on the transport of goods and passengers. The transport depends on the demand on the consumers' market, about the price which the end user is either capable or ready to pay. Therefore, for certain goods to be considered for transport, the differences in means within the price have to be created (it is the difference between the import and selling price), which must cover the costs of transport, insurance, storage and sales.

Regarding the observed rules, a question arises about the elasticity of transport demand for traffic services.

2. TRAFFIC SERVICES DEMAND ELASTICITY

The goal of the transport policy is to match the available capacities with the development of traffic demand, in order to achieve its optimal profitability and on the other hand, to emphasise the traffic function during social reproduction.

The transport services demand elasticity is the adaptation of traffic supply to the traffic demand. The elasticity of such demand is low which is specific for this market, particularly from the point of view of designing traffic supply.

The essence of the problem of low elasticity can be seen from three basic characteristics of the traffic service which determines the traffic demand or traffic relation regarding business policy.

The first one is in the change of place which determines the transport demand or transport relation, thus resulting in territorial adaptation of supply to the demand.

Secondly, demand for traffic services is low because there is a continuity of deliveries for transport of goods and passengers in industrial conditions regarding the development of social and territorial work distribution, as well as the distribution of production consumers centres.

Thirdly, the need for transport can change according to the changes which occur in the economy, but also in the society, thus changing also the sources of traffic demand. Therefore, the demand elasticity for traffic services is relatively low.

The demand elasticity is the capability of change of demand, depending on the flow of prices or movement of the income of citizens. The demand is elastic when the fall or rise of prices causes substantial increase or reduction of demand, that is, when the rise or fall of income results in the rise or fall of demand. Inelastic demand is the one which changes slightly according to the changes in prices or income.

In order to define the level of elasticity, the elasticity coefficient is used, which shows by how much percent the value of the dependent variable will change if the independent variable changes by 1%.

It does not matter what measuring units are used to express certain variables, since the coefficient is an inevitable number. The demand elasticity is different for individual types of products with different peoples, classes and social strata, and it changes also in certain periods and at different levels of social and economic development. It is the lowest for food products, heating, housing, etc. and the highest for items of luxury and other things.

Knowing elasticity and keeping track of it is significant for the traffic policy, economic forecasting and control management of economic policy.

According to Lj. Martić, there are several categories of demand elasticity and they are:

a) perfect elastic demand ($E_d = \infty$)
b) perfect non-elastic demand ($E_d = 0$)
c) relative elastic demand ($\infty > E_d > 1$)
d) relative non-elastic demand ($0 < E_d < 1$)
e) unit elastic demand ($E_d = 1$)

The price elastic demand (E_p) is expressed as a quotient of percentage change in the demanded quantity of goods and percentage change in its price (quotient of elasticity at one point).

If other variables regarding demand were assumed to be constant, there would be the following expression:

$$E_p = \frac{\frac{\Delta Q}{Q}}{\frac{\Delta P}{P}} = \frac{\Delta Q}{\Delta P} \cdot \frac{P}{Q}$$

where ΔQ and ΔP denote absolute changes of a certain traffic volume and price. Model (1) is true with the assumption of infinitely small changes of value.

In traffic practice sometimes the simplest way of calculating the elasticity coefficient is used (chain index), by formula:[1]

$$E_p = \frac{Q-100}{P-100}$$

where Q and P are chain indexes of quantity and prices in the analysed case. The type and characteristics of demand elasticity are reflected in the change of the total expenditure for the quantity of goods (or traffic service) in relation to the change of its price. If, e.g. the total expenditure increases, but as a result of the increase in the volume of demand at lower price compared to the expenditures obtained for the previously smaller quantities at higher prices, then this is called demand elasticity. If e.g. the quantity P is 100, price C 10 Kunas, then the total expenditure (P x C) = 1,000 Kunas. The change in quantity of demand from 100 to 120 Kunas as result of the reduction of price from 10 to 9 Kunas, in this example will be reflected through the increase of the total expenditure by 80 Kunas, as much as e.g. (120 x 9) is more than (100 x 10). The mentioned example illustrates elastic demand.

If the change in price results in the increase of demand, in the volume by which the whole expenditure remains at the same level, this is unit elastic demand. If increase in the demand occurred as result of price reduction from 6 to 5 Kunas, the total expenditure of 600 Kunas would be the same in both cases, that is, 100 x 6 equals 120 x 5 Kunas.

In this example the demand elasticity is 1, since 600 : 600 = 1 (hence the name unit elasticity). However, it should be noted that in cases when demand elasticity is greater than 1, this is called elastic demand, and when the elasticity is less than 1, this is called non-elastic demand.

If in the example, during the change in price from 6 to 5 Kunas per kilogram the demand volume increased by 10 rather than 20 Kunas, as the previous demand, since it now amounts to 110 Kunas, the total expenditure (P x C) would be reduced, since it is 550 Kunas (110 x 5) less compared to the expenditure before the price reduction. Since in this example the demand elasticity is less than 1, because 550 : 600 = 0.9 Kuna, the demand is non-elastic. The level of elasticity can be determined also by arithmetic mean which is calculated by the division of the percentage of the increase of the demand volume by the percentage of the price reduction, that is:

$$\text{level of elasticity} = \frac{\%\ \text{increase P}}{\%\ \text{increase C}}$$

If the price e.g. were reduced from 6 to 5 Kunas, the demand volume increased from 5 to 8 quantity units, so that 1/6 is 16.67, and 3/5 is 60%,

$$\text{the level of elasticity} = \frac{60}{16.67} = 3.60.$$

When the result of the mentioned amount is greater than 1, then this is called elastic demand. If the result is less than 1, then it is non-elastic demand, and when it equals exactly 1, then it is the unit elasticity.

When speaking of elasticity of single products or services, very often the so-called Giffen's paradox of increased demand in case of increased prices is mentioned. The cause of such demand, influenced by the change in prices, lies in the very low real income of the workers. Low income forces the population to increase the consumption of bread since it is relatively cheaper than other food. The increased price of bread reduces the real value of income (for the same income less bread can be bought), and this affects further increase in the demand for bread which substitutes the consumption of expensive food products of greater quantities and vitamin value. The level of elasticity of a product depends also on the number of its users. A greater number of users of certain goods (or services) usually results in a greater level of elasticity. The price reduction of such goods is fast reflected in the increase in demand, and the increase in prices is reflected in a reduction in demand.

The elasticity of goods demand depends also on the type of goods, considered from the point of view of its durability. More durable goods, namely, are usually also of a more elastic nature. Indeed, when a relatively longer period of service of some goods is required, then it is with great probability that the demand will be more elastic.

In short term, often due to the habits of the consumers who do not react immediately to the change in price, the demand will be less elastic, which cannot be claimed e.g. for the goods of longer service-life. Cars, television sets and other technical appliances belong to the group of elastic products regarding their longer service-life.[2]

The following Table and curve present the non-elastic demand.[3]

P	C	(P × C)
4	7	28
4	6	24
4	5	20
4	4	16
4	3	12
4	2	8

The curve has completely vertical lines, which shows that the quantity of demand is not changing, regardless of the level of price reduction (in this case this quantity amounts to 4). As result of the completely changed demand quantity with price reduction, the total expenditure decreases continuously, at every successive point of the demand curve.

The notion of elasticity to price, e.g. has been conceived so as to indicate the percentage at which the demanded quantity of a certain traffic value will react to any change in price. Such example is best illustrated by the curve of demand in Figure 2. The curves of demand (D_1, D_2, D_2, D_2), are drawn in such a way as to present two possible cases for the same traffic

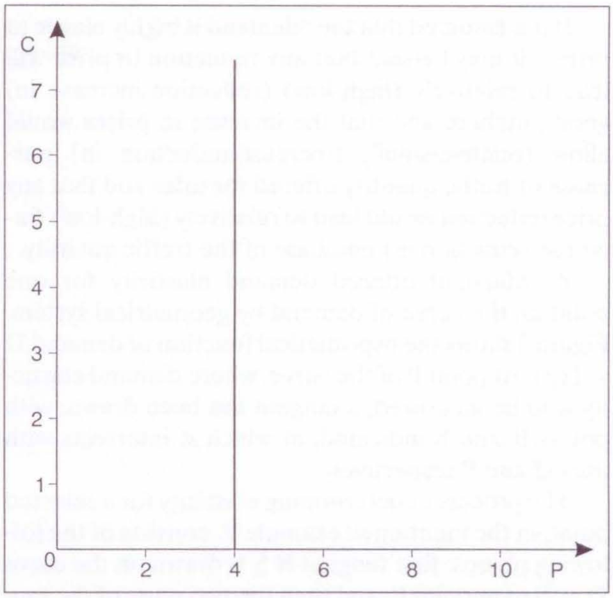

Figure 1 - Curve of demand non-elasticity

service Y. Both curves satisfy the "rule of demand" according to which any reduction in price will lead to increase even of the bought quantity of goods. In that case D_2 D'_2 is such a curve which is more elastic, since the demanded quantity is sensitive to any change in price.

Why is it so? In fact, if the price of the transport goods (or service) falls, e.g. from p_a to p_c, the demanded quantity would rise more along the curve D_2 D'_2. If the price, however, rose from p_a to p_b, the demanded quantity would decrease more along the curve D_2 D'_2. Therefore, the required traffic quantity (either goods or services) would be sensitive to the price change, that is more elastic along the curve D_2 D'_2.

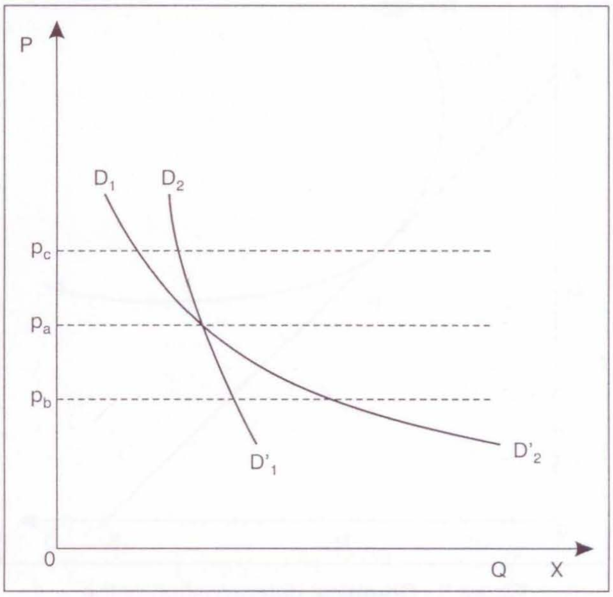

Figure 2

If it is assumed that the "demand is highly elastic to price", it may be said that any reduction in price will lead to relatively (high-low) (reduction-increase in) good purchase and that the increase in prices would allow (relative-small) (increase-reduction in) purchase of traffic quantity offered for sales and that any price reduction would lead to relatively (high-low) (increase-reduction in) purchase of the traffic quantity.

A. Marshall offered demand elasticity for one point on the curve of demand by geometrical system. Figure 3 shows the hypothetical function of demand D = f (p). At point P of the curve, where demand elasticity is to be measured, a tangent has been drawn, with points R and S indicated, at which it intersects with axes Q and P respectively.

The process of determining elasticity for a selected point, in the mentioned example P, consists of the following phases: first tangent R S is drawn on the curve D = f (p) at point P, and then the two parts of the tangent are set into the relation

$$E_p = \frac{ON}{NS} \text{ or } E_p = \frac{RM}{MO} \text{ that is } E_p = \frac{PR}{PS}$$

Relation:

$$E_p = \frac{PR}{PS}$$

can be defined as the elasticity of value Q according to the change of p which equals the ratio of tangent sections between the mentioned point and axis Q, i.e. p.[4]

If the curve of demand P_d is gradually moved from one point to another, it may be noted that the elasticity fails to be equal at all points. In the part of the curve which corresponds to high prices, the elasticity is non-elastic, and in the part which corresponds to low prices, it is relatively elastic.

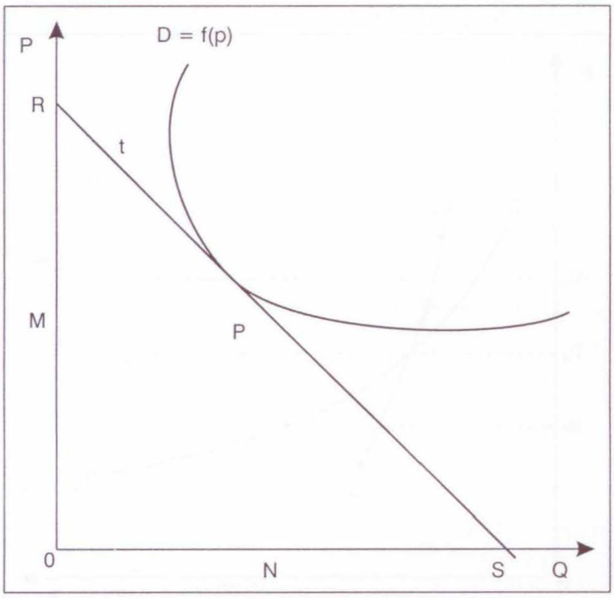

Figure 3 - Graphical determination of the elasticity coefficient

In practice, instead of measuring the price elasticity at one point, usually the arc price elasticity of demand is measured, that is, the price elasticity between two point on the demand curve of the third point Q and P.

The expression for the arc elasticity is:

$$E_p = \frac{\Delta Q}{\Delta P} \cdot \frac{\frac{P_2+P_1}{2}}{\frac{Q_2+Q_1}{2}} = \frac{Q_2-Q_1}{P_2-P_1} \cdot \frac{P_2+P_1}{Q_2+Q_1}$$

where indexes 1 and 2 denote initial and new values of quantities and prices.

The demand for traffic goods (services) does not depend only on the price of the goods, but also on the prices of other goods with which the mentioned good (or service) is in certain relation (substitute or complementary good).

For example, if the price for rail cargo transport increases, there will be an increase in the price of other transport modes as well (road, river, etc.). The demand curve, e.g. in road transport will shift to the right, resulting in the greater demand of service in road or river transport.

The sensitivity of demand for traffic goods (or services) X to the change of the price of goods (or services) Y is measured by the cross-price elasticity of demand (E_{xy}).

3. CROSS ELASTIC DEMAND

Cross elastic demand shows the relative changes in the demanded quantity of certain goods depending on the relative changes in the price of another goods.

The coefficient of the cross elasticity of demand is mathematically expressed by the formula: $\frac{\Delta Q}{Q}$.

$$E_{xy} = \frac{\frac{\Delta Q_x}{Q_x}}{\frac{\Delta P_y}{P_y}} = \frac{\Delta Q_x}{\Delta P_y} \cdot \frac{P_y}{Q_y}$$

where Q_x and P_y denote the change in the quantity of good x and price y.

Since the income of the consumers also affects the demand, the elasticity of certain good (or service) on the change of the consumer's income can be measured by means of income-related elasticity of demand (E_p). This is, in fact, the ratio of percentage change of the demanded quantity of good (or service) and the percentage change of income, assuming that all the other variables are constant.

The expression which shows the income-related elasticity is:

$$E_y = \frac{\frac{\Delta Q}{Q}}{\frac{\Delta I}{I}} = \frac{\Delta Q}{\Delta I} \cdot \frac{I}{Q}$$

where ΔQ denotes the change of the demanded quantity and the change of income.

For the majority of goods (or services) the increase in income will cause increase in demand ($\Delta Q / \Delta I$ is positive). In this case the coefficient of the income-related elasticity is also a positive number. Such goods are called normal goods. Regarding inferior goods, the demand income elasticity is a negative number.

Normal goods are purchased more when the income increases, but not as much as luxury goods.

If $E_I > 0$, and $a < 1$, then these are means necessary for living, and if $E_I > 1$, then this includes the so-called luxury items.

When, however, the numerical value of coefficient $E_I < 0$ (which happens always if ΔQ and ΔI are of opposite signs), then these are the so-called inferior goods. Their demand decreases with the increase in income (particularly at higher income-related levels).

4. SLOPE OF DEMAND ELASTICITY

The slope of the demand curve gets mixed with the curve elasticity. The vertical slope of the demand curve means non-elastic demand, and the horizontal slope denotes elastic demand. Although this is correct for extreme cases, still this rule does not hold for everything. The slope is not the same as the elasticity, because it depends on absolute changes of p and Q, and the elasticity depends also on their absolute changes.

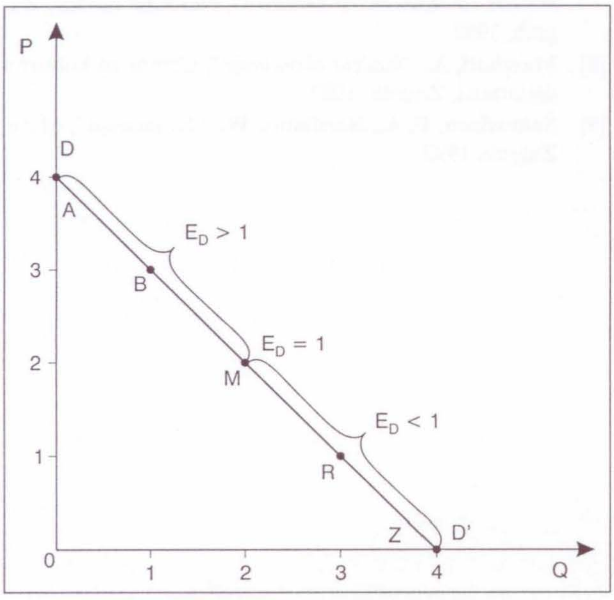

Figure 4 - Gradient and elasticity are not one and the same

Figure 4 illustrates the mixing up of the slope and elasticity. The presented straight line of demand has always the same gradient. However, at the top, near A, there are small percentage changes in price, and great percentage changes in the quantity, so that elasticity is quite big. It is, in fact, very big when we are high on the straight line DD. On the contrary, when the price is very low, the elasticity is near 0.

All the points on the straight line of traffic demand have the same gradient. Above the half, the demand is elastic, and underneath it is non-elastic, and in the middle it is unit elastic.

Taken generally, above the middle point of any length (straight line of demand), the traffic demand is elastic, with $E_d > 1$. At the middle point, the demand is unit elastic, with $E_d = 1$, and below the middle point, the demand is non-elastic, with $E_d < 1$.

Thus, regardless of the extreme cases, the perfect elastic and the perfect non-elastic demand can be determined only by means of the demand curve slope, and the elasticity itself cannot be determined by means of the slope, since the slope and elasticity are not one and the same.

The straight line in Figure 4 shows the distinction between the slope and the elasticity.

5. CONCLUSION

1. Traffic demand for certain goods (services) depends on the market (branch) demand for these goods. This is the sum of demand of all individual consumers (service users) on the traffic market. The mentioned demand depends on the price of the service, size of the traffic market (number of users), users' income, tastes, price expectations, advertising, etc. Demand for permanent service is less stable than the one that is of short-term character.
2. The price elasticity of traffic demand ($E_{p(pr)}$) has been expressed as the relation (ratio) of the percentage change of he demanded quantity of services and the percentage change of price, assuming that other variables in the function remain the same. The price elasticity of demand can be considered at one spot - arc. The linear curve of demand is price-related elastic (with $E_p > 1$), above, unit elastic ($E_{p(pr)} = 1$), and below the geometric middle of the curve it is non-elastic (with $E_d < 1$). The demand elasticity will be greater when more substitutes are available, but the time needed for quantity reaction of consumers to the change in price takes longer.
3. The income-related elasticity of traffic demand measures the percentage change of demand for traffic goods compared to the change in consumers

income of 1% assuming that all the other variables in the demand function remain the same. It is measured at one point or on the given interval. The majority of goods (even traffic services), are normal goods ($E_{pr} > 0$). The inferior goods are said to be ($E_{pr} \leq 0$). The goods with $E_{pr} > 1$ are called "luxury items" and those with $0 < E_{pr}$ are "necessary".

4. Cross price-related elasticity of demand for goods X compared to the goods Y ($E_{xy(pr)}$ measure the percentage change in the demand for the good (or service) X per one percentage change of price of the good Y, assuming that all other variables in the demand function (including also the price of good - service X) do not change. Such demand can be measured at one point or the given arc.
5. The first step in the traffic demand analysis is the identification of all the variables that influence the demand for service (production) of a company. A transport company can use these data to calculate elasticity of demand with relation to each variable in the demand function.
6. In the modern world (tourism, etc.), very fast convergence in taste can be noticed. The tastes, actually, affect fast the consumers (and even the transport service users) for travelling and changing places, destinations. Certain differences in service users will remain. However, acceleration of global convergence of tastes world-wide can be expected for the sake of information revolution, but also due to mixing and enriching of different cultures. This will certainly affect the traffic and other forms of operation of the companies around the world.

SAŽETAK

ELASTIČNOST POTRAŽNJE NA PROMETNOM TRŽIŠTU

Elastičnost potražnje za prometnim uslugama prilagođavanje je prometne ponude potražnji. Elastičnost takve potražnje je mala što je specifičnost prometnog tržišta, posebno s motrišta oblikovanja prometne ponude.

Suština problema male elastičnosti uočava se iz triju osnovnih svojstava:

Prvo je u promjeni mjesta koje određuje prometnu potražnju ili prometnu relaciju.

Druga je kontinuitet potreba za prijevozom robe i putnika.

Treće, potrebe za prijevozom mogu se mijenjati sukladno promjenama u društvu i gospodarstvu, pa se kroz te promjene mijenjaju i izvori prometne potražnje. Zbog toga je elastičnost potražnje za prometnim uslugama relativno mala.

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