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Preliminary Communication
U. D. C.: 656:330.163
Accepted: Jan. 18, 2000
Approved: Apr. 4, 2001

FACTORS OF TRAFFIC DEMAND

ABSTRACT

Traffic demand and supply are in mutual interaction and mutually coordinated.

Transport needs (of goods and passengers) cause an increase in consumption, and on the other hand influence the construction and improvement of available traffic capacities, which in turn provides conditions for new increase in transport demand. As a result, traffic acts in return on the development of industry and also for the needs of people. It precedes the development of demand, i. e. its interaction provides the possibility of increase in the transport service demand.

KEY WORDS

traffic demand, traffic supply, substitution effect, income effect, transport market, demand tendency, consumption tendency.

1. INTRODUCTION

Demand is usually defined as the quantity of goods and services that buyers are ready to pay for, according to certain prices, and at a certain period of time. Economically, only the financially sound demand is relevant.

Factors which determine the users' demand of traffic (or any other) service include the price of the goods (service), customers' income, preferences, as well as other specific factors influencing the demand for certain goods.

J.M.Keynes¹ uses the expression effective demand, and it serves him as the basis for his whole theory and thinking about those forces (factors) that are determined by the quantity of demand, employment and services for the economy. Therefore, "actual or effective demand for goods, traffic and other services is such demand that abounds with financial soundness (solvency), and is connected with the suppliers through price mechanism".²

Quantity and stability of current and future demand for traffic products are of significance for determining more efficient methods of production and sales of products (services), planning the expansion of the production-servicing capacities, entering new markets and increase in the production of other products in the production range.

2. INDIVIDUAL DEMAND FOR TRAFFIC SERVICES

Service demand results from the will and ability of the customer (wish or need for the goods at an adequate purchasing power).

According to the theory of customers' (traffic service users) demand, the quantity of goods demanded depends on the price of the goods (services), customers' income, related prices (complementary or substitutes) of goods and the customers' preferences.

Function of demand, therefore, expresses the dependence of demand for a certain (traffic) goods. "Main variables on which the demand D_i for the i -th goods (or provided services) depends include: price of the goods p_i , price of other goods (particularly substitutes and complementary goods) $j \in \{1, 2, 3, \dots, n\}$, $j \neq i$, customer's income y , time t , advertising costs A , inflation expectation E and others"³, which can be expressed by the model:

$$D_i = f(p_1, p_2, p_3, \dots, p_i, \dots, p_n, y, t, A, E).$$

The first mathematical formulation of the law of demand was given by A.A. Cournot (1938)⁴ in the form of function:

$$D = f(p), \text{ under the simple condition: } f'(p) < 0.$$

Graphically, this form would be as follows:

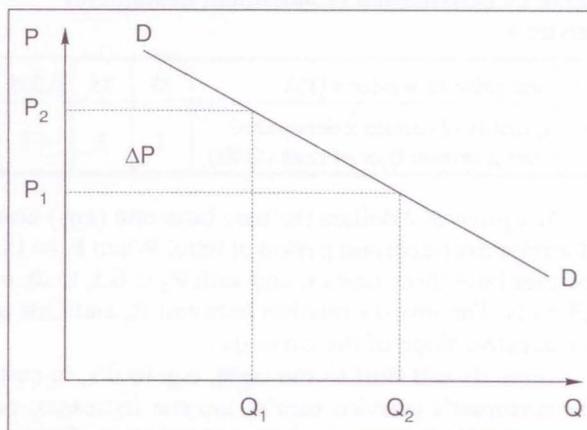


Figure 1 - Demand curve $D=f(p)$ under condition $f' < 0$

If the graph is interpreted, it would seem that the demanded quantity of certain goods (service) D , is the

function of its price (p) and that it has a falling character, because the condition is obvious that p is partial derivation of function of price (p) less than zero (0). Increase in price from p_1 to p_2 causes reduction in demanded quantity from Q_1 to Q_2 , which means an inverse relation between price and quantity.⁵

Many managers have probably had the opportunity to note that parallel to increase in price of certain goods (traffic service), the sales start to fall. Also, package sales may be increased by reducing the price. Therefore, an *inverse* relation is expected between the quantity (traffic service package) of the demanded goods and its price. By price increase, the sold quantity decreases, and by price reduction the quantity increases.

On the other hand, if the customer's (traffic service user's) income increases, they tend to buy substantially larger quantity of (services) goods (shoes, meat, trips, education, cars, etc.). Such goods are usually called *normal goods*.

Table 1 shows a hypothetical example of individual demand distribution. Figure 2 shows the demand curve (d_x). Goods x can refer to traffic service (or some other goods). Values in the Table, and in the Figure as well, show that at unit price of 2 dollars, the user buys one (any) unit of goods in a given period of time. When $P_x = 1\$$, the user buys three units x , and with $P_x = 0.5$ dollars, $Q_{dx} = 4.5$ units. In Figure 2 it may be noticed that the individual demand curve d_x is negatively sloped, warning that the service user is buying a greater quantity of (services) goods over the same period of time. This means, the lower the price, the income, prices of related goods and preferences remain constant.

The inverse relation of price of service (or any other goods) and the demanded quantity over a certain period is called the *law of demand*.

Table 1 - Distribution of individual demand for service x

1	unit price of service x (P_x)	2\$	1\$	0.50\$
2	quantity of service x demanded over a certain flow of time (Q_{dx})	1	3	4.5

At a price of 2 dollars the user buys one (any) unit of service over a certain period of time. When $P_x = 1\$$, the user buys three units x , and with $P_x = 0.5$, $Q_{dx} = 4.5$ units. The inverse relation between P_x and Q_{dx} is the negative slope of the curve d_x .

Curve d_x will shift to the right, e.g. to d'_x , in case the customer's (service user's) income increases, or the price of substitute, in case customer's preference for this goods (or traffic service) increases, or maybe in case the price of complementary goods decreases. Opposing changes of independent variables will cause the shift of curve d_x to the left (goods or services that

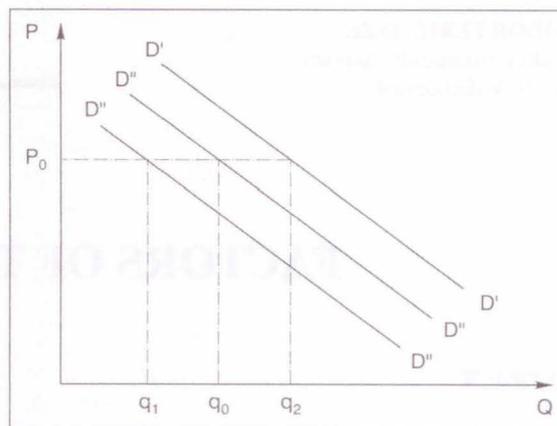


Figure 2 - Increase in traffic service demand

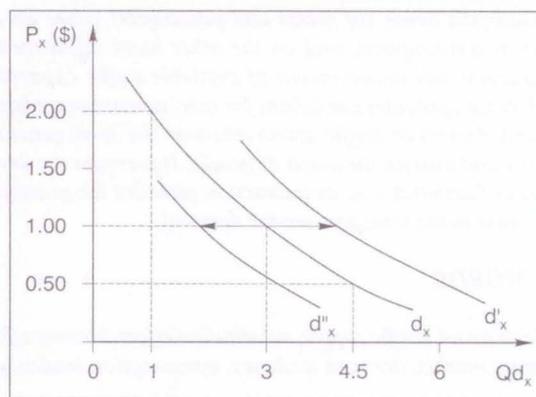


Figure 3 - Individual curve of demand for the goods x

are now relatively expensive). This phenomenon is called *substitution effect*.⁵ However, when the price of service (goods) decreases, the user may buy more goods (realise more journeys, etc.) since real income of the user (customer) is increasing. This is called *income effect*. Decrease in P_x leads to increase in Q_{dx} (so that d_x is negatively sloped), due to the substitution effect and income effect.*

If e.g. a price of a certain service would amount to AO, then of free will the quantity AF (or OC) would be offered. This quantity depends only on the deci-

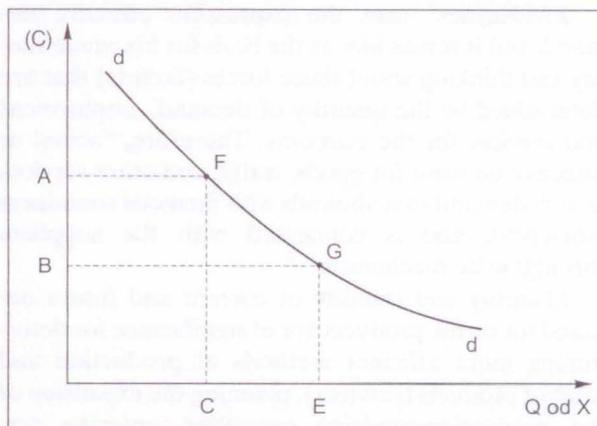


Figure 4 - Demand curve that depends on the tenderer's decision

sion-making parameters of the tenderer, who do not show the customer's wish to buy the given quantities at the given prices.

If the price of the service (or any goods) fell to OB, then the offered quantity would fall to BG (or OE). These quantities depend on the tenderer's decision-making parameters, and they do not indicate in any way the willingness of the customer to buy the given quantities at set (marked) prices.

As noticed, "the law of demand and supply" means that "anything that at one time shows increase has to decrease at some time (or other)". However, such "law" does not exist in the transportation system practice. Even if it did exist, it could not determine supply and demand. We use supply and demand to understand how the "conflict" between customers and suppliers on the market results in prices which "clear" the market. In other words, supply and demand inform us about the method in which markets develop the system order, unifying it in a way described by Adam Smith.⁶

3. NOTION AND TYPES OF TRANSPORT DEMAND

Starting from the definition of market, that it is any organised linking of supply and demand of goods or that its existence depends on the organised form of linking supply and demand of traffic services, which is in a way more accurate, since traffic service as goods has its specific characteristic. First of all, it has no physical form. The process of its generation and consumption is very unique. Such goods cannot be stored, nor realised on other markets, in consumption sphere outside its place of consumption, rendering special characteristics to the market of transport services.

Transport companies do not offer ready-made goods on the market, but rather operating processes, which results in generation of services. At the beginning of the operation, transport companies will find out whether they are going to sell the provided services or the transport means will drive empty. Therefore, only during the operation will the users know what the quality of their service is, since it is very difficult to predict the realisation in advance. The users cannot change the market if the transport needs are related to certain – determined relations. On the other hand, neither can transport companies change the markets since they cannot store their services to sell them at some later period, on some other market. On the contrary, they may come into a position to invest work in the process of transport without realising their services.

The mentioned specific features are reflected in two ways, when referring to the transportation service market.

Firstly, regarding the very important role transportation plays in the process of social reproduction, and the relation between supply and demand for these services, they cannot be left to market mechanisms, but rather have to ask for social intervention.

Secondly, under conditions of developed transport system infrastructure, the transport market has to be defined, and at the same time the physical space it covers has to be formed and it has to be clearly defined.

The basis for defining the transport market regarding the market of material production (other goods) is the understanding of simplicity or heterogeneity of the market, in physical sense. Therefore, Voigt⁷ starts from the knowledge that there is no such thing as a unique market of transportation services, since even every departure of a transport vehicle may be regarded as a separate market, that there is no single market of complex or railway transport in a country, but rather a complex system of substitution possibilities.

Having in mind that transport understands mastering of traffic – physical distances, H. S. Seidenfus⁸ defined market according to its geographical aspect. Every relation is recognised as a separate transport market, offering heterogeneous and various services that have a different degree of substitution. The transport demand⁹ can be expressed also as a function of the service user income.

In that case it is necessary to determine the income-based elasticity of demand which shows variations in demand according to the variations in income.

Income increase (ΔI) – Figure 5, results in traffic demand for transportation services. In practice, however, there are also inverse cases. For instance, in underdeveloped countries, the income increase increases the demand for passenger automobiles, as opposed to demand for public transport.

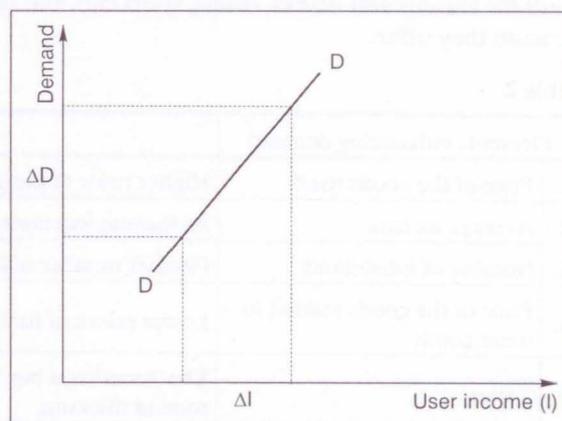


Figure 5 - Dependence of transportation demand on the transportation service user income

The passenger transport demand should be distinguished from the freight transport demand, since it is heterogeneous. Freight transportation demand occurs where the goods necessary for production are not located at the place of production, but have to be transported from greater or shorter distances.

Passenger transport demand occurs where the place of residence is far from the place of other human activities (work, school, shopping, excursions, holiday, sport and recreation, etc.), and physical distances have to be travelled, thus resulting in transportation demand.

Freight transportation demand is reflected in various accompanying forms. This is because there are very big differences in the characteristics of goods being transported, ranging from the degree of processing (raw material, semi-product, finished product), purpose (for the purposes of production, public or personal consumption, etc.), form (liquefied, solid or gaseous state), handling method, value of goods, etc.

Passenger transport demand, on the contrary, is more homogeneous, since all the passengers are classified in the same way and according to same principles. The differences may be noticed only through the income-based principle.

On the other hand, there are differences regarding the purpose of travelling (work, education, holiday, recreation, etc.) which greatly influence the volume and structure of transport demand.

Such demand has its origins in the benefits that an individual (passenger) wants to realise at a certain destination.

In addition to the given statements, the analysis may include also some subjective cases of preferences.

Preferences regarding demand represent different social and historical influences. They may represent actual (real) psychological or physiological needs (for liquids, salt, heat, but also love). On the other hand, they may include also the artificially caused (created) needs for various soft drinks, drugs, sport cars and the pleasure they offer.

Table 2

Elements influencing demand		Example for automobiles
1.	Price of the goods itself	Higher price of the goods itself reduces the demanded quantity
2.	Average income	As income increases people buy more automobiles
3.	Number of inhabitants	Greater number of inhabitants increases the number of purchased automobiles
4.	Price of the goods related to these goods	Lower prices of fuel increase the demand for automobiles
5.	Tastes	The Americans buy more automobiles than the Europeans, provided other goods remain the same
6.	Special influences	Special conditions include availability of underground rail, quality of roads and railway tracks, and expectations of future price increase, etc.

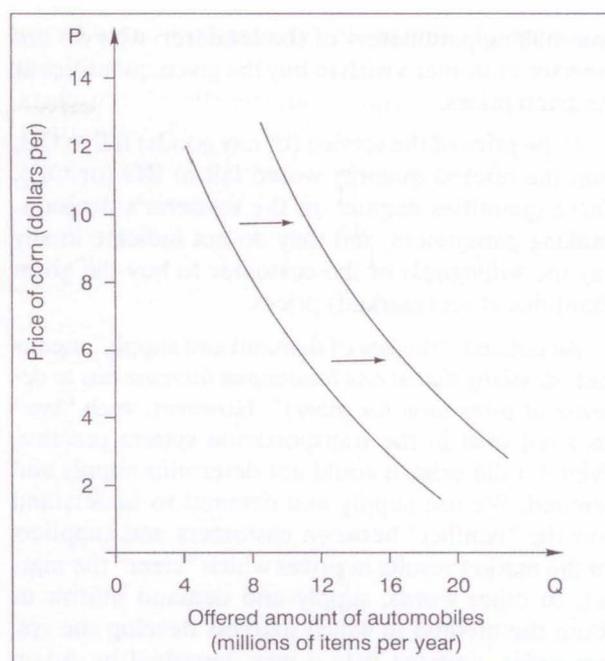


Figure 6 – Increase in the demand for automobiles

Source: P.A. Samuelson and W.D. Nordhaus, "Economy", p. 517.

The demand for certain goods can be influenced also by special impacts, such as e.g. exogenous factors – rain, snow, etc., which influence the demand for umbrellas, warmer clothes, and the level of snow influences also the sales of skis, winter equipment, e.g. regarding automobiles (tyres, tyre chains, etc.).

Table and graph show how the price, i.e. increase in income influences the demand for passenger cars.

If elements that determine the demand change, the demand for automobiles will change as well. The mentioned example (table and graph) shows increase in the average income, number of inhabitants, but also a decrease in the price of fuel, that influence (increase) the demand for automobiles.

For that reason, they increase the demand. The curve DD shifts to the right, to the position D'D'; the higher the price of certain goods (e.g. corn), the greater the consumption, i.e. the greater the income,

resulting of course in greater consumption of goods.

The most important characteristic of transportation demand is that it is derived demand. Therefore, it is very important, in fact, what is being demanded¹⁰: is it the travelling implicitly, or maybe something else, something specific. One thing is certain, and that is that people travel not for the sake of travelling only (excluding exceptions), but to gain certain advantages to a certain destination. Therefore, the advantage (preferred personally by every factor – transport user) is one of the dominant variables of transport demand, which is otherwise difficult to quantify or include in the system of transport demand calculation.

If a company is the only producer of goods (services) for which there is no other substitute, the company is a monopolist. It represents the whole traffic branch and faces the whole branch or market demand with its goods (services).

Examples of monopoly are the local telephone company, electrical distribution, public transport, and public utilities.

Perfect competition is the inverse case. It means that there are a number of companies (transport and others) that produce homogeneous products or perform identical services. Such companies are small, or insufficiently big and their technology and activities do not have major influence on the price of the service (product). Such service (or production) companies accept the price as it is, and they face a horizontal curve of demand.

In other words, company can sell a quantity of products or offer certain services without disturbing the sales prices, service prices.

In modern business conditions, there are organisations that can be classified as “oligopoly” and “monopoly competition”. These are such forms of organisations that are somewhere between the monopoly and perfect competition. Oligopoly is considered to be the existence of several (transport) companies that produce or perform homogeneous business (e.g. cement, steel, chemicals, but also transport service activities) or even heterogeneous and differentiated products (automobiles, cigarettes and beverages). The most distinct characteristic regarding demand is the interdependence of companies within a branch, since there are several similar companies, the pricing, advertising, and the activities of a service company cause very fast response of others in the form of behaviour, even unfair actions, in realising monopoly competition.

Elements of monopoly result from the fact that products (services) of every company differ from the products of other companies. Therefore, every company of such an organisation has a certain degree of price control. This further means that every such com-

pany faces a falling demand curve. At the same time, every company faces a slightly sloped demand curve, which means that a slight increase in transport service price (transport activities e.g.), causes a decrease in the sales of the product (or transport arrangements).

This is the reason why monopolistic competition is emphasised precisely in service activities, as well as in the servicing branch of industry. The demand which is required of a company can be presented in linear (mathematical) form as:

$$Q_x = a_0 + a_1 P_x + a_2 N + a_3 J + a_4 P_y + a_5 T + \dots + a_n$$

where:

Q_x means the demanded quantity of goods (services) X , required of a company P_x , N , Y , P_y , T , price of the goods (services) X , number of customers, users on the market, customers' income, price of the related goods but also tastes of the customers – service users.

Furthermore, the demand will determine the type and quantity of the means (or producers' goods) that a company should purchase, in order to produce the goods or services that will satisfy the demand (transport or other). The greater the demand for products of a certain (transport) company, the greater the demand for products and means for their production and servicing.

Therefore it may be concluded that the demand and supply interact and get mutually co-ordinated. Transportation needs cause increase in the demand for transport services, and these in turn construction and improvement of available traffic capacities, providing conditions for new increase in transport demand. On the other hand, traffic then acts in return on the development of industry, but also in the interest of people. It precedes the development of demand, i.e. through interacting it creates the possibilities for increase in the demand for transport services.

4. CONCLUSION

Transport demand is defined as the totality of requirements for transport services needed by their users, which they can purchase at a certain price and over a certain period of time.

The volume of transport services that are to be purchased over a certain period of time, depend on numerous factors. The most important among them are: tendency to consume, price of the complementary services substitute, purpose and target of travelling, and time and distance.

Transport demand can be expressed also as the function of income, users' habits, or some other variable.

Demand required of a company depends on the market or branch demand of all the individual customers on a market. It also depends on the price of goods

(services), size of the market (number of customers – users), income, price of the related goods, tastes, price expectations, advertising moves of a company, and competition prices and advertising.

Regarding total demand and supply of services in social frames and the process of social reproduction, individual traffic demand cannot be considered isolated, but as a complex of interdependencies, integrally connected services in the whole traffic network.

Therefore, they need to be considered integrally, in a homogeneous integrity, which is the basis for forming the structure of a traffic system, i.e. structure of supply of traffic capacities that have to satisfy in a more optimal manner the demand for traffic services.

SAŽETAK

ČIMBENICI PROMETNE POTRAŽNJE

Potražnja i prometna ponuda stoje u obostranoj interakciji i međusobno se usklađuju.

Prijevozne potrebe (robe i putnika) izazivaju porast potrošnje, s druge strane, utječu na izgradnju i poboljšanje raspoloživih prometnih kapaciteta, što opet doprinosi stvaranju uvjeta za novi rast prijevozne potražnje.

U svezi s tim, promet povratno djeluje na razvoj gospodarstva ali i za potrebe ljudi.

Prethodi razvoju potražnje, odnosno svojom interakcijom stvara mogućnost porasta potražnje za prometnom uslugom.

NOTES

1. **J. M. Keynes:** "General Theory of Employment, Interests, and Money", "Cekade", Zagreb, 1987, p.34
2. Ibidem, page 35
3. **P. A. Samuelson, W. Nordhaus:** "Economy", "Mate", Zagreb, 1992, p. 49.
4. **F. Edgeworth,** "Mathematical Psychics", pp. 28-29
5. Demanded quantity is the one that depends on the price or its change, and therefore it needs to be differentiated from the notion of demand increase. Demand increase means shift of the demand curve to the right, and can be seen in Figure 2.
5. **D. Salvatore:** "Economy for Managers in World Industry", "Mate", Zagreb, 1994
- * If the goods (service) x is inferior, increase of real income, as consequence of reduction of P_x , results in the customer (user) buying (purchasing) fewer and not more goods x . Then the income effect is negative, and substitution effect, the same as in case of normal goods, is positive (when the price of service - goods falls, the user uses more).
6. "The beauty of the market lies in the fact that it is its own supervisor. Should anyone's prices, wages and profit go

astray from the level defined for all, the power of competition will bring them back. Therefore, there is a curious paradox. It seems that market, which represents the peak of economic freedom, is at the same time also the most strict economic order-issuing authority. There is no contempt in market laws."

(**A. Smith:** "The Wealth of Nations", New York, Modern Library, 1937., str.4 i 5.)

7. **V. Voigt:** "Untersuchung der Elemente des Bedürfnis unter Berücksichtigung der Nachfrage", Paper at the II International Symposium on Practice in Transport Economics, Munich, 1967
8. **H. S. Seidenfus:** "Verkehrsmarkte" Basel, Tübingen, 1939, p.141.
9. **Locklin, P. D.:** "Economics of Transportation", Richard D. Irwin, Illinois, pp. 28-32, and Button K.J. (1993), cit. pp. 39-65
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5. **Seidenfus, H. S.:** "Verkehrsmarkte", Basel, Tübingen, 1939, p.141
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