

# Development of the theory of demand and utility in the conditions of change of quality of the goods

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**Abstract** – This paper are investigated questions of interrelation of quality and demand and are considered concepts, which limiting utility, quality and demand On the basis of revealing of interconnection between theories of welfare and markets of imperfect competition, by quality non-homogeneity of goods and services, consumers and producers there determines the influence of public welfare on mechanisms of imperfect competition market and their adverse effect on public welfare which includes stimulation of demand and growth of welfare on the basis of rising level of quality of produced and consumed goods and services

**Keywords:** consumer demand, quality, marginal utility on quantity, quality management.

## I. INTRODUCTION

Changes taking place in the global economy form a new economic mode which is radically different from the traditional models of the mixed economy. Stages of the economic development and its features have been already occurred in the present developed countries. They have obtained such names as "post-industrial economy" information economy "and" the economy based on knowledge." A characteristic feature is the presence of the information components of knowledge in products and services. In other words, the basis of economic benefit of both consumers and producers is the using of specialized knowledge and that they have the relevant information.

In these circumstances one need more generalized and adequate to current realities models of consumer behavior and demand – which include the competition, incomplete information and studying. Consumers weakly differentiate brands and manufacturers of new products for them. Firstly they accidentally choose a product, chaotically, only then in the process of consumption they assess the quality. Competitors fill the market at the same time with the similar, low-quality products. Customers lose the confidence in the quality of all these products - the demand and the price drop and as the result we get the market degradation. In such cases neither consumer protection measures nor legislation can help if not to explore and make sense of this phenomenon in relation to many factors of demand and market signals. One need new models of the market demand in relation to the quality, conditions of uncertainty and unknown quality of the goods.

In this article we would like to answer some of these questions.

## II. DATA AND METHODOLOGY

The concept of demand means a necessity, want or de-

sire to have any goods, supported by the amount of money which is needed to purchase it. In economics, the demand is always based on the willingness and ability to pay, not only on the necessity of goods. The total demand of consumers' goods is described by the functional connection of the factors or can be reflected in the demand curve.

But we should not think that the power of money eliminates the stimulation of demand by other factors.

Approach which includes the using of graphics in the study of the demand has been proposed and widely used by the British economist A. Marshall in his work "The principles of Economics ", published in 1890. He wanted to determine at what price to the particular commodity the market equilibrium would be established. This fact caused him to think that the commodity price was the function  $p$ , and the argument - the number of the product demand  $Q_p$ .

This initial phase of the economic categories of demand study was, in fact, a factor demand, i.e. it derived the dependence of demand on the one factor – on the price at a constancy of other factors. It should be noted that, historically, the competition in the market economy started with the dominance of the methods of price competition. This situation was typical for the period of free competition. It was caused by a well-known constancy of the needs system and of the range and quality of goods. Therefore, A. Marshall studied only the dependence of the volume of demand on the one factor -on the price. He studied the factor demand from the price at the constancy of other factors.

However the demand - is a broader concept which depends on many factors that influence consumer demand. From the position of joint consideration of demand and competition and in order to determine the consumer benefits we offer to enter another important factor - the quality of the goods into many other known demand factors. Since the Marshall research to the present time features of the goods, exactly, the quality of the product was undergoing great changes. Quality has become more important than price. As a result, new methods of competition have been occurred,

including non-price competition, focused mainly on the quality of the goods.

The law of demand establishing a link between the quantity (volume) of the demand and the price of the goods was derived in the empirical way. However, in our opinion, in competitive markets, consumers are interested not only in the price of the goods, but in the quality and competitiveness which shows the level of their well-being.

In the process of purchasing the product consumer (consumers) as if "weighs" the quality of the product with its price. In economic theory, as a rule, we study the effective demand, which characterizes not only desire, but also the opportunity to buy the commodity. Due to the competition low-quality goods leave the markets, because of poor quality they are not able to compete, consumers don't want to make worse their welfare buying such items.

Suppose that there is market balance on the market, it characterized by balanced price  $p_{11}$  of goods with quality  $g_1$  and balanced volume  $Q_{11}(g_1)$ , and costs of its production  $C_1(Q_{11}, g_1, p_{11})$ .

With the increase of quality up to the level  $g_2$  producer will surely will have additional expenses for obtaining and providing of higher quality, which will stipulate for larger costs  $C_2(Q_{11}, g_2, p_{11})$ . In this connection according to the law of supply, producer's wish to produce goods and offer it to the market will go down, because the norm of profit with permanent price for producer will reduce to  $\Delta C = C_2(Q_{11}, g_2, p_{11}) - C_1(Q_{11}, g_1, p_{11})$ . as a result it will lead to displacement of supply curve  $S_1(g_1)$  to the left to the position B  $S_2(g_2)$  (fig. 1).

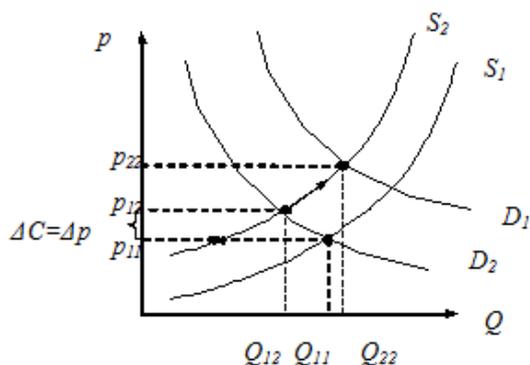


Fig. 1. Model of influence of quality on demand and supply

According to supposed law of demand from quality, with increase of quality the volume of goods consumption must increase, which will provide displacement of demand curve  $D_1(g_1)$  to the position  $D_2(g_2)$ , i.e. to the right. Thus there will be new balanced price on the market  $p_{22}$ . with balanced volume  $Q_{22}$ . Thus there can appear three occasions, when  $Q_{22} > Q_{11}$ ,  $Q_{22} = Q_{11}$ ,  $Q_{22} < Q_{11}$ , but there must be held a condition of increase of original profit  $\Pi(g_1)$  over profit at the quality  $g_2 - \Pi(g_2)$ , i.e.  $\Pi(g_2) > \Pi(g_1)$ , in other words condition of appearance a new norm of producer's profit, larger than with the quality and  $g_1$ .

Considering this question we proceed from Smith's self-interest when everyone maximizes either utility in case of consumer, or profit in case of producer i.e. we consider not a social man who cares about social well-being and increases quality without getting additional profit but a producer who takes economic decisions for his own welfare.

In such reasoning there is some ambiguity about increase of consumption of better quality production. You know the expression – “We are not that rich to buy cheap things”. In this case “cheap things” means low quality things (goods). It's well-known that it's better to buy one quality thing even if it is more expensive, than purchase low quality things at a lower price. (fig. 2). For example to buy good and expensive iron “Tefal” for longer working period than to buy cheaper iron with less functions every year.

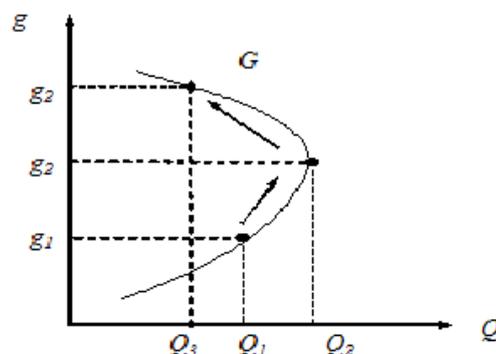


Fig. 2. Curve of demand from quality

Thus we can suppose that the volume of quality goods consumption may not increase, but even decrease, which means displacement of the curve of demand  $D_1(g_1)$  not to the left but will go either up, which will correspond with former level of balanced volume of consumption  $Q_{11}(g_2) = Q_{11}(g_1)$ , or also will go up with the lowering of consumption volume, in any case the price of goods will increase.

In the process of such reasoning there appears necessity to explain in what conditions takes place the movement of the curve of demand to the right or up with the decrease of balanced volume. At our point of view we can suppose that given variants are stipulated by the degree of increase of production quality, which is graphically characterized by the degree of curve displacement to the left.

Insignificant change of quality side of production is caused as a rule by insignificant increase of additional expenses (if we are not talking about improvement of expensive and high-tech production brought to the high degree of perfection.) Therefore, the norm of profit with insignificant increase of expenses will change also insignificantly and we can (according to producer's behavior) state that curve of supply will displace to the right by insignificant value. At that demand, to be precise the volume of consumption will increase or stay on the former level  $Q_{11}(g_2)$  (which can be characteristic also for the second case). AS a result the price of production will increase by the larger value than growth of additional costs  $\Delta C$  and therefore the norm of producer's profit will increase.

In the third case, when the curve of demand displaces up with the decrease of consumption volume there will be significant change in quality level. As a result the displacement of the curve of supply to the left will be significantly bigger than in the first and second cases. At that we can state that utility of each item of such production will by many times exceed production with lower quality. Since value of quality goods for consumer is significantly higher. Therefore general utility is reached by less quantity of goods. That's why quantity of consumption of high-quality goods is lower.

(fig.3).

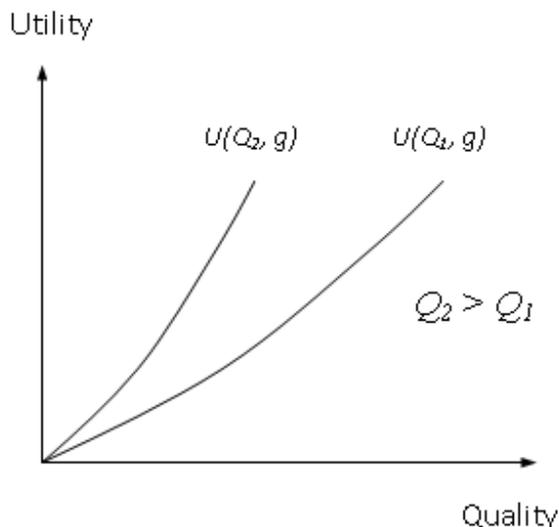


Fig. 3. Behavior of utility from quality at the different levels of consumption

Understanding of demand, supply and utility interaction mechanisms, methodological work out of questions of influence of quality on market forms of management will enable to do production activity of management subjects of all levels more effectively.

In well-known works of marginalists utility is considered as function or dependence from volume of consumption. At that quality is not taken into account. Obviously the researches of marginalists can be considered as some simplification i.e. with invariability of goods quality. Even if they wanted to take quality into consideration they couldn't do it because quality as a value wasn't estimated.

### III. RESULTS (OBLIGATORY)

We can consider well-known results of marginalists' theory of utility as some particular case, i.e. consider utility like function of two variables – quantity and quality, but with fixed invariable quality, i.e.  $U = U(g, Q)$ ,  $g = const$ .

Such approach was used by A. Marshall while developing the theory of demand and supply. He considered demand and supply as a function from price with other things being equal. So there was introduced the principle "Other things being equal." However non-price factors in his works were considered as factors influencing on the shift of demand or supply lines.

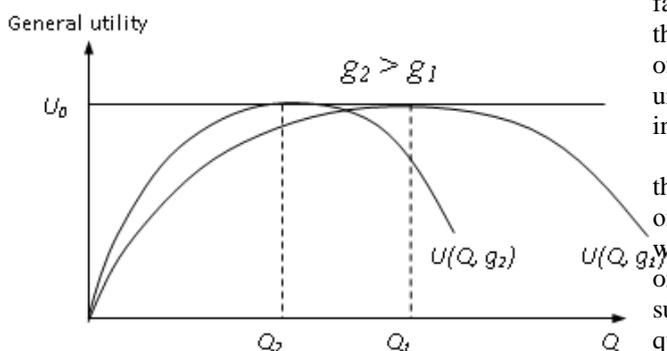


Fig. 4. Graphs of general utility for two levels of quality

Let's formulate the following axioms: quality and quantity of goods are arguments of the function of utility (this is hypothesis of the research axiom 1)

2 axiom the higher is quality the higher is utility i.e.  $U(g_2) > U(g_1)$  при  $g_2 > g_1$ .

However in the works of marginalists we don't meet the shift of the curve of utility. Let the utility be  $U = U(g, Q)$ ,  $g = const$ . Then utility in dependence of  $Q$  behaves as follows:

Family of graphs of utility for different quality  $g_2 > g_1$  presented on fig.

Given utility at increase of quality of goods is reached at less volume..

Law and the same utility at increase of quality of the same type product is reached at less volume of its consumption.

For example fresh apples contain more vitamins than apples, stored for a long time. That's why for replenishment of organism by needed vitamins one need to eat less volume of fresh apples compared to long-stored apples.

#### Budget line of goods with different level of quality.

The quality of the goods B is higher than quality of goods A. i.e.  $g_B > g_A$ , then  $P_B > P_A$ .

Budget line of different quality goods is totality of points each of which shows some combination of two goods  $A = A(g_1) = B = B(g_2)$ , which one can purchase having totally spent all income.  $Q(A)$  и  $Q(B)$  – volume of consumption of goods A and B.

If income increased then budget line for the different quality goods will displace to the right. However quality goods will always be bought in less volume than low-quality goods i.e. at the decrease of price of goods A the point of intersection of budget line with the datum line will move farther from point of origin compared to goods B quality of which is higher. Thus at the increase of quality of one goods the point of intersection of budget curve with the datum line will strive for the point of origin closer and closer (the law of budget line for goods of the same type and different quality).

#### Quality as a basis of rise of utility and choice of consumer.

As it known rests on the subjective evaluation of satisfaction that he gets from consumption of goods. In economic theory such consumption is called utility. However, the level of achievement of utility depending on quality is not clearly understood The dependence of utility on quality was studied in the theory of marginal utility.

As a rule each consumer is interested in maximizing of the total amount of utility which he will get depends not only on goods quantity, but on the level of its quality. That's why gain that he gets from consumption of one item depends on its quality. In his strive to maximize utility effect consumer simultaneously aims at purchase goods of better quality and grow the volume of consumption that depends on quality as a whole. With consumption of each additional

item of goods of the same type of certain quality level the total utility grows by some value.

Graphs on fig. 6 illustrate changes of total ( $TU_i$ ) and marginal ( $MU_i$ ) utility for two levels of quality  $g_1$  and  $g_2$ .

Each graph of total utility according to growing of consumed goods item grows slower and slower because marginal utility of each of them steadily decreases.

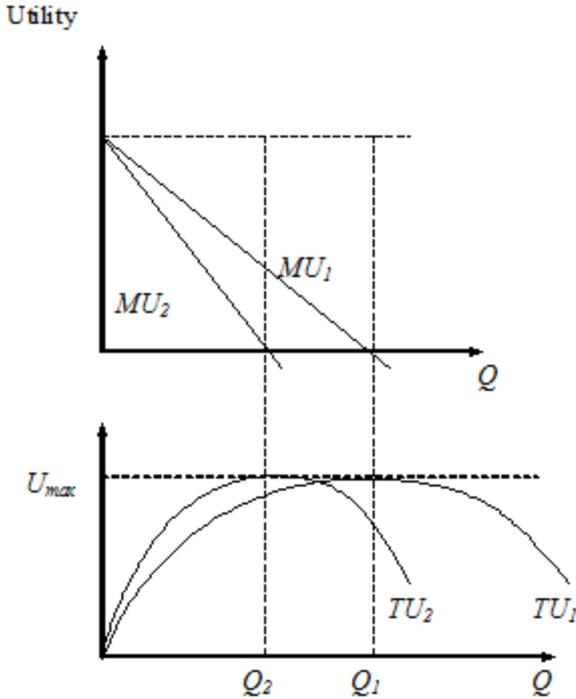


Fig. 5. Correspondence of marginal utility and total utility for two levels of quality

When marginal utility of each graphs becomes equal to zero, each total utility reaches its maximum.

However maximum of total demand of the second graph relative to the first one displaced to the right because one and the same utility at the increase of quality of goods of the same type is reached at its less consumption.

If consumption is carried on in processes of each goods different from the other by level of quality then marginal utility of each of them becomes negative value, and total utility of each of them begins to decrease.

Between marginal and total utility there exist the following connections.

$$MU_Q = \Delta TU / \Delta Q$$

$$MU_g = \Delta TU / \Delta g$$

$$MU_{Qg} = \frac{\Delta^2 TU}{\Delta Q \cdot \Delta g}$$

And at infinitesimal changes of volume and quality these indexes are described by first derivatives from total utility on quantity and quality.

$$MU_Q = \frac{\partial TU}{\partial Q}, \quad MU_g = \frac{\partial TU}{\partial g}, \quad MU_{Qg} = \frac{\partial^2 TU}{\partial Q \cdot \partial g}$$

$MU_Q$  – marginal utility on quantity of consumption – quantitative constituent of marginal utility.

$MU_g$  – marginal utility on quality of consumed goods – qualitative constituent of marginal utility

$MU_{Qg}$  – marginal utility from combined change of quality and quantity of consumed goods – combined constituents of marginal utility from quality and quantity.

Total marginal utility is the sum of quantitative, qualitative and combined of their constituents of marginal utilities.

$$MU = \frac{\partial TU_Q}{\partial Q} \cdot \frac{Q}{TU} + \frac{\partial TU_g}{\partial g} \cdot \frac{g}{TU} + \frac{\partial^2 TU_{Qg}}{\partial Q \cdot \partial g} \cdot \frac{Q \cdot g}{TU^2}$$

Improvement of goods quality from  $g_1$  to  $g_2$  can allow producer producing given product to rise price from  $p_1$  to  $p_2$ , which will reflect the increase of quality. If the price increases less than proportionally to increase of product quality  $g_1 g_2$ , i.e. less than by  $p_1 p_2$  (as it shown on figure), then consumer gains clear profit from increase of product's quality.

#### IV. CONCLUSIONS

In this article we tried to complete and expand the scientific results in the field of theory quality, value and profits by identifying mechanisms of influence the quality of goods and services to offer the producer, the consumer utility and the utility of the formation of their benefits (profit and utility).

In economic theory, the total gain is interpreted as a social welfare and is denoted as  $W = CS + PS$ , where CS - profit (surplus) of consumers, equal to the area under the curve bounded at the top of the demand curve, the bottom line of the market price,

PS - profit (surplus) of manufacturers of equal area bounded at the top line of the market price, the bottom of the supply curve.

As it was mentioned earlier the consumers benefit is the difference between the maximum amount of money that consumers are ready to pay for a given quantity of the goods and their actual costs, based on the current market prices for these goods. For the consumers it is the area between the demand curve and the market price line.

In work there was obtained the following dependence: producers-sellers increase volume of supply of goods with the rise of price, lowering of quality and competition, which connected with decrease of expenses for providing the given low quality level and competitiveness of goods. The largest volume of supply is reached with maximal price minimal possible quality level and competitiveness requests of goods. And vice versa the least volume of supply is reached with minimal price and high quality of goods and competitiveness requests. At the same time the volume of supply increases with the growth of demand level on high-quality goods.

Limit quality welfare can be defined as an additional increment of social welfare by increasing the level of quality of goods consumed by one additional unit. Changes in the level of quality also implies some change in the consumption.

The growth of social welfare as a result of improving the quality is provided by the increment of consumer surplus and the profit (surplus) of the manufacturer (shaded area).

In our opinion, the qualitative growth of wealth - this is a trend to increase the amount of consumer high-quality surplus and manufacture high-quality surplus which is derived from improving the quality of goods and services.

Qualitative growth of social welfare is a function of the growth of high-quality consumer and manufacture surplus when the level of quality of consumed goods and services changes.

Producer, achieving increment of level of goods quality, gets additional increment of profit, equal to remainder of profits at quality levels  $g_1$  and  $g_0$  and prices  $p_1$  and  $p_0$ .

As seen from the figure, growth of public welfare as a result of increase of level of quality is provided by increment of benefit of consumer and benefit (surplus) of producer equal to hatched areas by horizontal and vertical lines.

This reasoning allowed introducing a number of new notions. Qualitative growth of welfare – is a tendency of increase of amount of qualitative consumer surplus and qualitative producer surplus, happening as a result of rise of level of goods and service quality. Qualitative growth of public welfare is a function of growth of qualitative consumer and producer surpluses with change in level of quality of consumer goods and services [4, 5].

Thereby qualitative growth of public welfare can happen only on following conditions:

Marginal utility on quality (MU (g)) exceeds marginal price on quality (MP (g)):  $MU (g) \geq MP (g)$ .

Marginal utility on quality exceeds marginal price on quality. Marginal price on quality (MP (g)) exceeds marginal costs (MC (g)):  $MP (g) \geq MC (g)$ .

Economical sense of these two conditions consists in following: the first condition is connected with the growth of consumers demand as a result of rise of goods quality, which happens as a result of qualitative stimulation of consumes demand. The second condition is connected with producer's gain of additional profit as a result of sales of quality goods by higher price than goods of lower quality level, which also, eventually, is the result of qualitative stimulation of producer's supply.

Otherwise we can formulate these conditions as follows: With one and the same speed of quality level growth the following conditions must be held.

1) the velocity of utility level growth  $V$  utility (g) exceeds velocity of price level growth ( $V$  price (g)):

$$V \text{ utility (g)} > V \text{ price (g)};$$

2) The velocity of price level growth exceeds velocity of cost level growth with  $V$  price (g)  $>$   $V$  costs (g).

As a result of integration of these two conditions we come to the important necessary condition of quality level growth on goods and service market: the necessary condition of growth of goods and service quality is excess of velocity of utility level growth over level of consumption of quality product price and over velocity of production costs for providing goods with given level of quality i.e..  $V$  utility (g)  $>$   $V$  price (g)  $>$   $V$  costs (g).

It should be noted that qualitative costs of consumers and producers also can be interpreted as expressed in money losses of consumers and producers from prohibition of consumption and production of goods of given quality level.

Starting from such reasoning we go to the sphere of practical application of obtained results, consisting in state regulation of economic development both the country as a whole and separate subjects of management (producers and consumers).

It's common to think that postulates of Pareto's theory of welfare are value judgements. That means that Pareto-optimality – normative notion. As it known the basis of normative approach are recommendations on carrying out economic policy. With a breakdown into this we open value judgments connected with qualitative changes of goods. In the framework of methodology of public welfare, value judgments have special place. At the beginning we cite widely known obvious example of value judgment, according to which economic growth, of quantity measured of real net national income is always desirable. But will be this judgment so immovable, if with that economic growth leads to absolute worsening of situation with people, whose income belong to lower quartile (decile or quintile) of the corresponding distribution. The same way, for the substantiation of our hypothesis of “qualitative growth always leads to the growth of public welfare”, we have a right to put a question: 1) Is it always justified to raise salary with rise of work quality? 2) Will the price of high-quality goods always be higher than low-quality goods with reliable information about level of quality?

Asking our self-questions in this direction we find difference between “basic” and “non basic” value judgments, connected with qualitative changes. In this context let's apply to the most common definition introduced by A. Sen. “Value judgments can be called “basic” for a man if it implies that it relates for him true at any circumstances, otherwise it is “non basic”.

As long as value judgment is non-basic or mixed, to which belong value judgment on qualitative changes, discussion about it is based on facts. This approach is effective, since as it known, our standard methods of dispute resolution about facts are not as doubtful as our methods of dispute resolution about values. If value judgment about qualitative changes was basic, or clear value judgment – like for example in the case of allegation of little-informed person “Work quality of professor is high, and therefore his salary is high”,- thereby we stated absence of ability to analyze and discuss qualitative growth of people welfare.

Thus, quality is the basis of development of individual and public welfare and production prosperity. The presence of the quality allows getting an additional welfare defined by consumer surplus through additional utility increment for consumer.

With this the increase of costs for providing of quality will be lower than obtained benefit from utility, caused by the growth of quality. For manufactures that will mean not only efficient use of limited economic resources but additional surplus defined by the growth of income from increasing quality level, which is more than costs of providing of quality.

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