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THE MARGINAL GROUNDING OF SYSTEM MODEL OF PRODUCTION FUNCTION ENTERPRISE

Доведено необхідність побудови системної моделі функції виробництва (СМФВ) у математичній формі, а також розроблено алгоритм її розрахунку шляхом використання емпіричних даних за будь-яким аспектом. Тут використано гранично допустимий підхід до побудови цієї функції. Доведено що ціна сировини і витрати на неї мають різні кількісні невипадковості. Відкрито форми методологічних обмежень класичних моделей функцій.

Доказана необходимость построения системной модели функции производства (СМФП) в математической форме, а также разработан алгоритм ее расчета путем использования эмпирических данных по любому аспекту. Здесь используется предельно допустимый подход к построению данной функции. Доказано, что цена сырья и затраты на него имеют разные количественные неслучайности. Были открыты формы методологических ограничений классических моделей функций.

It had been proved the essence of the system model of production function (SMPF) both with the mathematical form and algorithm of its calculation on the basis of empirical data for any business subject. It is used the marginal approach to construction of production function. It had been proved, that the price and the cost of one commodity unit have different quantitative definiteness. The forms of methodological limitation of the classic production function's models were opened.

the system model of production function (SMPF), mathematical form, marginal approach, price, cost

Forming of economic institutes as rules of rational behavior of all subjects in interests of integrated society and also limitations identification of monopolistic managing, which are adequate to regularities of market development. All are related to essence of production function phenomenon. Researches of production function in scientific works [1–3] showed its principle restrictions in practical application, stipulating the rare use on microeconomic level, weak practical consequences. Actually possibilities of production function are so varied, so it causes us a consideration of its formative dependences as an independent social-economic institute of market economy [5–6].

The object of the research is a concept of new sense of marginalizes, which allows viewing the methods of estimation of all factors forming product otherwise by what it was accepted traditionally, and also to extend the view of pricing on different types of commodities created in conditions of postindustrial economy.

Use modern bookkeeping data of firms and enterprises for the economic analysis; we paid an attention that all information of firms accumulates on the successive time periods.

Calculating specific figures of expenses or profits of one or other period of concrete production functioning, actually in bookkeeping an economist deals with the additional figures of expenses/profits on additional unit of output. It is that in the expenses accounting per unit of commodity any economist actually deals with the figures of first derivation, transforming obvious expenses into full marginal costs MC.

Accumulating such data on concrete enterprise continuously for a few successive observation periods, it is possible to build a curve MC for this enterprise and to calculate its equation by approximation. That could be built the same curve which often use in textbooks on microeconomics, but never while built it for real productions.

From equation of curve MC we constructed the system of 3 equations, which reflects a production function's (SMPF) sense of enterprise.

The production function (SMPF) expresses a connection between different combinations of production inputs and receipt of optimum output of commodity as the system of three equations:

$$\begin{cases} MC(t) = at^2 + bt + c, \;\; a \neq 0, \;\; t = \overline{1,n}, \;\; n \in R_2^+; \\ AC(t) = \dfrac{1}{t}\int MC(t)dt, \;\; t \neq 0; \\ Q_{opt} = Q_{trend}. \end{cases}$$

The offered production function's (SMPF) system model differs from classic and engineering models by many reasons [5].

Foremost the offered model is universal for all production types and any industries. Unlike the macroeconomic Cobb-Douglas model, it is applicable on microeconomic level, that exactly wherein commodities are produced, including innovative goods. Adding up of production costs for one industry or for one country allows using model on macroeconomic level.

Besides that, system model of PF has a finance and economic sense and money measuring makes unlike engineering and CES-functions, which have just technological sense [10]. That's why system model of PF has more multipurpose field of application, than natural indexes.

In addition, there is no necessity to differentiate factors of the materialized capital K from direct labour L in the offered model, which could not be divided and isolating measured in real life (and, especially, as far as development of postindustrial economy) [10]. In our model of PF it is possible to take into account the expense of *all* production factors in a money form, including both material-materialized and immaterial (intellectual, informative, communications, organizational, etc.), and also including transaction and imputed costs.

Finally, the system model of PF keeps a semantic accordance in all forms: verbal, mathematical, table and graphic. Their mutual accordance to each other is an additional confirmation of authenticity of the offered system model of production function and it helps to apply this model for description and research of economic regularities of any managing subject behavior, including applying innovative resources and creating innovative commodities at the monopolized markets.

Evidence of that, a production function is an institute, comes forward circumstance that three laws of institutional architectonic are executed in properties of the system model of production function (PF), which reveal limitations in marginal costs' dynamic of the concrete enterprise.

Marginal approach to application of production function allowed to detect all signs and properties of social-economic institute in its new system model of PF, which is necessary to adjusting of monopolistic management in conditions of modern market economy.

PF's forms of display	Verbal form of PF is a word dependence between determined variation of input – output
	Analytical form of PF is a mathematical model, which can be introduced as $Q = f(x_1,..., x_n)$, where Q is a maximum output of giving inputs; x_i – number of using i-input ($i = 1,2,..., n$)
	Geometrical form of PF is a graph of input-output values by axis
	Tabular form of PF is a summary table of total costs, output, marginal and average products by columns

Production function extends our imagines of production efficiency by including of selling costs and appeal of property competences on a commodity, including transaction and imputed costs, and also by connecting interests of rational allocation of public resources, but not only demand and supply interests in one model. Optimum establishment of public necessary costs, that is application of an approach using a differentiation of price phenomenon from cost of any commodity, is possible only based on calculation of PF for this enterprise or production of this commodity.

Actually, PF as a system model is more exact criteria of production efficiency, which takes in account results of output producer activity not only in his own interests, but also utility of this management for society. It is special important at the use of natural resources and innovative resources, which possess big public meaningfulness and limited possibilities of reproduction. Natural and public meaningful resources either carry out sides' externals issue or need very heavy expanses of immaterial fixed assets for reproduction. The forms of immaterialized capital, not overcame by the institutes of government control, in innovative commodities create the threats of uncontrolled prices and nonmonetary growth of inflation increase.

What gives the application to the production function in an economic theory and economic practice?

– We made sure, that on bookkeeping data of concrete enterprise it is possible to build curves MC and AC for any enterprise, rather than just imaginary one.

– Along with the mathematical and geometric sense, we saw the economic sense of production function as it applies to conditions of concrete enterprise.

– The MC curve of this enterprise reflects to the cost change of produced commodity as far as increase of production scales and growth of demand inflation on used resources. Unlike MC curve, global (long-term) curve AC shows a tendency of cost on the commodity of this production in the process of complete depreciation of the initial advanced capital.

– Intersection point of MC and AC curves is the second break-even point of production and is needed for the calculation of all combined volume of output, which can be got from the initial invested capital. Continuation of issue after this optimum will cause the costs on enterprise, growing with greater speed, than growth of profits. That, production will be ineffective, and resource expenses – inefficient.

– Along with principle of pricing on marginal costs, which really everywhere is in economic practice, we discovered the other – alternative principle of pricing – on average costs AC, which can be used in society's behalf in many cases, for example, in inhibition of inflationary prices advance or at costs adjusting of monopolists.

What will be without application of system model of production function?

1. Till present days, on micro- and macroeconomic level in managing practice proceeds the application of such criteria of economic efficiency like a level of profitability, which eliminates interests of society and destroys an economic equilibrium in it. Without using the production function, the criteria of production efficiency, expressed as a level of profitability, does not include interests of society, does not allow to see the producer's inexpensive mechanism of costs limitation, especially

important in conditions of increasing monopolization of all markets as far as increase of commodities part of postindustrial epoch, that productions of services, competences and human capabilities. In creation of these commodities the part of immaterial factors (live labour, qualifications, concrete individual experiences, knowledges and information, exchange by rights and actions) increases considerably, besides it is not added to the exact account and measuring, joggling the subjective aspirations to the monopolize, and by the same – to inexorable prices' advance and exciting of inflation. It is impossible to treat for the removal of this effect, for example, just by simple administrative introduction of limitations up to the level of profitability. In fact, the base of expenses is elusive in number and easily extended for application of one or another percent of profitability.

2. In a postindustrial economy the inflation will be inevitable and uncontrolled increase by a growth of part and value of immaterial production factors. Application of PF will allow to limit it.

3. In a national economy of Ukraine such organizational form of commodity markets, as monopolize, broadens out and prevails. For its adjusting it is needed not appeals to creation of competition, and introduction of unexpense mechanism based on production function of PF. Detecting negative consequences of monopolize is possible not artificial creating the terms of pure, perfect, just competition. In fact the mechanism of pure, perfect competition is concluded in properties of intersection point of AC and MC. Consequently, the terms of perfect competition can be modeled, be calculated for subjects really being in imperfect competition (monopolistic) environment.

While to the phenomenon of competition automatically and groundlessly add all-powerful properties of spontaneous equilibrium. Such properties are inherent in perfect competition, which was never and nowhere present in reality. As a concept, «perfect competition» is needed only as an abstraction for theoretical constructions. In real life it is not and never was. It can't be realized in reality [8].

4. In creation of services and competences an objective growth of part of immaterial factors inevitably joggles all prices' advance. It means that during development of informative epoch the intellectual production and postindustrial economy already arose up quite a bit not only technological, industrial, ecological, but also economic dangers from distribution of innovations. Thus, while to the economic theory these negatives are not marked and are not studied. Above all things there are such problems, as violation of economic equilibrium and absence of necessary institutes of public adjusting in a process of innovative development.

The danger to use the criteria of production efficiency without bringing in of PF concludes also that:

– at uncontrolled development of innovative markets the interests of many socially unprotected (insolvent) sections of population are economic restrained,

– as a result of disturbance of economic balance the social polarization increases in society, social-politic conflicts intensify,

– an ecological danger of unbalanced expense of natural and public resources, their uncontrolled exhaustion increases,

– there is detriment of the economic and political stability of every national public system, and with the processes of globalization – and whole world association.

Without including of production function to the existent criteria of market management efficiency appears that producers' interests restraint society and consumers possibilities, as they have all possibilities to impose intensively uncontrolled, unbridled, unreserved enlargement of issue of one goods in harm to goods with positive public externals and commercially unprofitable for market effects. In such cases the balance of values, which are necessary for people and society reproduction, is disturbance and, in final analysis, the equilibrium of goods equivalents collapses in a market exchange.

It is clear in theory, that among immaterial factors for creation of any commodities-services, commodities-competences, commodities-capabilities, it is sharply increases

a part of living labour, cost and price of which is difficultly quantitative expressed, is not determined by direct appearance and frequently involuntarily conduces to violation of proportions in exchange equivalence. A market exchange is unable to catch and fix publicly necessary costs of living labour. In modern economic practice they are fixed subjectively, arbitrarily, often just individually, without publicly acknowledged and mass acceptable norms, rules, stereotypes, algorithms. Probably, it is impossible to measure them by quantitative in straight and directly, but it is possible to involve through the mediated, indirect methods of the imputed estimation. For measuring of living labour's expenses in creation of immaterialized results there are not enough special institutes of indirect (imputed) measuring and quantitative estimation of non-obvious costs.

The evidence of that, to take or not production function to the institutes, comes forward circumstance that three laws of institutional architectonic are executed in properties of the offered system model of production function (PF).

For the first, the law of equilibrium is observed in our model. In a point MC = AC level of commodity cost comes forward an intermediate level between a demand price (AR = MC) and supply price (MC = MR). It testifies to balancing interest of two sides – salesman and buyer – in the third independent point of costs function. Every purchase act of commodity means an achievement of short equilibrium in concrete case. Sum of all purchases at this commodity market in this period is equilibrium in industry. Clearly, that interest of salesman – is a maximization profit on sales. Interest of the solvent total demand – is a maximal utility of a commodity. A balance between them is achieved in point of MC = AC. Costs combination of any producer's supply at this market with possibilities of resources' public allocation forms the short-term equilibrium of exchange in behalf of the system of higher order, that in behalf of society. Otherwise, mechanism of MC = AC as point of equilibrium makes interest of society as integral organization.

For the second, the law of averaging executed. In every fixed period, looking after the costs of one or another commodity, we see that motion of MC is accompanied proper curve AC, which is unique in this period and reflects that average costs level. The last one falls on integral average parameters incident to the organic structure of this production in this period. This average value simultaneously comes forward a parameter of the system of higher order. That in every commodity exchange a function AC reflects interest of society to innovations, resources and receipt of this commodity amounts.

Average descriptions of costs AC are non-obvious; they are not evident at the direct supervision. They are integral average costs, connecting any exchange with the system of next level. It turns out that averaging AC in commodities costs is revealed only analytically. As an institute of production function (PF) allows to put in order benefits and expenses of two participants of commodity exchange, entering interest of the third party. For an organized manner society can bring set of a purpose into each act of commodity exchange by institutional fixing of production function (PF).

For the third, in our model of production function it is confirmed the law of «gold section». For realization of this law we will check up sufficient terms: on the one side, it is necessary to identify integrity which is parted on two unequal parts, from the other, – to check, whether there is attended-entering integrity as component in the context of more wide system.

In order that whole, parting to pieces, seemed wonderful from aspect of form, between smaller and bigger parts must be that relation like between bigger part with whole. In our case every act of exchange comes forward the completed integral relation of microeconomic level. The material and immaterialized expenses of all resources are components of costs, which form a price equation. As material costs are obvious, so by the gold proportion it is possible to impute a measure of immaterial costs in money form and then to define a cost of commodity in money term.

So, marginal approach to application of production function allowed to discover all signs and properties of social-economic institute in its new system model of PF – as a publicly necessary rule of economic behavior of all managing subjects, and as an adjusting mechanism of public interests, and as a way of people's collective thinking, and as purposeful action of whole society. As our researches showed, new sense of marginalize allows to differentiate and even to calculate a cost of commodity along with its market price and to see principle difference in this problem of ordinary (particular) goods from innovative commodities, from the commodities of natural monopolies, finally, from the common goods, incapable to grow into commodities. These theoretical circumstances substantially extend our imaginations of the market price formation and ground possibilities of creation of new public institutes for adjusting of prices, inflation, economic conduct and economic equilibrium in society.

As a norm and a model of behavior in society, as appearance of actions and thoughts, managing subjects do not know about production function yet. But among traveling indicatory signs in development of present economic processes it is able to explain a mechanism of rational choice organization and agreement of economic behavior of all managing subjects in integrity behalf.

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