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CALCULATION OF OUTLAYS IN A SOCIALIST ECONOMY

Economic literature today gives much attention to the problem of the planned utilization of the law of value and to methods of calculating outlays. Economists differ, however, over the nature of the shortcomings in the calculation of outlays and how they can be eliminated. Some believe that prices of output should be set at the level of its value, while outlays should be calculated according to the individual value of each product. Other economists hold that price formation and calculation of outlays should be based on the price of production formula. Still others think that the principles of price formation and calculation of outlays in a socialist economy do not fit within any price formation formulas of past systems and that a special, transformed form of value operates in a socialist economy which is specifically characteristic of it.

All of the participants in this discussion proceed from the same premise: outlays actually consist only of labor and value is determined by its outlay. Controversy arises only over the principles and methods of calculating outlays. In our opinion it is desirable to apply mathematics when solving this question. By means of mathematics and modern computing techniques we can greatly improve the methods of calculating outlays in a socialist economy.

The problem of the principles involved in the calculation of outlays under socialism can be solved only on the basis of Marx's theory of value. Consistent application of the major propositions of this theory under socialism is of decisive importance for elaborating the principles of optimum planning.

Let us move from the abstract to the concrete. First we shall examine the principles of calculating outlays, ignoring the conditions that complicate such calculations. Their role is interpreted in different ways by our economists. Successively complicating the premises, we shall clarify the part each of them plays in the calculation of outlays.

We shall begin with the calculation of outlays under the following conditions: 1) optimum planning, i.e. fully corresponding to the economic laws operating under socialism. This means that the methods of calculating outlays allow us to draw up a plan requiring the minimum outlay of social labor to produce the stipulated output. 2) The administrative organization of the national economy is based on the principles of democratic centralism. This means that the cost accounting outlays must reflect the outlays of the national economy in such a way that the minimum of cost accounting outlays is always a true indicator of the national economic outlays. 3) Relatively better means of production are not limited: the program of end-product output can be fulfilled with the use of only the best conditions for the application of labor. This, in our view, is unrealistic, but it helps to explain the significance of a condition whose role is the main source of disagreement on the question of calculating outlays – the shortage of certain resources. We shall subsequently replace this proposition by a more realistic one - the shortages in a number of the best means of production - and compare the calculation of outlays with and without such shortages. This will make it possible to determine the importance of shortages in particular resources in calculating outlays.

Under the above conditions the optimum plan, as regards outlays, will be the one in which every endproduct is turned out with minimum outlays of labor. To draw up such a plan it is necessary to find a variant of production for every enterprise and section which will ensure the minimum

individual cost of production. After all, the third proposition shows that the individual cost minimums are compatible with each other and with the minimum cost of the entire end-product of the national economy. That is why the prices for means of production in the optimum plan must equal their cost, while outlays for each given product must be calculated from its individual cost in drawing up and implementing the plan. Under these conditions the difference between the social and individual costs of production of the enterprise must be the basic cost accounting index. An enterprise operates in accordance with the optimum plan if this difference equals zero. Above-plan profit would mean that the enterprise has improved on the norms of the optimum plan (by mastering new techniques, for instance), while losses would mean the opposite.

Let us now replace the third proposition by a new one: some means of production cannot be reproduced and are in short supply as compared to demand for them. It is obvious that this condition greatly complicates planning, cost accounting and distribution according to labor.

Planning is complicated by the fact that as a consequence of the scarcity of the best means of production the minimums of the individual costs of products in whose manufacture these best resources can be used become <u>incompatible</u> with each other. In this case it will not suffice to calculate the cost of the given product to find plan variants corresponding to the minimum outlay of labor on the entire social product. It is also necessary to calculate the effectiveness of using limited resources in the given production and to compare it with the effectiveness of their possible application in other sectors of production.

Economic calculation is complicated by the fact that divergence of the individual cost of production at any enterprise from its value reflects not only the quality of the latter's work, but also differences in the effectiveness of the applied resources.

Incompatibility of individual cost minimums involves the incompatibility of the individual maximums of net output and net income. This means that in economic calculation the principles of minimum outlays and maximum results are valid only if a like amount of equally limited resources is used in the compared cases. If this condition is lacking (and this is usually the case), the saving received from the output's individual cost at the enterprise cannot be regarded in all cases as a reflection of economy in social labor. After all, the economy derived by a given enterprise through the application of raw materials that are in short supply may be exceeded by the additional outlays at other enterprises, which could have used the rare raw materials to much greater advantage, but were deprived of this opportunity. For instance, if the use of critical raw materials at one enterprise yields an economy of one million rubles, while other enterprises could have saved two million rubles by using them, it will mean depriving the national economy of a saving of one million rubles.

A scarcity of the best resources also complicates distribution according to labor. Under these conditions synthetic indices of the results of living labor - net output and net income - depend not only on the quantity and quality of labor, but also (very often even to a greater extent) on its equipment with the means of production.

In order to surmount these difficulties we must solve the following problems: 1) When planning it is necessary to draw up an optimum balance of scarce resources, meeting the following requirements: a) every variant for using scarce resources adopted in this balance must conform to the program of turning out the national economy's endproduct and ensure greater labor economy than any of the rejected variants; b) the total requirement of scarce resources in this balance is fully met by the available stock in hand. 2) Economic calculation must be organized in such a way that the enterprise's savings in outlays reflect the economy of social labor, the minimum cost accounting outlays are compatible with each other and with the minimum cost of the entire social product, and all enterprises are placed in equal conditions for the application of labor so that enterprises disposing of better resources will not enjoy cost accounting advantages as compared to enterprises possessing less effective means. 3) Indices of labor results must not depend on its equipment with means of production. They are called upon to reflect only differences in the quantity and quality of labor.

All these problems are solved through the planned application of the law of value, with the assistance of the methods of optimum planning.

Commodity prices are determined by the law of value, but at the same time they depend on demand and supply. Moreover they serve to adjust demand to supply. In a planned economy, adjustment of demand to supply for a scarce resource means to balance the planned need for it with the available stocks by fixing a single value norm of effectiveness of its use. This norm must express the minimum economy of labor yielded by application of a unit of the scarce resource in the optimum plan. By including in the outlays for the production of a given product the normative effect produced by the use of a quantity of this resource, (1) we can check the degree to which the given application of the resource meets the optimum plan, and whether it is sufficiently effective. This check is done by comparing the outlays, calculated with due account for the normative effect of the resource's use. Selection of the most effective variants for the latter's use is done according to the principle of minimum outlays.

Proceeding from minimum individual outlays (with due regard for the normative effect) and having drawn up, in accordance with this principle, a plan for the output of the needed end-product, let us determine all the variants for using the scarce resource which yield the greatest economy of labor. In this any single norm of effectiveness ("price") of the scarce resource meets the requirements of point "a" (every adopted variant is more effective than any of those rejected). The very same norm of effectiveness, under which the planned need for the limited resource is adjusted to the available supply, also meets the requirements of "b." The following is convincing evidence of this.

Let us assume that the scarce resource can be used in the production of <u>n</u> different products, and that all of these products are included in the production program of the national economy.

The cost of making these products with the use of the scarce resource shall be indicated by $C_1, C_2, ..., C_n$, and the quantity of the said resource needed for this purpose correspondingly by $q_1 \not q_2, ..., q_n$. The cost of the same products without the use of the given resource shall be indicated by $c_1^0, c_2^0, ..., c_n^0$. (If any product cannot be produced without the use of the scarce resource, its cost (c^0) is assumed to be infinitely high.) (2)

Let us denote the aggregate norm of effectiveness of this resource by r. (3) Then the normative effect from the use of $q_1, q_2, ..., q_n$ units of this resource will be $rq_1, rq_2, ..., rq_n$, and outlays for each of the n products, with due regard to the normative effect from the used resource, will amount correspondingly to $c_1 + rq_1, c_2 + rq_2, ..., c_n + rq_n$.

Let us assume that for the first $\underline{\ell}$ products these outlays are less than or equal to the cost of putting out the products without use of the scarce resource, that is, less than or equal to c^{0}_{1} , c^{0}_{2} , ..., c^{0}_{n} , and for the remaining $n - \hat{\ell}$ products they are greater than $c^{0}_{\ell} + 1$, $c^{0}_{\ell+2}$, ..., c^{0}_{n} . Then, planning the use of the scarce resource in the output of the first $\underline{\ell}$ products, we obtain the most effective plan for using it: each of the variants adopted in the plan for the utilization of this resource will be more effective than each of the rejected versions.

To prove this let us write down inequalities showing that outlays of the type (c + rq) for each application of a resource adopted in the plan are smaller than or equal to the cost of producing these products without this resource, while for each rejected variant they are greater:

$c_1 + rq_1 \leq c_1^0$	$\mathbf{c}_{\ell^{+1}}^{}$ + $\mathbf{rq}_{\ell^{+1}}^{}$ > $\mathbf{c}_{\ell^{+1}}^{0}$
$c_2 + rq_2 \leq c_2^0$	$\mathbf{c}_{\ell^{+2}} + \mathbf{rq}_{\ell^{+2}} > \mathbf{c}_{\ell^{+2}}^{\mathbf{O}}$
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$\mathbf{c}_{\ell} + \mathbf{rq}_{\ell} \leq \mathbf{c}_{\ell}^{0}$	$\mathbf{c_n} + \mathbf{rq_n} > \mathbf{c_n}$

Now let us regroup these inequalities in such a way as to have on one side indices of the actual effectiveness of using a scarce resource and on the other — the norm of its effectiveness.

$\frac{c_1^{0}-c_1}{q_1} \ge r$	$\frac{c_{\ell+1}^{0}-c_{\ell+1}}{q_{\ell+1}} \leq r$
$\frac{c_2^{0}-c_2}{q_2} \ge r$	$\frac{c_{\ell+2}^{0} - c_{\ell+2}}{q_{\ell+2}} < r$
$\frac{\mathbf{c}_{\ell}^{\mathbf{O}}-\mathbf{c}_{\ell}}{\mathbf{q}_{\ell}} \geq \mathbf{r}$	$\frac{c_n^{0} - c_n}{q_n} < r \qquad (I)$

Ratio $(c_i^0 - c_i)/(q_i)$ expresses the saving in production costs derived from the per unit application of a limited resource, that is, the effectiveness of its utilization in producing the <u>i</u>-th product (i=1,2...,n). Let us denote it with E_1 . Then inequality (I) can be expressed in the following form:

$$\begin{array}{c|c} \mathbf{E}_{1} \\ \mathbf{E}_{2} \\ \cdots \\ \mathbf{E}_{\ell} \end{array} \middle| \geq \mathbf{r} > \begin{array}{c} \left| \begin{array}{c} \mathbf{E}_{\ell+1} \\ \mathbf{E}_{\ell+2} \\ \cdots \\ \mathbf{E}_{n} \end{array} \right| \end{array}$$

The left-hand column shows the effectiveness of plan variants for the per unit use of scarce resource, and the right-hand one — the rejected variants. In view of the fact that the center column consists only of magnitude (r), the effectiveness of each adopted variant is greater than that of each rejected version. (4)

Thus an important function is discharged by the single norm of effectiveness (single price) for means of production that are not freely reproduced: it narrows down the range of the most effective versions for the use of a scarce resource. Apparently this function can be discharged by any uniform price of this resource contained between the maximum and minimum magnitudes of effectiveness of the variants of use. But only one of these prices serves as a borderline, balancing the need for the given resource in the adopted versions with the available supply. To determine this norm means, in effect, to find an optimum plan for using the limited resource.

If there was only one type of scarce resource in the national economy, the optimum plan for its utilization and the norm of its effectiveness could be determined rather easily by simply selecting, for instance, the most effective variants of its application. (5) In reality, however, the range of such resources is much greater. First, they comprise soils, minerals, etc. Second, there are a substantial quantity of goods whose reproduction involves certain limits. Thus the output of all reproducible means of production is restricted by the volume of the national economy's accumulations. Furthermore the reproduction of a part of the available productive assets in their previous form now becomes ineffective because of their obsolescence, though they can still be used effectively. Finally the use of the most up-to-date machinery is also restricted by the fact that a definite period of time is needed to put it into production.

The limited nature of accumulations finds expression in the fact that their volume is smaller than the opportunities for effective capital investments. The non-reproducible factor here is the period of production and circulation. Since the time needed to produce anything is an indispensible element of production, it places a definite constraint on all the reproducible means of production. It is precisely because of this limitation that the growth of planned accumulations lags constantly behind the growth of opportunities for effective investments.

The quantity of obsolete means of labor is fixed in a different sense than is the quantity of natural resources or even of capital investments: natural resources and production time cannot be reproduced, while the reproduction of obsolescent implements of labor is <u>unprofitable</u>. Linked with this distinction is a distinction in price-formation: non-reproducible factors tend to raise prices, while the unprofitability of reproduction depresses prices below the cost of production.

With fixed supply the price of obsolete means of production is set not at the level of their reproduction costs, but at a lower level. Let us assume that the cost of reproducing an obsolete raw material equals C_v , the cost of new raw materials - C_n , the cost of processing these types of raw materials into a finished product equals P_y and P_n respectively. The surplus payments equal $(C_y + P_y) - (C_n + P_n)$ if we use the obsolescent raw materials. Writing off these surplus payments from the cost of reproducing the obsolete raw material, we can get its cost with due regard for obsolescence: $C_y - [(C_y + P_y) - (C_n + P_n)] = C_n + P_n - P_y$. This means that the price of obsolete means of production equals the cost savings derived from their use instead of from the technically up-to-date equipment, assuming that the cost of obsolete equipment equals zero. (6) If this calculation shows that the price of obsolete means of production is not below zero, they can and must be used in production. Many obsolete means of production can be classed in this category equipment which is obsolete for reproduction, but not for utilization.

Under the first form of obsolescence, when means of production are reproduced in their previous form, but at a lower cost, the cost savings from their full utilization equal the cost of their reproduction. Thus calculation of prices on the basis of cost savings is a consequence of the fact that the cost is determined by the outlays for reproduction.

A temporary shortage of the latest equipment boosts its price above its value, but in conformity with the same principle that applies to prices of obsolete means of production: depending on the effectiveness of their use. Temporary wholesale prices on new types of machine-building and metalworking products should be set according to this principle.

According to the decision of the Party Central Committee and the USSR Council of Ministers "On the Economic Stimulation of Enterprises and the Raising of the Material Incentive of Workers in the Development and Introduction of New Machinery and Technology and in the Integrated Mechanization and Automation of Production," these prices must be determined in conformity with the level of the existing wholesale prices on previously mastered products which are analogous or similar in design or purpose. Corrections should be made for higher productivity, as well as other technical and economic advantages enjoyed by the users of the new production (lower production costs, higher quality of produced articles, better working conditions). Such a price greatly encourages the use of new machinery. At the same time it promotes its production, inasmuch as its temporary nature induces machine-building plants to put the new machines into production more quickly.

Thus we see that restrictions are also placed on the reproduction of the so-called freely reproduced means of production. The law of value takes these constraints into account by means of prices which equate demand and supply. Stable deviations of prices from value appear in the process. At the same time it becomes necessary to evolve effectiveness norms for the use of resources or factors that have no cost at all.

What is the sense of a value calculation of outlays for factors which have no cost? It was noted above that prices adjusting the demand for scarce means of production to their supply may discharge an important function in the planned management of the socialist economy: they may aid in drawing up the optimum balance of these resources and, thereby, for determining the aggregate minimum of labor outlays on the entire end-product of the national economy. Prices of non-reproducible resources, in turn, express such increments of outlays on the production of other products, which are linked with the application of a unit of these resources in the output of any product. There would be no such increments (or they would have been different), had the given product been produced differently (on another plot of land, for instance).

Indeed the outlays on various products, due to the limitations placed on non-reproducible resources, are connected not only directly but inversely as well, which means that they are related in such a way that the selection of a variant with the smallest outlays for a given product causes a rise in outlays on other products, and vice versa. Thus the use of the best land for growing wheat, let us say, cuts labor outlays in its cultivation, but simultaneously raises outlays on the production of crops which could be obtained from this soil with smaller outlays than on other plots. Here is another example: selection of a production variant in which the product is obtained with smaller outlays, but with greater capital investments, boosts the cost of those products whose output should get less investments because funds are allocated to the expansion of the former.

It follows from this that it is necessary, when determining a variant conforming to the aggregate minimum of labor outlays for the entire end-product of the national economy, to measure not only the outlays for producing the given product, but also the increments of outlays on the output of other products brought about by precisely this kind of utilization of the best means of production. Let us call such increments of outlays on other objectives the inverse dependence outlays. Then we can say that the variant conforming to the aggregate minimum labor outlays for the entire end-product of the national economy is the one which ensures the lowest total outlays on its production considering the inverse dependence outlays. The index of the magnitude of this sum is of great economic significance: it expresses the change in outlays on the reproduction of the entire end-product caused by the production of the given product. In turn, calculation of outlays as increments of a variable magnitude permits us to call them differential outlays of the national economy for the given product. In value terms differential outlays for the production of particular products equal the difference between the cost of the national economy's end-product, including the given product, and the cost of this production with the same limited resources but without the production of the product in question.

It follows from what has been said that measurement of differential outlays not only does not contradict the thesis that outlays involve only labor, but is based on it. Differential outlays are a special form of measuring labor outlays derived from labor expended on the production of the entire social product and serving to find that variant of the production of the given product which corresponds to the minimum outlays of labor for the entire social product. Under the operation of the law of value, these outlays are expressed by the transformed form of value.

The objective necessity of this transformation of value in the socialist economy is based on the fact that the law of economy of labor operates when there are several scarce (non-reproducible) factors of production. Therefore it is objectively necessary to take stock of the limitations in the form of prices of scarce resources (or norms of their effectiveness). However the normative effect from the use of scarce resources cannot be added to the overall cost of the product, inasmuch as the sum of prices for the end-product would then exceed their total value. This means that the value accounting of the use of scarce resources should be included in the value of the social product in such a way that the algebraic sum of price deviations from the value of end-products would equal zero. Thus value accounting of the use of scarce resources can be effected only through the creation of a transformed form of value. This calculation must be superimposed on magnitudes proportional to values. Moreover the coefficient of proportionality must be equal to the ratio between labor outlays on the national economy's endproduct and the sum of the differential outlays involved. This means that the wage fund of workers employed in the sphere of material production must account for the same share of the endproduct's cost as outlays on its production in the total sum of differential outlays for this product.

The norms of effectiveness for scarce (fixed) resources may be differently named depending on the type of the means of production to which they belong. Thus for reproducible but no longer reproduced implements of labor these norms express the prices of implements of labor that are too obsolete to be reproduced (buildings, structures, equipment). The norms of effectiveness are, so to speak, a sort of rent for their use, calculated with due regard for their lower effectiveness, i.e. for both actual wear and tear and obsolescence. For natural resources they will express differential rent, and for all capital being reproduced — the norms of investment effectiveness.

The form of value transformed by means of these norms is similar to the price of production. This similarity springs from the fact that the price of production is a spontaneous and imperfect value expression of differential outlays. (7) However there are also substantial differences between the price of production and the transformed form of value. Under socialism the law of value is not a regulator of production. The category of capital, and the competition of capitals which leads to the formation of prices of production, does not exist under socialism. As a result, methods of determining the transformed form of value under socialism cannot be deduced from the price of production formula, since all the norms for calculating this form of value serve the purpose of optimum socialist planning, while the price of production is formed in a different way.

Therefore it would be more correct to give this form of value a special name. Moreover, it is expedient to have two terms: one for designating individual costs in the transformed form, the other for social costs.

Actually such terms have long been in circulation in the form of the terms "production costs" [sebestoimosti] and "planned price," but these terms lack adequate content. Indeed, production costs reflect neither production outlays nor differential outlays fully. This is borne out even in their definition as a part of value.

But can we be satisfied with an index which does not express all outlays, but only a part of them? Practice is not satisfied with it: production cost is not regarded as the only index of outlays. However in practice the production cost index is supplemented not by the index of the value of product created by living labor for society, but by other indices; capital investments (for projected enterprises), indices reflecting the use of productive assets (for existing enterprises), expenditures of scarce materials, terms of construction, etc. Consequently practical experience shows that production costs must be supplemented by inverse dependence outlays, and that overall production costs must reflect differential outlays.

What makes us strive for a cost measure of differential outlays? The law of economy of labor: its implementation is rendered difficult by gaps in the calculation of inverse dependence outlays.

Inasmuch as production costs practically do not reflect the inverse dependence outlays, their individual minimums are, as a rule, incompatible. That is why in practice the index of production costs is supplemented by other indices, taking into account the limitations causing incompatibility of individual production cost minimums. As a result we see that products costs so many rubles plus so many tons of scarce materials, plus such and such capital investments, plus a certain period of construction, etc. The problem arises of the commensurability of production costs with other outlay indices, that is, actually, the problem of calculating the unaccounted inverse dependence outlays.

This breaking down of outlays into heterogeneous

elements demonstrates the need for calculating inverse dependence outlays and, consequently, their inclusion in production costs. Therefore, to our mind, estimation of outlays and price formation will develop from the production cost index as part of value to the index of overall production cost as a special economic category: the socialist transformed form of value. (8)

Two problems arise in moving from the principles to the methods of the planned use of the law of value: how to calculate the cost of every product (which is the basis for calculating the transformed form of value) and how to determine the host of effectiveness norms for scarce resources.

At first glance it may seem that calculation of the overall outlays of labor in value form is an arithmetical problem, rendered difficult mainly by the multitude of initial data. In reality, however, this is not so. The need to use higher algebra in this calculation is dictated by the fact that production relations among different branches have a mutual rather than unilateral character. The movement of products occurs correspondingly. For instance, the machine-building industry consumes fuel, while the fuel industry needs machinery. Under these circumstances one must solve the same system of equations to determine overall outlays in the production of any product as advanced more than sixty years ago by V. K. Dmitriev: (9)

$$x^{i} = a_{i1}x_{1} + a_{i2}x_{2} + ... + a_{in}x_{n} + t_{i}$$
 (i = 1, 2, ...n) (2)

where x is the cost of the i-th product, t_i — outlay of living labor on the i-th product in the form of value, a_{i1} , a_{i2} , ... a_{in} — expenditure of each of the <u>n</u> products on the production of the i-th product.

If we substitute for the overall cost of the product of living labor (t_i) the wages, x_i will express a figure proportional to the values, which is practically needed for the calculation of the transformed form of value. It is not difficult to solve this system of equations if their number is not big. But when the system consists of a multitude of equations the computing task may prove to be beyond the powers of modern electronic computers.

With these reservations it can be said that V. K. Dmitriev's equations are sufficient for calculating the actual cost. Then the expenditure coefficients of the means of production $(a_{i1}, a_{i2}, ...)$ and the outlay of living labor (t_i) must be taken in their average significance. However V. K. Dmitriev's equations are inadequate for estimating the planned cost, inasmuch as calculation of planned outlays is inseparably tied up with the drawing up of the plan. V. K. Dmitriev's equations do not include those limitations on means of production which must be taken into account if the plan is to be realistic.

These equations are not sufficient even to calculate costs for the plan's variants (let alone in determining the optimum one). If we use equations (2) to calculate the cost of reproduction, equations of the cost of products that are no longer reproduced will drop out of their system. In the meanwhile many of them are used in the reproduction of other products. Therefore the cost equations of other products will contain as unknowns the costs of reproducing products that are no longer reproduced. As a result the number of unknowns in the equation system will be greater than the number of equations.

However if we supplement V. K. Dmitriev's equations by methods of the cost accounting of reproduction limitations, it will be possible to calculate both the cost and its transformed form — overall production costs.

Indeed the unknown costs of reproducing those items which are no longer reproduced can be assumed to equal either the cost of their production (in the past), or zero. Given any of these assumptions, the number of unknowns will become equal to the number of equations. However in this case solution of the equations, will give either exaggerated or underestimated costs of products, which will have to be corrected by taking into account either the obsolescence of the utilized obsolete implements of labor, or such a cost of their reproduction as would reflect the differences in effectiveness of the obsolete and new instruments. For this purpose we determine effectiveness norms for the use of obsolete machinery (by the same methods as the effectiveness norms for non-reproducible resources). If these instruments had been evaluated according to the cost of their production (in the past), the effectiveness norms will be negative (they will reflect their obsolescence). If the cost of these implements was taken as zero, their effectiveness norms will express the cost of reproducing the equipment replacing them, with due regard for the differences in production capacities and operating costs.

How are the effectiveness norms of non-reproducible resources determined?

The difficulty of this task, as pointed out above, lies in the fact that there are not one but many types of scarce resources. Therefore plan variants often differ from one another as regards outlays of two or more scarce resources. In such cases the economy of costs yielded by the joint application of q_1 , q_2 , ... q_n units of different resources constitutes a uniform, indivisible effect from all these resources. (<u>10</u>) It follows that it is impossible to calculate the true effectiveness of every resource separately, to draw up an optimum balance for each of them divorced from the balances of other resources, to determine the effectiveness norm for one resource divorced from the effectiveness norms of other resources. And since at least one limited factor is used in all branches of the national economy — the factor of time — it follows that the effectiveness norms of limited resources can be determined only in the process of compiling an optimum plan for the development of the entire national economy.

One of the ways to find such norms is suggested by the law of value. It is necessary to find such effectiveness norms for critical resources as would balance their planned requirements with their planned stocks. The method of tentative norms may be used for drawing up the given system of balances, checked by comparing the need for each one of the resources and its available reserves, corrected and again verified by the balance method until the balances of all the limited resources are properly adjusted. This method, however, does not guarantee that every rise of the effectiveness norm, when there is a shortage of resources, or every fall, when they are in excess, will improve the plan, bring it closer to the optimum. (11) Thus the planned reproduction of the mechanism of equating demand with supply through prices does not guarantee that this equality will be attained. Hence it follows that the problem of correcting the effectiveness norms in conformity with requirements for the resources and their available reserves, must be linked with mathematical methods of optimum planning, which ensure the steady perfection of the plan and its development to the optimum level. Such methods have already been evolved to a certain degree (linear programing, dynamic programing, etc.). However their elaboration and adaptation to problems of economic planning is a difficult task.

The application of mathematical methods of optimum planning will permit us to improve not only planning but also the system of economic accounting and distribution according to work.

Indeed overall production cost possesses all the elements necessary for the organization of improved economic accounting. Thus its individual minimums are compatible with each other and with the minimum outlays of labor on the whole endproduct of the national economy. Furthermore its calculation places all enterprises on an economically equal footing as regards the application of labor: the "better" are the resources at the disposal of an enterprise, the more it pays for them in the form of rent, differential rent, credit payments, etc. Therefore the overall production cost of one type of product, produced in different labor conditions, will tend to level out, thereby increasing the importance of profitability. Moreover the price of the assimilated means of production in an optimum plan should, as a rule, equal the average overall production cost. Prices on certain consumer goods can digress somewhat from their overall production costs, but it is advisable to compensate for these digressions by means of the turnover tax. Then the optimum plan norms will be a requisite of every enterprise's operation without losses, the mastering of new machinery will be a requisite for its profitability, and failure to fulfill the plan — the reason for losses. The latter will arise, in particular, when inadequately effective use is made of capital investments, production funds, natural resources, let alone of living labor.

These properties of overall production cost are valuable not only for economic accounting but also for distribution according to work. The law of distribution according to work requires that the cost indices of the efficiency of individual sectors of production (enterprises, shops, etc.) should not depend on labor conditions which cannot be influenced by them. Otherwise these indices cannot be used for distribution according to work. The need for converting the qualitative characteristics to equal conditions of labor is confirmed by socialist economic practice. When determining results indices attempts are made in practice to isolate them from the influence of factors that do not depend on the enterprises, but the methods used for this purpose are still not very effective. (12)

It follows from what has been said that in optimum planning we must proceed from the following basic premises: 1) the value of commodities is determined by the socially necessary labor expended in their production, and therefore the prices of freely reproduced commodities gravitate towards their value; 2) the prices of non-reproducible resources gravitate to levels where demand for them is met by supply. The first proposition makes possible the mathematical formulation of the conditions for forming value, the second -- the conditions for its transformation.

The principal conclusion of our article is that the law of value expresses the operation of the law of the economy of labor not only by the first proposition, but by the second one as well. Although nonreproducible resources do not have any value of their own, their prices reflect definite labor outlays, namely the increment of labor in the production of other commodities, stemming from the use of units of non-reproducible resources in the given sector.

Inasmuch as non-reproduced resources do not have any value, their outlays, calculated according to these prices, are not included in the cost of the corresponding commodities. This leads to the transformation of value, i.e., to stable deviations of prices from values, which balance each other out if we consider the end-product of the national economy as a whole. Thus a third proposition arises from the above two: the prices of commodities in whose production scarce non-reproduced resources are used gravitate towards transformed values. Since the prices of non-reproduced resources have a labor content, the transformed form of value also reflects definite labor outlays -- differential outlays of the national economy for the given product. (13)

The need to calculate <u>planned</u> outlays according to the formula for transformed value entails the need to estimate <u>actual</u> outlays according to the same formula, inasmuch as accounting indices should correspond to the plan indices with respect to methods of calculation.

This is how the need finally arises to include magnitudes in the actual outlays which are really not outlays — the normative effect from using scarce resources.

It is worth noting in connection with the application of linear programing in the national economy that the mistrust of this method by economists, to our mind, is partially explained by the fact that L. V. Kantorovich attaches too universal a significance to resolving multipliers in his mathematicaleconomic models. In his view, all prices in the optimum plan are resolving multipliers (objectively conditioned evaluations); even labor is given its objectively conditioned evaluations. We cannot agree with this. This means that the mathematical model of price formation does not reckon with the substantial difference between the scarcity of nonreproducible resources and of labor. Labor is limited in another, higher sense of the word than are natural resources or capital investments: men strive to cut its outlays to the minimum and to make maximum use of the conditions of its application. That is why the resolving multipliers in the model of planned price formation can only be the effectiveness norms of scarce resources. But in this role the resolving multipliers are an indispensible instrument for the optimum planning of the socialist economy, because they reflect that function of the law of value without whose use it is impossible to attain the optimum in the planning of the national economy - the function of the cost accounting of the use of scarce resources in production.

In conclusion let us touch briefly on the remarks of A. Katz. (14)

Katz asserts that the methods I proposed for

determining the total maximum effectiveness of capital investments and all the means of production in general, "are, in effect, based on the primacy of social demand and supply over production." (15)

This is incorrect. The indicated scheme of an optimum plan is based on the primary of production over demand and supply. This primacy is embodied first of all in the very fact that it raises the question of determining minimum labor outlays. Moreover the prices of all the reproduced means of production in this scheme express the transformed form of value, and consequently, in the final count, value: it is assumed that demand and availability of reproduced goods in the optimum plan will be accurately adjusted through production. Moreover the prices of the new means of production created in the planned period must, as a rule, be drawn up according to the average national economic cost. The previously produced means of production are evaluated in this production cost formula according to the principle of costs of reproduction: after all, evaluation according to the inverse dependence outlays, for the reproducible means of production, is a generalization of the rule of evaluating according to the outlays on reproduction. (16) "Demand and supply" in this scheme determine only the effectiveness norms for the non-reproducible resources and conditions of production. But they, too, are based on the determination of the size of the economy of social labor in production.

In this connection there are no grounds for the assertion that in my work the outlays of labor and "evaluation of scarcity" of production factors are placed on a par, as is done in the works of bourgeois economists. We know that the general equilibrium models of Walras and others minimized production outlays, calculated as the sum of prices of the "services of factors of production" - labor, capital and land. The proposed scheme seeks a common minimum of labor outlays. Production funds, capital investments and natural resources figure here only as conditions of the application of labor. Furthermore the general equilibrium models deduce prices on means of production, and through them prices on "service factors in production," from the value or utility of the consumer goods. In the proposed scheme, however, prices of means of production and the end-product are derived from labor outlays.

Katz's main objection is that the proposed scheme for finding the general minimum of outlays is aimed at retarding the development of technology and the rate of the growth of labor productivity. He believes that this scheme "does not select the best technical variants for observing the limit of capital investments and fulfilling the general production program for individual types of production." This

criticism is directed, in effect, not against the scheme, but against long-term plans: Katz believes that the basic shortcoming of the scheme is that it proceeds from a production program and investment limit fixed by the plan. If the scheme does not ensure the best technology, this means that the planned relationship of investments and program provides for obsolete technology. Katz holds that the best technology is ensured by the selection of variants not according to the general minimum of outlays, but according to the minimum outlay of labor on each type of production. His recommendation is "to ensure successively minimum labor outlays for individual types of production," which "at the outset changes but little the initially unfavorable relationship of the balance of means of production and social needs, reflecting the shortage of material resources. But the further we depart from the initial period, the more favorable becomes the balance of means of production and social needs as a result of the successive securing of minimum outlays of labor for individual types or sectors of production."

Katz's basic mistake is that he ignores the time factor. He proposes to fix high rates of economic growth in the future at the expense of lower rates in the nearer future. As a result, adoption of his recommendations would primarily delay the fulfillment of the Soviet Union's main economic goal. Moreover he does not even mention the need for some sort of limits for investment recoupment periods. Meanwhile our practice attaches greater significance to the time factor than does capitalist practice. This is borne out, for instance, by the short norms on investment recoupment periods by which our practice is guided: not more than three to seven years, and for some branches only - ten years. These norms obviously correspond to the ratio of growth rates stipulated by the Seven-Year Plan for output and investments. The absence of limits for recoupment periods dictates much lower rates of production growth in the next seven years than planned. Thereby, objectively, Katz substitutes for the task of winning time in the competition of the two systems a proposal to lose time in it: after all, in capitalist practice the time factor is always taken into account in economic calculations.

Katz also overlooks the fact that effective investments are possible even without changing the level of technology (for instance, increasing pipe diameters, reducing road grades, etc.). Such investments differ from investments in new machinery by the fact that their effectiveness decreases with growth. Therefore implementation of Katz's proposals, in addition to everything else, would lead to the full use of possibilities for less effective investments, which do not change the level of technology, at the expense of reducing highly effective investments in new machinery, and, consequently, would retard the growth of the technical level of economy and labor productivity in comparison with what is possible. The proposed scheme, on the other hand, excludes such a possibility. (17)

Along with this, Katz sees a "vicious $\overline{\text{circle}}$ " in this work because it uses mathematics to determine the long-term average effectiveness norms for investments. Actually mathematics is not used at all in this question. (18) The pages included by Katz in this invented circle refer to another question. He also finds there two "diametrically opposite views": first, that the scarcity of individual types of reproduced resources contradicts the economy of labor and should be eliminated; second, that as long as it remains the plan must take account of it, namely in prices. Meanwhile the "second" follows from the "first": temporary deviations of prices from the long-term level are necessary to eliminate more quickly this temporary scarcity by stimulating the production of the product. It is necessary only to determine correctly a temporary price. Katz holds that the temporary deviations of prices from their long-term level is bound to result in the selection of less perfected technical means. However no expert planner will plan investments for a period of service of say, 15 years, proceeding solely from temporary prices on means of production. If Katz were right, our new practice of planning prices on new technological means would delay their use. In reality, the new, raised prices will doubtlessly accelerate production and, consequently, the use of new machinery.

Footnotes

(1) Normative effect – product of the quantity of the used resource and the norm of its effectiveness.

(2) This condition ensures the fulfillment of the production program. The scarce resource should obviously be used primarily in industries where it cannot be replaced by other means of production.

(3) If the scarce resource constitutes an object of labor, r will express its price per unit. If it is a means of labor, then r will express the price of its use in a given unit of time.

(4) To simplify the proof, it is assumed here that there is only one version for the use of a limited resource in the production of every product. However this conclusion would not have changed if a more realistic premise had been accepted: that there are many ways of using a limited resource in the output of every product.

It also follows from the above that requirement

"a" is met by price uniformity for a freely unreproduced resource of a given type and quality. The price must be the same for all consumers. If value r had not been equal in all the ranks of the inequalities (I), the effectiveness of individual adopted versions for the utilization of a limited resource could prove to be lower than the effectiveness of some of the rejected variants of their application.

(5) Direct selection of the most effective variants for using a limited resource is done in the following way: 1) the indices of effectiveness are determined for each variant: 2) all the variants are arranged in the order of their decreasing effectiveness and the quantity of the limited resource needed for each of them is indicated: 3) as many variants are selected (starting with the most effective) as may be implemented with the available quantity of the given resource. The norm of effectiveness in this case will equal the effectiveness index of the least effective of the selected variants (see V. V. Novozhilov's article "Izmerenie Zatrat i Ikh Rezul'tatov v Sotsialisticheskom Khoziaistve," published in the collection Primenenie Matematiki v Ekonomicheskikh Issledovanijakh, Sotsekgiz, 1959).

(6) Implements of labor are usually subject to obsolescence. But it is much easier to calculate obsolescence in the prices of products of labor than in the price of means of labor. This is why the principle of calculating obsolescence is explained above on the example of the price of a product of labor. The price for an implement of labor, too obsolete to be reproduced, is determined according to the same principle, but with substantial modifications. It equals the sum total of savings derived from the cost of products, which can be obtained from the implement during the remaining period of its use. Unsynchronized economy is summed up with due regard to the time factor, while the moment when this economy becomes equal to zero is regarded as the limit of the implement's period of service. The time factor is taken into account on the basis of the investment effectiveness norm.

(7) See V. V. Novozhilov's article "Izmerenie Zatrat i Ikh Rezul'tatov v Sotsialisticheskom Khoziaistve," in the collection <u>Primenenie Mate-</u> matiki v Ekonomicheskikh Issledovaniiakh, pp. 177-183.

(8) In our previous works overall production cost was termed national economic cost.

(9) See V. K. Dmitriev, <u>EkonomicheskieOcherki</u>, 1904, p. 3.

(10) Contrary to the accepted view, the index of the recoupment period of capital investments does not reflect, in most cases, the effectiveness of these investments: the variants compared in this index usually differ not only as regards investments but as regards the outlay of other scarce resources. This is why solving the problem of investment effectiveness (investigating the actual effectiveness of investments, determining the norms of their effectiveness) without finding the effectiveness norms for the other scarce resources is an attempt with unsuitable means.

(11) R. Frisch, V. V. Novozhilov's Method of Process Selection and Its Transformation into Linear Programming Problem. Memorandum fra Sosialokonomisk Institutt Universitet i Oslo, September 27, 1959.

(12) Normalization of net income in accordance with the conditions of labor and not with the achieved level of production is a development of the tendency to normalize production assignments according to the conditions of labor (according to means of production). Consistent development of assignment normalization in accordance with labor conditions will ultimately lead to effectiveness norms for groups of uniform and equally effective means of labor, i.e., to the fixing of rent norms for the instruments of labor provided the enterprises, differential rent, etc.

(13) This is applicable to a planned economy. In a capitalist economy prices cannot have the same content as in an optimum plan. Therefore the price of production formula cannot serve to substantiate methods of estimating outlays and prices in a planned economy.

(14) See Voprosy Ekonomiki, 1960, No. 11.

(15) Ibid., p. 95.

(16) See the collection Primenenie Matematiki v Ekonomicheskikh Issledovaniiakh, pp. 141,174,175.

(17) Ibid., p. 103-107.

(18) Ibid., p. 188.