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ECONOMIC EFFICIENCY DURING THE TRANSITION: THE CASE OF UKRAINE

Ekonomska učinkovitost v tranziciji: primer Ukrajine

Abstract

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In spite of the fact that a market economy by definition must be more effective than a centrally planned economy, the various countries in transition from the latter to the former are faced with the problem of declining economic efficiency. In this paper a comprehensive index of economic efficiency is developed with the application of production function tools. The dynamics of economic efficiency of the economy of Ukraine, which met with one of the most pervasive transformational economic crises, are estimated and analyzed. It is shown that after a high rate of economic growth occurred in the Ukrainian economy in recent years, the level of efficiency of the economy remained quite low and even declined. This is explained by ineffective investments and innovations as well as an increasing intensity in use of materials.

Key words: economic efficiency, productivity, labour, capital, innovations

Izvleček

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Čeprav velja, da naj bi bila tržna gospodarstva učinkovitejša od centralnoplanskih, se različne tranzicijske države soočajo z upadanjem ekonomske učinkovitosti. V prispevku predstavljamo osnovni indeks ekonomske učinkovitosti, ki smo ga razvili s pomočjo proizvodne funkcije. Ocenili in analizirali smo dinamiko ekonomske učinkovitosti v Ukrajini, ki je bila izpostavljena eni največjih tranzicijskih kriz. Pokazali smo, da je kljub visoki gospodarski rasti v zadnjih letih raven ekonomske učinkovitosti ostala relativno nizka oziroma je celo upadla. Takšen trend lahko pojasnimo z neučinkovitimi investicijami in inovacijami ter povečano porabo sredstev.

Ključne besede: ekonomska učinkovitost, produktivnost, delo, kapital, inovacije

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Introduction

The transition from an administrative-command economy to a market economy raises many theoretical problems previously unknown (before the 1990s) to economic science because the transition from socialism to capitalism is an absolutely new historic process. One of the key problems is the decline of economic efficiency.

The centrally planned economy practically divested scientific and technological advances. In this connection there was not any effective motivation to improve the efficiency of the economic mechanism, either at the level of workers or the level or enterprises. Notably this concerned agriculture, consumer goods, and the food processing industries. This created a bulky and inefficient economy based on planned distribution of resources characterized by: domination of heavy industry and the defense sector, large enterprises chiefly oriented to production for intermediate use rather than final demand, inability to respond dynamically and adequately to consumer needs, slow-moving production apparatus, and constantly accumulating pervasive disproportions in production. In addition, inactivity of the economy was accompanied by professional inactivity of the labour force, and an essential system of employee dismissal, retraining, and reeducation could not be built. Increasing crisis in the socialist economies wasn't accompanied by liquidation of low-effective and obsolete enterprises and didn't favour the flow of capital to more effective economic sectors. It didn't create motives for renovation of production, which usually occurs in developed countries, by reason of the peculiarities of the administrative-command economy control system and the monopoly of state ownership. In a centrally planned economy, in comparison with a market economy, a smaller part of GDP was directed to personal consumption and public goods.

Thus, the administrative-command system wasn't able to provide high economic and social efficiency of the economy in comparison with a market one. Therefore, the transition process to the market economy model in terms of efficiency of the economy could be considered as advanced process.

At the same time, the transition to a market economy was accompanied by a drop in indexes of efficiency of the economy in practically all cases. Among the special characteristics of that decline, one may highlight the following basic principles:

(a) change in productivity of labour is inevitable under structural transformation, liquidation of inefficient manufacturing, creation and increasing of apparent unemployment, and changes in social needs for goods and services;
(b) growth of energy and materials intensity of the economy by reason of cancellation of government subsidies and price liberalization;
(c) rise in social inequality by reason of cancellation of many state social guaranties and increased capitalization of the economy.

However, while in countries implementing radical market reforms (Poland, Slovenia, Hungary, etc.) this decline was of short duration (2-3 years) followed by swift and stable growth, there were fluctuations of labour productivity in countries with gradual reforms (Bulgaria, Romania), and a decline in countries with inconsistent reforms (Russia, Ukraine etc.).

The most pervasive and durable bust of economic efficiency was observed in Ukraine where during the first 9 years of transition the labour productivity declined more than in 2 times . Despite the certain success of the country in the last few years in economic growth, monetary and currency stability, expansion of external trade and investments, increase of household incomes and savings, there are many factors that restrain high-efficient growth of the Ukrainian economy and constrain the level and rate of that growth. This paper is dedicated to analysing these factors and estimating the actual level and dynamics of economic efficiency of the Ukrainian economy.

Definitions and methodology

There are many approaches to defining economic efficiency and its basic indexes. The most common are described below.

Economic efficiency was defined by the Italian scientist V. Pareto as »a state which does not allow increasing the level of satisfaction of at least one individual without making any other member of the society suffer,« i.e. when the needs of all society members are satisfied as fully as possible, with given limited resources (Kuznetsova, Osadchaya 1993). This state is called Pareto efficiency or Pareto optimality. According to Pareto theory, resource allocation is effective in conditions of perfect competition. In a perfectly competitive economy, all benefits are produced (production efficiency) and allocated (consumption efficiency) effectively. Furthermore, the combination of produced benefits cannot be changed to improve consumer positions (exchange efficiency) (Vidyapin 1999).

However, the economy that according to Pareto is efficient isn't socially efficient since optimal resource allocation leads to the formation of social inequality. In order to reduce this inequality, the social economic policy of the government is engaged. Therefore, the concept of Pareto efficiency cannot be applied to the majority of factual situations where political arrangements improve the position of one group of people at the expense of another.

Moreover, according to Pareto, the shift from a state monopoly to free competition during the transition process means a rise in economic efficiency. But, as noted in the introduction, that process is accompanied by a drop in economic efficiency in the majority of transition countries, which refutes Pareto's conception of a transition economy.

When speaking about economic efficiency one should also emphasize the analytical conception of operational efficiency developed by Farrell (1957), which divides the economic efficiency into technical and allocative components (multipliers). Technical production efficiency reflects an ability to derive maximum output from a given set of production factors. Allocative efficiency (efficiency of allocation or »Pareto efficiency«) reflects an ability to use resources in an optimal combination, taking into account their relative cost and applied production technology. The economy may be called technically inefficient if it uses excessive resources to produce goods. In terms of allocation, the economy is inefficient if it uses a non-optimal combination of resources to produce goods.

The following definition of economic efficiency was used as the basis for the present research. Economic efficiency is obtaining the maximum output subject to minimum input of production factors. It defines the efficiency of the entire economy.

The following measures of using of particular production factors (i.e. labour, capital) are often used to estimate economic efficiency: labour productivity, capital productivity, materials-output ratio, etc. The other common indicator of efficiency that estimates influences of more than one factor is multifactor productivity, which is defined as the ratio of total output to input resources (total costs). Practically, multifactor productivity considers the influences of two factors, labour and capital (The Economist 2004). Formally, multifactor productivity A can be recorded in the following way:

$$A=\frac{Y}{F(K,L)}, \qquad (1)$$

where Y denotes total output (fixed base index of output), $F(K, L)$ is a production function and denotes average level of capital input (K) and labour input (L).

There A can be seen as an aggregate indicator of economic efficiency in contrast to particular indicators like average labour productivity (y) or average capital productivity (g). Furthermore A can be expressed as the average of y and g (with expedient measure). Assuming that $F(K, L) = K^{\alpha} L^{1-\alpha}$ is a Cobb-Douglas production function, then:

$$A = g^{\alpha} y^{1-\alpha}, \qquad (2)$$

where A is the weighted geometrical average of y and g. That means that the fixed base index of A must be set between the fixed base indexes of y and g with the same base. As the weights α and 1-α, the estimations of elasticity of output of the two factors use estimations of shares of the capital and the labour, received from the national accounts system often. Standard practice presumes setting the estimates of factor shares via expert evaluation at 0.3 and 0.7 respectively for capital and labour (OECD 2001, Dolinskaya 2002, Bessonov 2004). The given parameter values of production function (2) play a key role in determining the efficiency of labour and are very close to the values obtained by P. Douglas in the 1920s. During the last few decades the role of labour in the production of output declined essentially as a result of industrialization and an increasing degree of mechanization and automation processes. Indeed, given the existing level of technology, when the role of a person in various branches

consists of merely operating machines, it's impossible to talk about the domination of labour in the economy. As evidence one may adduce the empirical values of production function parameters obtained from statistical data of the Soviet economy for the years 1960-1985, which amount to 0.5382 and 0.4618 for labour and capital, respectively (Granberg 1988).

In addition, the approach described above is imperfect mostly because it overlooks the other key production factors – inventory and entrepreneurship. The latter is the fourth factor of production. It consists of the most effective arrangement of all other factors for the purpose of producing goods and services. In the current situation, process innovations, new products, organizational innovations, etc. are necessary features of entrepreneurship. Relative economic efficiency denotes a choice of such a combination of limited quantity of production factors that permits achieving the results with the least cost using business, production and management know-how.

Scientists justify excluding all factors but labour and capital from production function by the following: labour and capital are the results of production processes in the previous stages, where capital assets and labour force were also used and, therefore, all factors can be reduced to those two (Chetyrkin, Klas 1986). However, a factor such as inventory is the primary factor of production and it would be incorrect not to consider it. This is especially true for economies that do not possess ample raw materials of their own, such as the Ukrainian economy, and are reluctant to import those in sufficient quantities for their production needs. Therefore, it is necessary to develop a comprehensive measure of economic efficiency where influences of all basic factors must be considered.

Departing from the Cobb-Douglas function with constant returns to scale (scale effect) and adding to it factors of production which, in our view, are missing, the following production function was obtained:

$$Y_t = AL^{a_1} K^{a_2} M^{a_3} E^{a_4}, \quad (3)$$

where Y_t is total output (GDP), A is total factor productivity, L, K, M, E are the factors of production, employment (labour), fixed capital stock (means of labour), material resources and contributions of innovations (entrepreneurship), respectively. a_1, a_2, a_3, a_4 are parameters of function that define elasticity of output with respect to particular input resources.

Variable A in Equation (3) is standard »Solow residual« and indicates the return (output) from all used basic factors of production. In fact, A is a comprehensive measure of economic efficiency of the economy.

Re-denoting the given measure as EE after a usual transformation, the following formula for comprehensive measure of economic efficiency was obtained:

$$EE = y^{b_1} g^{b_2} m^{b_3} e^{b_4}, \quad (4)$$

where y is the average efficiency of direct labour (labour productivity), g is the average efficiency of application of the means of labour (fixed capital productivity or output-capital ratio), m is the average efficiency of the material inputs (output-materials ratio), e is the average efficiency of entrepreneurial innovations (output - innovations cost ratio). b_1, b_2, b_3, b_4 are parameters of function defined by the following formulas:

$$b_1 = \log_y(Y^{\frac{1}{4}}/L^{a_1}),\ b_2 = \log_g(Y^{\frac{1}{4}}/K^{a_2}),\ b_3 = \log_m(Y^{\frac{1}{4}}/M^{a_3}),$$
$$b_4 = \log_e(Y^{\frac{1}{4}}/E^{a_4}).$$

Rationally one should use as benchmark data the ratios (indexes) and not the absolute values since factors may have various dimensions during the construction of production functions. Accordingly, benchmark data about resource inputs, efficiency of resource application, and production output must be time series of corresponding economic indexes. Thereby the dynamics of economic efficiency may be measured by following index:

$$I_{ee} = I_y^{b_1} I_g^{b_2} I_m^{b_3} I_e^{b_4}, \quad (5)$$

where I_g, I_y, I_m, I_e are indexes of average fixed capital productivity, labour productivity, output-materials ratio, and output - innovations cost ratio, respectively.

Equation (5) is a four-factor production function and averaging function. That is, the dynamics of economic efficiency are a certain average value of the dynamics of efficiency of direct labour, means of production, material inputs, and entrepreneurial innovations.

Estimate of function parameters

Practical application of the equations described above requires an actual estimate of factor costs and corresponding function parameters.

The estimate of employment level, particularly in a period of economic depression in Ukraine, is plagued by problems of underemployment and latent unemployment. The high percentage of registered employment observed during the entire transformation period on a number of the legal and morally-ethical reasons is connected to the impossibility of dismissal of a part of employees liberated during decline of production. This led to a reduction in the workweek and in the length of the work day, an increase in the number of employees on administrative leave and part-time employees, which is an increase in underemployment. Thus actual working hours will be used below in lieu of number of employees to estimate the real value of direct labour costs. Hourly output per employee will be used to estimate labour productivity.

In measuring fixed capital stock, one faces the problem of adequate estimate of the value of fixed capital that is actually used in business activity. As noted by R. Solow, »capital in stock doesn't mean capital in work« (Solow 1957). The estimate of fixed capital unadjusted for depreciation and not taking into account the share that is unused prevents measuring the actual efficiency of its usage.

When fixed capital in stock is idle during a period of economic depression, the estimate of fixed capital depends on its utilization rate. Moreover, the balance sheet estimate of the value of fixed capital during the transformation period in Ukraine did not correspond to its market value, which has never been precisely estimated because of inadequate indexation, especially during hyperinflation. This resulted in a distorted system of capital depreciation that didn't reflect the actual usage of fixed capital in the production process.

According to various authors (Griliches, Jorgenson 1967, Costello 1993), the problem of fixed capital utilization records and their inadequate estimate may be solved by using data on power usage as an indicator of the rate of fixed capital utilization. However, that necessarily leads to overestimating the capacity utilization and couldn't provide a realistic estimate for fixed capital stock, taking into account the significant scope of the 'hidden' sector of the economy.

Therefore, it is impossible to obtain a realistic estimate of fixed capital stock due to the distorted systems of estimated balance sheet values and depreciation, the difficulty of estimating the actual utilization rate, and the absence of any market value data. In this case, it seems appropriate to apply an amount of annual fixed asset formation (in comparable prices), which are realized purposely for use in the production process as an evaluation of the dynamics of capital value. Correspondingly, we define assumptions about full utilization and application of invested fixed capital in the production of GDP.

There are annual data about material costs in the economy (in comparable prices) used as material resources in production.

The value of contributions to innovations is defined as the amount of funding for research-and-development activities by domestic entrepreneurs.

To define the parameters of function (5), elasticities of GDP with respect to particular measures of resource costs, a multiple regression analysis was carried out based on annual data (chain indexes) for 1991-2003, and the following equation was obtained:

$$Y_t = L^{0,428}\, K^{0,212}\, M^{0,160}\, E^{0,201}. \qquad (6)$$

Whereas the amount of factor elasticities equals approximately 1 (precisely 1.001), the scale effect is practically absent and the obtained function (6) may be considered as linear homogeneous. The parameters of the obtained model demonstrate its high accuracy and closely related variables. According to the estimates, 95% of real GDP dynamics is explained by the dynamics of four factors: number of hours worked, fixed asset formation, material costs and entrepreneurial innovations. Parameter A's proximity to 1 shows that it is not important, and this in turn shows that the average productivity of all factors hardly fluctuated during the period considered.

The elasticity of economic growth with respect to hours worked turned out to be the highest (0.428), which is evidence of the determinative influence of the human factor on the economic dynamics in Ukraine. This is certainly lower than the value of the same estimate (0.4618) calculated for the Soviet economy for the years 1960-1985 (Granberg 1988). This indicates increasing influences of other production factors for GDP dynamics. The obtained value of elasticity of output growth with respect to labour for Ukraine in comparison with the corresponding parameter of production function for most developed capitalistic countries during the post-war period (1950-1977), is lower than in the USA (0.447) and Great Britain (0.506), and higher than in Japan (0.397) (Chetyrkin, Klas 1986).

Parallel analysis carried out using fixed base indexes (1992=1) yielded rather different results for parameters of production function:

$$Y_t = 0,929 L^{0,383} K^{0,292} M^{0,190} E^{0,061}. \qquad (7)$$

The obtained regression equation is significant according to the parameters. The independent variables included explain 99% of Ukrainian GDP dynamics. In comparison with the function based on chain indexes, the given function shows the reduction of multifactor productivity that constrained GDP growth during the analyzed period in Ukraine. Moreover, the magnitude of parameters for all four factors in the last equation (7) being less than 1 (0.926) suggests diseconomies of scale, i.e. the influence of production consolidation on efficiency of the Ukrainian economy is negative. One should also note the considerable increase of elasticity of output with respect to capital (fixed capital and inventory investments) at the expense of elasticities with respect to labour and entrepreneurial innovations.

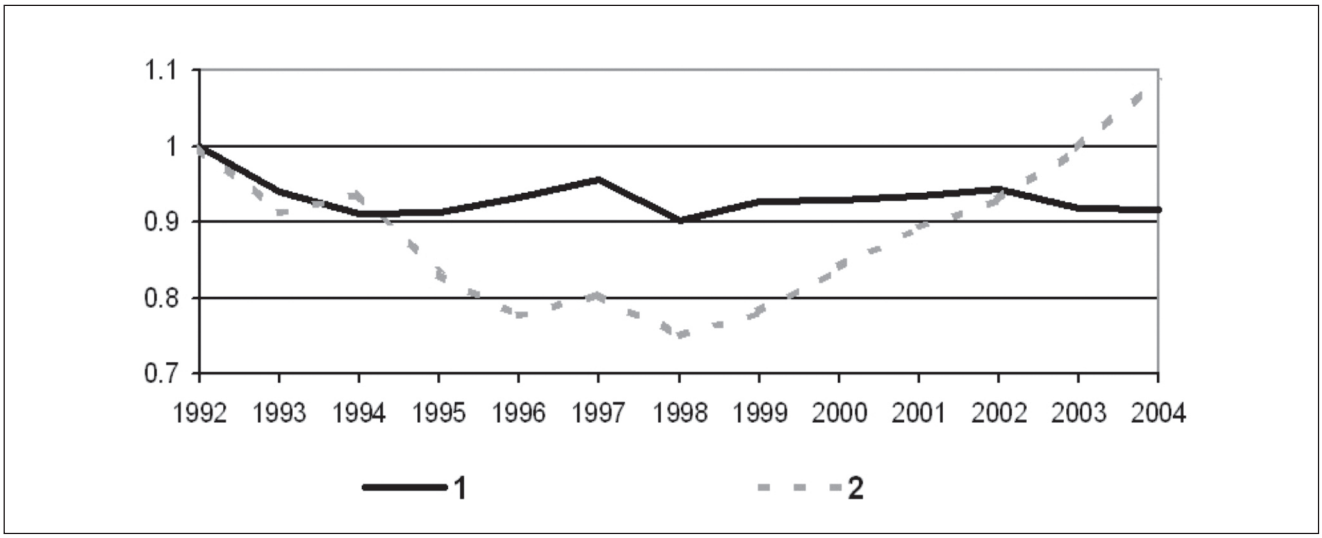
Estimate of economic efficiency of the economy

Whereas the parameters a_i of production function describe the dependence of economic growth on four key factors of production (7), here we proceed to the estimate of a comprehensive measure of economic efficiency. The results of this estimate in comparison with the dynamics of the productivity of social labour (ratio of GDP to actual working hours by all employees of the economy) are shown in Figure 1.

It can be seen that the economic efficiency of the Ukrainian economy declined over the last 12 years, and towards the end of 2004 was approximately at the level of 1995. The increases in 1996-1997 and 1999-2002 years were short-lived. This may be explained by the following reasons:

(a) the currency-financial crisis in 1998 adversely affected the economic efficiency of the economy, which fell to the lowest level in the history of Ukrainian independence; in contrast to the period 1993-1994, the drop in 1998 was related to the decline in productivity in practically all four factors of production;
(b) in the years 2003-2004, the decrease in economic efficiency was the result of a simultaneous decline in productivities of fixed capital investments, material resources, and innovations.

Figure 1: *Basic dynamics of economic efficiency and productivity of social labour in Ukraine from 1992-2004 (1992=1)*



1 – growth rate of economic efficiency, 2 – growth rate of productivity of social labour

The total decrease in economic efficiency during the entire analyzed period amounts to 8.5%.

While comparing the two lines in Figure 1 one may notice the following:

(a) while in 1992 the decrease in labour efficiency accelerated the decline in overall economic efficiency, in the years 1995-1996 the former already constrains the gain of the latter;
(b) the similarity of dynamics of both measures in 1997-1998 indicates the essential role of labour in the formation of economic efficiency for those years;
(c) the high growth rate of labour productivity in 1999-2002 compensated for the decreasing efficiency of use of the other factors and largely supported a gain in overall economic efficiency of the economy;
(d) in 2003-2004 the overall value of economic efficiency declined because of inefficient utilization of investments and innovations, as well as increasing intensity of materials use (materials-output ratio), and in spite of growth in labour productivity.

Conclusion

During the estimation of value of economic efficiency of the economy, it is necessary to apply comprehensive indexes that consider the efficiency of utilization of all key factors of production.

The estimates of parameters of the model developed here show that economic efficiency is for the most part explained by labour efficiency (working hours), but the influences of other factors (investments, materials costs, entrepreneurial innovations) on economic efficiency are also significant.

In spite of the high rates of economic growth that occurred in Ukraine during the years 2000-2004, economic efficiency remained quite low and even declined (during the years 2003-2004). This may be explained by ineffective investments and innovations as well as an increase in intensity in use of materials in the Ukrainian economy.

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