Estimating Structural Change Factors in the Ukrainian Economy

Oleksandr Chebanov
Institute of Industrial Economics of NAS of Ukraine
77 Universitetska Street, Donetsk, 83048, Ukraine
Email: alexandr_chebanov@yahoo.com

Abstract. In this paper we study the dynamics of deviations of actual proportions from their optimal values in the structure of Gross Value Added (GVA) distribution between branches of economy. We propose a grouping of the main factors affecting the change of these deviations in time and suggest a model for estimating the influence of these factors on the deviation dynamics. This model, which is based on Input-Output analysis and a production function modified for transition economy, is used for estimating the abovementioned deviations and factors for the Ukrainian economy for the period of time from 2000 till 2007.

1. Introduction

Structural proportions and their changes are some of the main indicators affecting the development of an economic system. In the countries with transition economy characterized by original accumulation of capital, it can be very useful to understand optimal values of both structural proportions and structural changes for effective governance of the economic system.

Estimating and analysis of structural change in this study are based on the following methodological assumptions. The changes in the structure of distribution of economic effect between the industrial activities are assumed to be the main structural factors of economic development. The study of the economic effect distribution is based on Neoclassical economic theory that gives a justification for the optimal values of the parameters of this distribution.

In Neoclassical theory, the optimal parameters of economic system are connected with competitive situation which is characterized by free movement of labor and capital providing the most effective distribution of available production factors. Under conditions of the competitive equilibrium at the macroeconomic level, the equivalent exchange between the economy branches takes place. It provides the equitable distribution of economic effect. The exchange between branches is considered to be equivalent (distribution - to be equitable, economic effect distribution structure – to be optimal), if there is no appropriation (by individual branches) of economic effect *de facto* created by other economy branches. We assume constancy and certainty of physical volumes of the main macroeconomic indicators and uncertainty in prices and structural proportions in the competitive equilibrium conditions. Under these conditions

distribution corresponds to the marginal productivity of production factors and optimal proportions of economic effect distribution structure are formed.

Following to Neoclassical theory, in this paper labor and capital are considered to be the main factors of production, and compensation of employees and gross operation surplus, mixed income are chosen to be their factor income of labor and capital. We also propose to consider the sum of all factor income (compensation of employees and gross operation surplus, mixed income) as an indicator of economic effect. It is GVA at factor prices in accordance with the methodology of the System of National Accounts (SNA).

We assume that distribution proportions and market prices for products are determined simultaneously in the economy and consider the distribution on the level of actual volume of GVA at factor prices created for the year. We call the structure proportions that correspond to the distribution under the conditions of competitive equilibrium as justified, effective and optimal proportions.

In reality the national economy is never in a competitive situation. Hence, the comparison of actual distribution parameters with the corresponding optimal values at a specific moment of time makes it possible to estimate the degree of the efficiency of structural proportions, whereas the similar comparison maid over some interval of time allows one to understand the degree of the efficiency of structural changes.

In modern economic theory, the production function provides one of the most adapted and well-developed tools for analysis and quantitative estimation of parameters of the economic effect distribution obtained from empirical data. This function was first applied by C. Cobb and P. Douglas to estimate the ratio between incomes of production factors in American economy. It was further developed by scientists representing Neoclassical approach (R. Solow, B. Minhas, H. Chenery, J. de Cani, M. Brown and others).

The production function is traditionally used for finding the values of parameters of the economic effect distribution based on the assumption that the social technology attains the largest output of products for each combination of the production factors (see, for example, (Blaug, 2001) or (Brown, 1971)). It is also assumed that well comparable dynamic series of data are available for a long period of time. All of the above makes it quite difficult to get the adequate description of transition economy. Hence, alternative deterministic methods for empirical estimation of the production function parameters are required. One of such methods, presented in (Grebennikov and Suvorov, 1998), is developed on the following premises: (1) the relative fraction contributed by individual economy branches into the cumulative resources is equal to the mean between the shares contributed by those branches into the capital and employment assets; (2) the unit loss for one of the production factors is equivalent to the unit

gain of other factor. This method provides a framework for the estimations of optimal structure proportions given in the paper.

The remainder of this paper is composed of four sections. We present a grouping of the main factors affecting the dynamics of deviations of actual proportions from their optimal values in the structure of GVA distribution between branches in Section 2. Section 3 describes the model for estimating these deviations as well as the influence of the proposed factor groups on them. Our estimation results are presented in Section 4. The final section concludes the paper.

2. Structural Change Factors

According to Neoclassical economic theory, structural change under the conditions of pure competition is caused by groups of factors acting on the aggregate demand side and aggregate supply side. In a real economic system characterized by conditions of imperfect competition, the group of institutional factors is affecting the dynamics of basic structural proportions too. Therefore, in order to estimate the influence of the separate complex factors on the dynamics of deviations of actual structural proportions from their optimal value, it is convenient to group the main factors affecting the change in the structure of interindustry distribution of economic effect as shown in Figure 1.

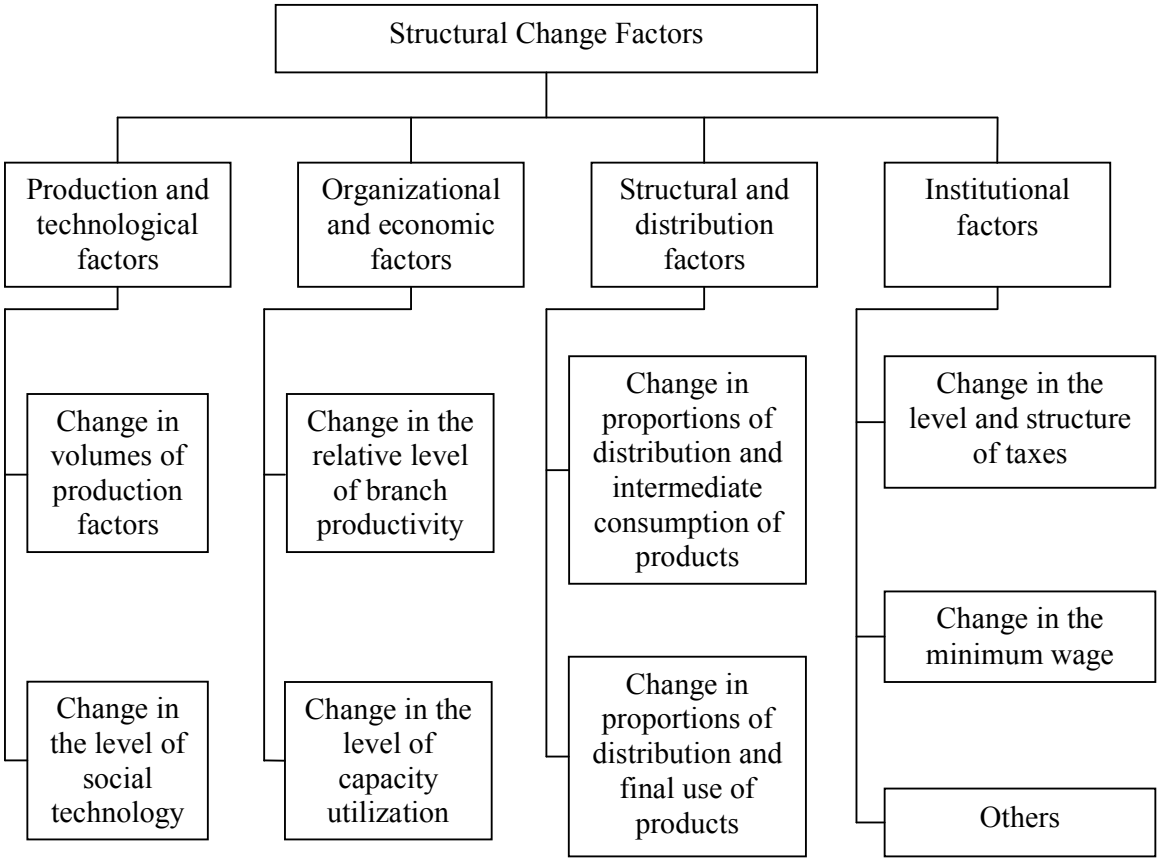

Figure 1. Factors of the change in economic effect distribution structure

The group of production and technological factors and the group of organizational and economic factors are composed of the factors affecting the structural change on the aggregate supply side. The first group consists of both the disproportionate change in volumes of production factors which are used by individual branches and the change in the average level of technology development in an economic system, while the second one contains the change in capacity utilization and the technological change leading to the change in the relative branch level of production factors productivity.

The branch share increase in production factors consumption causes, *ceteris paribus*, the corresponding growth of both branch production volumes and branch share in economic effect structure. It is principally an extensive factor of structural change.

In the absence of other factors, production technology improvement of a separate branch results in increase of both quantity and quality of the branch product. This changes economic effect distribution structure in favor of the branch. It is mainly an intensive factor of the structural change.

Part time capacity utilization is typical for countries with economies in transition. Hence, in the case of constant industry structure of production factors distribution and the absence of technological change, fuller utilization of branch production capacity results in growth of branch share in the total economic effect.

The group of structural and distribution factors consisting of the proportion change in distribution and consumption of branch products affects the structural change on the aggregate demand side.

All other factors have mainly institutional nature. Thereby, the changes in government economic policy and key regulators, and the factors that take into account quality of the institutional environment (level of corruption and shadowing of individual activities, social and economic standards etc.) can be combined to the group of institutional factors of economic effect distribution.

According to Institutional economic theory, laws and other regulatory documents (so-called “official rules”) governing a society and contributing to the process of reproduction (production, distribution, exchange and consumption) of social product, cause more efficient use of limited resources and progressive economic development. Imperfect (backward) institutional framework which does not correspond to the needs of reproductive cycle and to state of both productive forces and production relations conversely impedes the development of the economy.

It should be noted that, assuming justice distribution of economic effect in accordance with the marginal productivity of production factors, the factors belonging to the group of production and technological factors cause the dynamics of optimal structural proportions.

Hence, the influence of these factors on the dynamics of deviations of actual structural proportions from their optimal values is neutralized. Thus, only the remaining groups (i.e, organizational and economic factors, structural and distribution factors, and institutional factors) affect the dynamics of these deviations.

Estimating the influence of these factor groups on the structural change is the task of the further analysis in this study.

3. Estimation model

In (Grebennikov and Suvorov, 1998), the comparative resource output (CRO) is selected as an indicator characterizing deviations of actual proportions from their optimal values in the structure of economic effect distribution between branches. It is obtained by multiplying the branch resource output (i.e., the ratio of branch gross domestic product to branch aggregate resource (AR)) by the resource intensity averaged for economy. It should be noted that this indicator is helpful for structural change analysis. However, from our point of view, the approach for calculating the CRO indicator should be modified so that the proposed method for estimating economic effect distribution parameters according to marginal productivity would be adapted to the available statistical data.

It is known that the value of branch gross domestic product is an indicator characterizing final result of branch activity. According to the SNA methodology, the gross domestic product consists of compensation of employees, gross operation surplus, mixed income and taxes (less subsidies) on production and imports. Since, according to the method described in (Grebennikov and Suvorov, 1998), the AR value consists of two production factors – labor and capital, the value of economic effect should be free from taxes and subsidies on production and imports for most adequate reflection of the result of branch activity. Following the SNA methodology, the difference between the gross domestic product and taxes (less subsidies) on production and imports equals to "gross value added at factor costs" (System…, 1993). That is why, from our point of view, the usage of value of GVA at factor prices as an indicator of economic effect for estimation of CRO values seems to be more reasonable.

Below we describe our modification of the deterministic method (Grebennikov and Suvorov, 1998). In further discussion, the economy is presented by m branches (types of economic activity) and two production factors (labor and capital). Let $x(i) = X(i)/X$, $c(i) = C(i)/C$, and $n(i) = N(i)/N$ be relative weights (shares) of separate economy branch i in GVA at factor prices (X), capital assets (C), and employment (N), respectively. Then, $r(i) = \min(c(i), n(i))^{\lambda} \max(c(i), n(i))^{1-\lambda}$ is the share of branch i in AR which is determined as aggregate from capital and labor, and $q(i) = x(i)/r(i)$ is the value of CRO of branch i.

By definition, $\sum r(i) = 1$. Solving this equation for λ makes it possible to define the values of *r(i)* and, consequently, the values of *q(i)* for every branch *i*.

For separate economy branch *i*, the marginal rate of substitution of labor by capital (*MRS (i)*) is defined by the formula:

$$MRS(i) = \begin{cases} \frac{C(i)}{N(i)} \cdot \frac{\lambda}{1-\lambda}, \; if \; c(i) = \max(c(i), n(i)), \\ \frac{C(i)}{N(i)} \cdot \frac{1-\lambda}{\lambda}, \; if \; c(i) = \min(c(i), n(i)). \end{cases}$$

Therefore, the *MRS* for the whole economy is calculated as averaged value over industrial values: $MRS = \sum MRS(i) \cdot r(i)$.

Denoting the values of elasticity of AR to capital and labor by δ_C and δ_N, respectively, and assuming that their sum equals to one, one can determine these values for the whole economy from the following equations: $MRS = \frac{C}{N} \cdot \frac{1-\delta_C}{\delta_C}$ and $\delta_N = 1 - \delta_C$.

Let us assume that the CRO does not depend on the AR scale, i.e. $\frac{\partial X}{\partial R} = \frac{X}{R}$. Then, in our case, the marginal products of labor and capital are defined as follows: $\frac{\partial X}{\partial N} = \frac{X}{N}\delta_N$, $\frac{\partial X}{\partial C} = \frac{X}{C}\delta_C$. Thus, under the assumption of independence of CRO from the AR scale, the indicators δ_N and δ_C also represent elasticities of GVA to labor and capital, respectively. Therefore, the ratio of these indicators characterizes the economic effect distribution between production factors according to their marginal productivity in economy. Then, $d(i) = \frac{\frac{\partial X}{\partial N} \cdot N(i) + \frac{\partial X}{\partial C} \cdot C(i)}{\frac{\partial X}{\partial N} \cdot N + \frac{\partial X}{\partial C} \cdot C} = \delta_N \cdot n(i) + \delta_C \cdot c(i)$ is the share of branch *i* in optimal structure of distribution of GVA at factor prices.

It should be noted, that, in our case, the share $d(i)$ is identical to the branch share in AR structure calculated according to production factors marginal productivity:

$$r^*(i) = \frac{R(i)}{R} = \frac{\frac{\partial R}{\partial N} \cdot N(i) + \frac{\partial R}{\partial C} \cdot C(i)}{\frac{\partial R}{\partial N} \cdot N + \frac{\partial R}{\partial C} \cdot C} = \delta_N \cdot n(i) + \delta_C \cdot c(i) = d(i).$$

That is why we define CRO (i.e. indicator characterizing deviations of actual proportions from their optimal values in the structure of economic effect distribution between branches) by the formula:

$$q^*(i) = \frac{x(i)}{r^*(i)}. \quad (1)$$

Next, we take the square root of the conditional moment of the second order distribution *M1* (here the deviations of $q^*(i)$ are determined with respect to the unity) and consider its value as an integral estimation of the discrepancy between the actual and optimal distribution of economic effect for each type of economic activity. Similarly, we use the square root of the conditional moment of the second order distribution *M2* as an integral characteristic of the discrepancy between the actual and optimal distribution of economic effect in the national economy.

Below we describe our approach for estimating the influence of factor groups on the deviations of actual structural proportions from their optimal values. This approach assumes the calculation of branch GVA at comparable prices. It can be done on the basis of either extrapolation method or double-deflation method.

The double-deflation method is based on calculation of branch GVA in current year as the difference between the deflated branch values of gross output and intermediate consumption in prices of the previous (basic) year. This method uses the deflators and the structure of distribution and use of products in current year. However, the same value of branch GVA can be calculated as the difference between extrapolated branch values of gross output and intermediate consumption in prices of the previous (basic) year. In this case, the volume indexes as well as the structure of distribution and use of products in basic year are used for the extrapolation.

Under the assumptions adopted in this study, the dynamics of GVA structure indicators calculated by extrapolation is caused by the change in the structure of production factors' volumes, the change in the level of branch technology development, and the change in the level of capacity utilization. However, the change in the structure of GVA optimal distribution (indicators of this structure are calculated by formula (1)) is caused by the structural change in the production factors' volumes and the change in the level of social technology. Hence, the difference between the changes in extrapolated GVA structure and in the structure of GVA optimal distribution (see formula (3)) characterizes the influence of both the change in the level of branch technology reflected in the deviations of branch marginal products of production factors from the average levels by the economy and the change in the level of capacity utilization on structural change efficiency in economic system, i.e. the influence of the group of organizational and economic factors.

The deviation between GVA branch levels that are calculated for structures of both distribution and use of products in current year and in basic years (by deflation and extrapolation) is caused by the change in the distribution and use of products. It should be noted,

that in practice the values of both deflated and extrapolated total GVA for the whole economy are different. This difference is due to the influence of the change in the aggregate demand structure on the production factors payment. Hence, the change in the aggregate demand structure is main factor of the change taking place in the structure of distribution and use of products during short periods of time.

Thus, we propose to calculate the influence of the change in volumes in the commodity markets, fixed in the change in the structure of distribution and use of products in the Statistical Tables "Input-Output", (i.e. the influence of the group of structural and distribution factors) on structural change efficiency as the difference between the values of deflated and extrapolated branch GVA.

The deviation of actual branch GVA from its deflated value is characterized by the influence of the institutional group of factors on the structural change. Hence, the influence of institutional group of factors on the structural change efficiency leads to either increase or decrease (from year to year) in the part of the deviation of actual parameters of economic effect distribution from optimal values, which remains after subtraction of deflated branch GVA from its actual value.

We would like to point out that branch GVA at consumer prices ($X_{cp}(i)$) consists of the GVA at factor prices (*X(i)*) and taxes (less subsidies) on production and imports (*T(i)*). Hence, the change in the deviation of actual proportions of the structure of the distribution of GVA at consumer prices from the optimal values is caused by the influence of structural change of its components,i.e.,

$$(\frac{X_{cp}^{(j+1)}(i)}{X_{cp}^{(j+1)}} - \frac{X_{cp}^{j}(i)}{X_{cp}^{j}}) - (r^{*(j+1)}(i) - r^{*j}(i)) = (\frac{X^{(j+1)}(i) + T^{(j+1)}(i)}{X_{cp}^{(j+1)}} - \frac{X^{j}(i) + T^{j}(i)}{X_{cp}^{j}}) -$$

$$-(r^{*(j+1)}(i) \cdot \frac{X_{cp}^{(j+1)}}{X_{cp}^{(j+1)}} - r^{*j}(i) \cdot \frac{X_{cp}^{j}}{X_{cp}^{j}}) = (\frac{X^{(j+1)}(i)}{X_{cp}^{(j+1)}} - \frac{X^{j}(i)}{X_{cp}^{j}}) + (\frac{T^{(j+1)}(i)}{X_{cp}^{(j+1)}} - \frac{T^{j}(i)}{X_{cp}^{j}}) - (r^{*(j+1)}(i) \cdot$$

$$\cdot \frac{X^{(j+1)} + T^{(j+1)}}{X_{cp}^{(j+1)}} - r^{*j}(i) \cdot \frac{X^{j} + T^{j}}{X_{cp}^{j}}) = (\frac{X^{(j+1)}(i)}{X^{(j+1)}} \cdot \frac{X^{(j+1)}}{X_{cp}^{(j+1)}} - \frac{X^{j}(i)}{X^{j}} \cdot \frac{X^{j}}{X_{cp}^{j}}) + (\frac{T^{(j+1)}(i)}{T^{(j+1)}} \cdot \frac{T^{(j+1)}}{X_{cp}^{(j+1)}} -$$

$$-\frac{T^{j}(i)}{T^{j}} \cdot \frac{T^{j}}{X_{cp}^{j}}) - (r^{*(j+1)}(i) \cdot \frac{X^{(j+1)} + T^{(j+1)}}{X_{cp}^{(j+1)}} - r^{*j}(i) \cdot \frac{X^{j} + T^{j}}{X_{cp}^{j}}) = [(x^{(j+1)/j}(i) - r^{*(j+1)/j}(i)) \cdot \frac{X^{(j+1)}}{X_{cp}^{(j+1)}} -$$

$$-(x^{j}(i) - r^{*j}(i)) \cdot \frac{X^{j}}{X_{cp}^{j}}] + [(t^{(j+1)}(i) - r^{*(j+1)}(i)) \cdot \frac{T^{(j+1)}}{X_{cp}^{(j+1)}} - (t^{j}(i) - r^{*j}(i)) \cdot \frac{T^{j}}{X_{cp}^{j}}].$$

Thus, we propose to estimate the factor groups' influence on the efficiency of the change in the structure of GVA at consumer prices on the basis of deterministic additive model by the chain substitution method given by following formulas:

$$\Delta x_{cp}^{(j+1)/j}(i) - \Delta r^{*(j+1)/j}(i) = \Delta d_{1,cp}^{(j+1)/j}(i) + \Delta d_{2,cp}^{(j+1)/j}(i) + \Delta d_{3,cp}^{(j+1)/j}(i),$$

$$\Delta d_{1,cp}^{(j+1)/j}(i) = (x_{d1}^{(j+1)}(i) - r^{*(j+1)}(i)) \cdot \frac{X^{(j+1)}}{X_{cp}^{(j+1)}} - (x_{d1}^{j}(i) - r^{*j}(i)) \cdot \frac{X^{j}}{X_{cp}^{j}},$$

$$\Delta d_{2,cp}^{(j+1)/j}(i) = (x_{d2}^{(j+1)}(i) - x_{d1}^{(j+1)}(i)) \cdot \frac{X^{(j+1)}}{X_{cp}^{(j+1)}} - (x_{d2}^{j}(i) - x_{d1}^{j}(i)) \cdot \frac{X^{j}}{X_{cp}^{j}},$$

$$\Delta d_{3,cp}^{(j+1)/j}(i) = [(x^{(j+1)}(i) - x_{d2}^{(j+1)}(i)) \cdot \frac{X^{(j+1)}}{X_{cp}^{(j+1)}} - (x^{j}(i) - x_{d2}^{j}(i)) \cdot \frac{X^{j}}{X_{cp}^{j}}] +$$

$$+ [(t^{(j+1)}(i) - r^{*(j+1)}(i)) \cdot \frac{T^{(j+1)}}{X_{cp}^{(j+1)}} - (t^{j}(i) - r^{*j}(i)) \cdot \frac{T^{j}}{X_{cp}^{j}}].$$

Here

$\Delta x_{cp}^{(j+1)/j}(i) - \Delta r^{*(j+1)/j}(i)$ is the total change in the deviation of actual share of branch *i* in the structure of GVA at consumer prices from its optimal value for a period of time from year *j* to year *j+1*;

$\Delta d_{1,cp}^{(j+1)/j}(i)$, $\Delta d_{2,cp}^{(j+1)/j}(i)$, $\Delta d_{3,cp}^{(j+1)/j}(i)$ are the changes in the deviation of actual share of branch *i* in the structure of GVA at consumer prices from its optimal value as a result of the influence of organizational and economic factors, of structural and distribution factors, and of institutional factors, respectively, for a period of time from year *j* to year *j+1*;

$x_{d1}^{j}(i)$ is the share of branch *i* in the structure of GVA at comparable prices estimated in accordance with structure (in basic year) of both distribution and use products for year *j*;

$r^{*j}(i)$ is the share of branch *i* in the AR structure for year *j*;

X^{j} is the GVA at factor prices in the economy for year *j*;

X_{cp}^{j} is the GVA at consumer prices in the economy for year *j*;

$x_{d2}^{j}(i)$ is the share of branch *i* in the structure of GVA at comparable prices estimated in accordance with structure (in current year) of both distribution and use products for year *j*;

$x^{j}(i)$ is the actual share of branch *i* in the structure of GVA for year *j*;

$t^{j}(i)$ is the share of branch *i* in the structure of taxes (less subsidies) on production and imports for year *j*;

T^{j} is the total value of taxes (less subsidies) on production and imports for year *j*.

Various groups of factors can have different (sometimes the opposite direction) influences on the change of the share of branch *i* in the structure of GVA. Thus, the scale $\Delta d_{m,|Dcp|}^{(j+1)/j}(i)$ and proportion $\Delta d_{m,Dcp}^{(j+1)/j}(i)$ of the influence of every factor on the efficiency of the

change of branch share in the structure of GVA at consumer prices can be estimated by the formulas:

$$\Delta d^{(j+1)/j}_{m,|Dcp|}(i) = \frac{|\Delta d^{(j+1)/j}_{m,cp}(i)|}{\sum|\Delta d^{(j+1)/j}_{m,cp}(i)|},$$

$$\Delta d^{(j+1)/j}_{m,Dcp}(i) = \frac{\Delta d^{(j+1)/j}_{m,cp}(i)}{\sum\Delta d^{(j+1)/j}_{m,cp}(i)}.$$

5. Analysis of estimation of the CRO values and the influence of the structural change factors

In this paper, the Ukrainian Input-Output Tables (see, for example, (Ukraine's Input–Output Table…, 2009)) and the statistical data regarding employment, capital assets (in comparable prices of 2000 year) and GVA for the period of time from 2000 till 2007, which is contained in the official publications of the State Statistics Committee of Ukraine (see, (Labor…, 2008) and (Fixed Assets…, 2008)), has been used as the information base for the estimation of the CRO and the influence of factors groups on the structural changes in the national economy. To calculate the estimations values for the CRO and the factor groups influence, we have used the data for 26 types of economic activity (such as agriculture, forestry, fishery, production of energy materials, production of non-energy materials, food-processing industries, textile and leather industry, woodworking, pulp and paper industry, publishing, manufacture of coke products, petroleum refinement and processing of nuclear fuel, manufacture of chemicals, rubber and plastic products, manufacture of other non-metallic mineral products, metallurgy and metal processing, manufacture of machinery and equipment, other production, electric energy, gas supply and water supply, construction, trade, hotels and restaurants, transport, post and telecommunications, financial intermediation, real estate transactions, renting and services to legal entities, public administration, education, health care and social assistance, community, social and personal service activities, and other activities).

Our estimations of the CRO values are shown in Table 1. A few years of the CRO increase were alternated by its decrease for production of non-energy materials, textile and leather industry, manufacture of coke products, petroleum refinement and processing of nuclear fuel, manufacture of machinery and equipment, and manufacture of other non-metallic mineral products. Fluctuations of this indicator with tendency to reduction were observed for production of energy materials, food-processing industries, woodworking, pulp and paper industry, publishing, manufacture of chemicals, rubber and plastic products, and metallurgy and metal processing. Stable decrease of CRO can be noticed only for electric energy, gas supply and water supply.

Table 1. The CRO values (by type of economic activity) for the Ukrainian economy in 2000-2007

Type of economic activity	2000	2001	2002	2003	2004	2005	2006	2007	M_1
Production of energy materials	0,904	0,979	0,897	0,747	0,649	0,686	0,699	0,741	**0,241**
Production of non-energy materials	0,960	0,650	0,921	1,032	1,111	1,249	1,206	1,482	**0,245**
Food-processing industries	1,145	1,288	1,336	1,382	1,167	1,334	1,212	1,100	**0,264**
Textile and leather industry	0,559	0,677	0,907	0,933	0,920	0,834	1,063	1,110	**0,213**
Woodworking, pulp and paper industry, publishing	1,304	1,647	1,684	1,529	1,676	1,591	1,433	1,081	**0,531**
Manufacture of coke products, petroleum refinement and processing of nuclear fuel	0,274	1,018	1,069	1,605	1,970	2,319	1,788	2,000	**0,806**
Manufacture of chemicals, rubber and plastic products	1,065	1,050	0,973	1,051	1,132	1,251	1,327	1,004	**0,157**
Manufacture of other non-metallic mineral products	0,489	0,765	0,759	0,768	0,804	0,842	0,942	1,010	**0,249**
Metallurgy and metal processing	1,811	1,276	1,207	1,246	1,533	1,503	1,629	1,549	**0,509**
Manufacture of machinery and equipment	0,574	0,704	0,735	0,738	0,786	0,646	0,657	0,827	**0,301**
Electric energy, gas supply and water supply	1,240	1,153	1,086	0,996	0,836	0,709	0,699	0,639	**0,229**
M_2	**0,422**	**0,290**	**0,276**	**0,299**	**0,406**	**0,504**	**0,377**	**0,387**	

It should be noted that both manufacture of machinery and equipment and production of energy materials had unsatisfactory CRO values. Relatively low value of CRO for manufacture of coke products, petroleum refinement and processing of nuclear fuel in 2000 year is stipulated by considerable loss of this type of economic activity.

As follows from Table 2, the difference in changes of CRO values for separate types of economic activity are stipulated by different growth rates of their fractions in the GVA at factor costs and in the AR. Food-processing industries, woodworking, pulp and paper industry, publishing, metallurgy and metal processing belong to the group of types of economic activity having relatively high values of CRO during the period of time under consideration.

The discrepancy between the values of CRO and its averaged level for the whole economy appeared to be the most substantial for such activities as manufacture of coke products, petroleum refinement and processing of nuclear fuel. At the same time, it had almost no influence on manufacture of chemicals, rubber and plastic products (by indicator *M1*). Manufacture of coke products, petroleum refinement and processing of nuclear fuel was the first

among the types of economic activity by the CRO indicator in 2004 (compared with its last place in 2000).

Table 2. Grouping of types of economic activity by dynamics and factors of CRO changes in 2000-2007

Type of economic activity by dynamics group	Change of share	
	in GVA at factor prices	in AR
I. Increase (q)		
Manufacture of coke products, petroleum refinement and processing of nuclear fuel	(+)	(+)
Manufacture of other non-metallic mineral products	(+)	(–)
Textile and leather industry	(+)	(–)
Production of non-energy materials	(+)	(+)
Manufacture of machinery and equipment	(+)	(–)
II. Decrease (q)		
Electric energy, gas supply and water supply	(–)	(+)
Production of energy materials	(–)	(+)
Woodworking, pulp and paper industry, publishing	(+)	(+)
Metallurgy and metal processing	(+)	(+)
Manufacture of chemicals, rubber and plastic products	(–)	(–)
Food-processing industries	(+)	(+)

The results of our computations testify that the structure of the Ukrainian economy has improved due to the decrease of specific weights of branches having relatively low values of the resource output during 2000-2007 (the value of indicator *M2* decreased by 8,3%). The largest discrepancy between the CRO values is observed for the year of 2005. The structure of economic effect distribution between the types of economic activity was close to the structure of AR distribution (by indicator *M2*) in 2003. So, the structural changes did not have any stable nature.

Our estimations of the influence of the structural change factors are shown in Table 3. The factor groups' influence on the structural proportion dynamics is highly varied in the direction and scale from year to year. The group of structural and distribution factors as well as the group of institutional factors (i.e., the factors that are related to a greater extent with price proportions changes than the changes in the gross output volumes) had a decisive influence on the efficiency of the structural proportion dynamics in all activities. Also, the group of structural and distribution factors had a decisive influence on the efficiency of the dynamics of the structural proportions in production of energy materials, food-processing industries, woodworking, pulp and paper industry, publishing, and electric energy, gas supply and water

supply. Efficiency of the structural proportion changes in manufacture of coke products, petroleum refinement and processing of nuclear fuel equally depended on the group of structural and distribution factors and the group of institutional factors. The factors of the last group significantly affected in the other activities.

Table 3. Estimating scale of factors' influence on the dynamics of branch share in GVA (by type of economic activity) for the Ukrainian economy in 2000-2007, %*

Type of economic activity	Organizational and economic factors	Structural and distribution factors	Institutional factors
Production of energy materials	23,4	43,2	33,4
Production of non-energy materials	32,4	28,5	39,1
Food-processing industries	34,1	43,2	22,7
Textile and leather industry	12,4	33,3	54,3
Woodworking, pulp and paper industry, publishing	20,5	42,2	37,3
Manufacture of coke products, petroleum refinement and processing of nuclear fuel	31,8	34,1	34,1
Manufacture of chemicals, rubber and plastic products	32,4	28,4	39,2
Manufacture of other non-metallic mineral products	23,4	28,7	47,9
Metallurgy and metal processing	31,1	33,1	35,8
Manufacture of machinery and equipment	30,8	27,1	42,1
Electric energy, gas supply and water supply	33,9	39,0	27,1

*- average for the period of time

Thus, the deviations of actual share in GVA structure from its optimal value for production of energy materials, food-processing industries, woodworking, pulp and paper industry, publishing, manufacture of coke products, petroleum refinement and processing of nuclear fuel, electric energy, gas supply and water supply are caused primarily by the change in the aggregate demand for products of these branches. So, improvement of the structure of aggregate demand for products of these branches should be one of the main directions of the government economic policy aiming to increase the efficiency of the existing structural changes.

5. Conclusions

In this paper, we have considered the deviations of actual proportions of GVA distribution from their optimal values. Alternative deterministic method for empirical calculation of the production function parameters was used for estimating the optimal proportions of distribution structure. We have proposed a grouping of factors of the change in economic effect distribution structure and suggested the model for estimating the influence of these factor groups on the efficiency of the structural changes. We have presented the estimation and analysis of the

deviations between actual and optimal proportions in GVA distribution structure for Ukrainian economy for the period of time from 2000 till 2007. The analyses given in the paper could be used for economic policy improvement.

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