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EFFICIENCY OF INVESTMENT IN THE LABOUR FORCE

The production function is modified to determine the impact of the financial costs, aimed at human resources development. The analysis of efficiency of social investments is carried out. Comparison of the return level of social charges and the return indexes of material and other charges is conducted.

Keywords. Social investments, efficiency of investments in a labour resource, productive function.

Introduction. Adverse factors including consequences of impact of world financial crisis ambiguously influence formation, development and functioning of the majority of domestic enterprises. In these conditions the special importance is purchased by research of development of a labor resource and investment soundness determination in production factors.

The significant contribution to development of theoretical reasons, development of methodological bases of researches of consequences of impact of crisis on functioning of social and economic system of Ukraine and its regions was made by scientists: Geets V.M., Dolishniy M.I., Zhalilo J.A., Evdokimenko V.K., Kolesnik V.I., Shkola I.M. and other. However there is a need of the maximum attraction of all known arsenal of data, statistical methods and economic-mathematical models for complex research of cost efficiency of production.

Problem. In case of research of economic processes mathematical models in the form of functional or statistical dependences are very often used. For example, it is obvious that between entity or industry release and the costs performed in a production process, there is a functional communication. Function, dependence between costs of production and release of its products expresses it is accepted to call a production function.

On a production function it is possible to perform the production rate forecast in case of costs of its factors in these or those sizes. Comparing production functions of two various processes or during the different periods of time, it is possible to speak about more or less effective process, to perform the analysis of structural shifts.

Research of a production function in which are reflected dependence of production on factors among which the amount of spent working hours appears, is connected more with economic concept of a labor productivity. If us return from finance costs which are aimed at the development of a manpower interests, a production function needs to be modified a little.

For creation of modifications production functions for industries of Chernovitska region we will use common methods of their creation in neoclassical economic to school.

Researches often consider a multiplicative production function which is set by a formula:

$$y = A (x_1)^a (x_2)^b \dots , \quad (1)$$

where y – production volume, x_1, x_2, \dots – production factors, A, a, b, \dots – fixed positive numbers. Sometimes consider a linear production function:

$$y = A + a x_1 + b x_2 + \dots , \quad (2)$$

which makes simple economic sense: production in proportion increases with increase in any resource.

Let's look for production functions for types of economic activity in the form of (1) and (2), where parameters A, a, b, \dots for each type of economic activity are unknown. It is necessary according to observed data for each type of activity to find

their approximate values so that the constructed production function precisely reflected real dependence.

Within research we will use data of quarterly state statistical supervision on a form № 1 - entrepreneurship «The report on the main indicators of activities of the entity for ___ quarter of 200_ years». The above modification is that the indicator of the «Amount of sold a goods, works, services (excluding VAT and excise)» form undertakes products amount in models (1) or (2), and for production factors - indicators «Operating expenses on a goods sold, works, services». All these forms are filled in one thousand UAH with one decimal sign.

For achievement of the purpose set in work it is possible to reduce twice quantity of the constituting operating expenses, determined to a statistical form, having grouped them as follows:

- The first «production factors» - material costs where indicators of the «Material Costs (less the Cost of Returnable Waste)» and «Depreciation» form entered;

- The second group - the social expenses which are including «Expenses on compensation» (including on educational issues, in connection with reorganization and staff reduction, surcharges in case of temporary disability) and «Assignments on social actions»;

- The third group - other expenses where «Cost of goods and the services purchased for resale and implemented without additional handling at this entity» and «Other operating expenses».

So, our mathematical (1) and (2) models to include three independent variables (exogenous parameters):

$$Y = d \cdot K^a \cdot L^b \cdot X^c, \quad (1')$$

$$Y = aK + bL + cX + d, \quad (2')$$

where Y – volume of sales for the quarter of goods (works, services), K , L , X – physical, social and other costs of products (works, services), a , b , c , d – unknown positive numbers.

Method of the smallest squares it is simpler to look for parameters of linear function (2'). The method consists in search of their such values which minimize the amount of squares of deviations of observed values of amount of products of Y_i implemented in a quarter from the simulated values (values on a straight line) from the simulated values (values on a straight line) \tilde{Y}_i [1, c.45]. The specified deviations are equal:

$$Y_i - \tilde{Y}_i = Y_i - aK_i - bL_i - cX_i - d,$$

where Y – volume of sales for the quarter of goods (works, services), K , L , X – physical, social and other costs of products (works, services) in i-m supervision. The amount of squares of deviations shall reach the minimum value:

$$\sum_i (Y_i - aK_i - bL_i - cX_i - d)^2 \rightarrow \min. \quad (3)$$

At least expression (3) reaches under necessary conditions when the first derivatives are equal to zero, i.e.

$$\frac{\partial}{\partial a} \sum_i (Y_i - aK_i - bL_i - cX_i - d)^2 = -2 \sum_i K_i (Y_i - aK_i - bL_i - cX_i - d) = 0,$$

$$\frac{\partial}{\partial b} \sum_i (Y_i - aK_i - bL_i - cX_i - d)^2 = -2 \sum_i L_i (Y_i - aK_i - bL_i - cX_i - d) = 0,$$

$$\frac{\partial}{\partial c} \sum_i (Y_i - aK_i - bL_i - cX_i - d)^2 = -2 \sum_i X_i (Y_i - aK_i - bL_i - cX_i - d) = 0,$$

$$\frac{\partial}{\partial d} \sum_i (Y_i - aK_i - bL_i - cX_i - d)^2 = -2 \sum_i (Y_i - aK_i - bL_i - cX_i - d) = 0.$$

These equations form system of four linear algebraic equations from four unknown a , b , c , d . Having solved it's one of methods, for example, the Gauss method, we receive linear production functions.

The received model needs to be checked on adequacy. The determination coefficient is for this purpose used. He specifies that part of dispersion (dispersion from average value), caused by regression. Differently, as a percentage he specifies, on how many percent the constructed model explains change of a productive sign.

It is slightly more difficult to construct a production function in the form of multiplicative model (1'). For this purpose it is necessary to reduce at first it to linear model [2, page 142]. Taking the logarithm the equations (1'), we will receive:

$$\ln Y = \ln (d \cdot K^a \cdot L^b \cdot X^c),$$

$$\ln Y = \ln d + a \cdot \ln K + b \cdot \ln L + c \cdot \ln X.$$

If we enter designations

$$y = \ln Y, \quad e = \ln d, \quad k = \ln K, \quad l = \ln L, \quad x = \ln X$$

that for new variables y, k, l, x let's have linear model which we build like (2'). After model creation for y, k, l, x we return to previous variables Y, K, L, X .

To construct the modified production functions for types of economic activity of economy of Bukovina in case of impact of world financial and economic crisis, pertinently to consider data in six quarters - four in 2009 and the first two quarters 2010. Naturally, on duration to consider the same period before crisis - four quarters 2007 and the first two quarters 2008.

As the extent of both periods is insignificant (constitutes one and a half years) and each of them separately doesn't cover any events which could affect production technologies, production organizations or the resource capacity of the region, easy there is an assumption that parameters of production functions for each industry during the pre-crisis and crisis periods were invariable, and for their determination with an identical weight it is possible to take data quarterly the period.

All economy of Chernovitska region according to the Qualifier of types of economic activity (2005) and requirements of filling of a form No. 1 entrepreneurship (approved by the order of Goskomstat of Ukraine of 20.07.2006 No. 347) we will break into 44 main types of economic activity (at the level of separate sections, subsections and sections QTEA).

Under state statistical observation form number 1-business (quarterly) Continue past years get more than 600 entities in Chernovitska region by different ownership, authority and organizational forms of management. Given the versatility of individual companies (the company can operate several technological cycles of various economic activities, and for each individual company delivers data) in the

sample to construct production functions in all economic activities got so many observations:

Table 1

Number of enterprises in Chernovitska region, which have come under observation in quarters pre-crisis and crisis

Period	Quarters of pre-crisis period						Quarters of crisis period					
	I q. 2007	II q. 2007	III q. 2007	IV q. 2007	I q. 2008	II q. 2008	I q. 2009	II q. 2009	III q. 2009	IV q. 2009	I q. 2010	II q. 2010
Number of companies	856	841	836	851	927	941	816	821	828	848	843	878

That is, as a whole for research there was available such information on sales amounts and operating expenses by all types of economic activity: in quarters 2007-08 the 5252 data sets, in quarters 2009-10 - the 5034 sets. After rejection of sets with a zero indicator of sales amount of products (works, services), real production engineering procedures distorting the description, for the pre-crisis period there were 4941 data sets, for crisis - 4778 sets.

After creation of approximations of the modified multiplicative and linear production functions for each of 44 main types of economic activity during the pre-crisis and crisis periods it was performed check on adequacy. For this purpose in each case the determination coefficient which is a variation ratio was analysed, is explained by model, in a general variation of endogenous size. This coefficient always matters in the range from zero to unit. Than more its value, that constructed model is adequate. Fischer's criterion was applied to conclusion confirmation about adequacy of model from 95% of reliability.

Results of determination of coefficients of multiplicative and linear production functions and calculation of the corresponding coefficients of determination are provided in Table 2.

Table 2

**The results of the construction of production functions in terms of economic activities for economic agents
Chernovitska region in the pre-crisis and crisis periods**

Type of economic activity	Period	Sample	Coefficients of linear model				Coefficient of determination	Coefficients of multiplicative model				Coefficient of determination
			a	b	c	d		a	b	c	d	
1	2	3	4	5	6	7	8	9	10	11	12	13
Agriculture, hunting and related services	pre-crisis	13	0,95	1,16	0,00	-7,09	>0,93	0,69	0,22	0,02	3,20	>0,8
	crisis	4	0,69	1,65	0,50	3,59	1	0,38	0,49	0,06	3,74	1
Forestry and related services	pre-crisis	78	1,14	0,99	0,94	7,20	>0,98	0,44	0,30	0,10	7,91	>0,52
	crisis	70	1,08	1,01	0,94	-38,95	>0,99	0,47	0,48	0,09	2,18	>0,91
Fishing	pre-crisis	7	model is inadequate					model is inadequate				
	crisis	11	0,33	1,21	1,25	71,65	>0,84	0,25	0,46	0,19	5,80	>0,73
Extraction of energy resources	pre-crisis	0										
	crisis	0										
Mining and quarrying, except of energy	pre-crisis	31	1,09	1,75	0,87	-131,51	>0,96	0,65	0,18	0,06	5,93	>0,79
	crisis	47	0,63	1,29	1,16	-11,96	>0,99	0,73	0,23	0,01	2,66	>0,95
Food and beverages	pre-crisis	212	1,11	1,26	0,00	127,81	>0,91	1,45	0,00	0,00	0,14	>0,43
	crisis	174	0,98	2,13	0,00	144,30	>0,94	0,90	0,13	0,00	1,45	>0,93
Textile industry, production of clothes, fur and fur products	pre-crisis	78	1,53	0,87	1,34	-172,94	>0,95	0,66	0,33	0,00	3,42	>0,32
	crisis	61	1,11	1,18	0,87	13,82	>0,98	0,51	0,48	0,03	2,88	>0,85
Manufacture of leather, leather and other materials	pre-crisis	16	1,34	1,00	0,55	-60,38	>0,99	0,20	0,44	0,37	4,13	>0,48
	crisis	19	1,32	1,23	1,92	-134,66	>0,99	1,23	0,00	0,09	3,16	>0,86
Processing of timber and wood products, except furniture	pre-crisis	225	0,89	0,98	0,41	58,39	>0,88	0,50	0,29	0,09	5,00	>0,63
	crisis	244	1,01	1,13	0,43	4,70	>0,92	0,56	0,31	0,12	3,04	>0,82
Manufacture of pulp, paper and paperboard including	pre-crisis	10	1,16	0,48	0,85	-4,05	>0,99	0,93	0,05	0,02	1,53	>0,98
	crisis	18	0,34	4,17	0,39	-40,40	>0,99	0,46	0,60	0,04	1,45	>0,70
Publishing, printing and reproduction of recorded media	pre-crisis	148	1,04	0,83	0,84	-6,45	>0,95	0,64	0,14	0,10	4,60	>0,70
	crisis	100	1,13	0,44	0,46	23,16	>0,91	0,53	0,31	0,05	4,33	>0,66
Production of coke, products of oil processing and nuclear materials	pre-crisis	0										
	crisis	0										
Chemical industry	pre-crisis	24	1,33	0,63	1,45	-61,39	>0,98	0,67	0,38	0,06	1,23	>0,96
	crisis	32	1,04	0,94	1,11	-43,59	>0,98	0,35	0,47	0,10	5,30	>0,84

1	2	3	4	5	6	7	8	9	10	11	12	13
Manufacture of rubber and plastic products	pre-crisis	67	0,92	0,81	0,00	214,43	>0,91	0,80	0,00	0,27	8,13	>0,81
	crisis	84	1,15	1,78	0,00	-30,46	>0,92	0,70	0,28	0,00	2,42	>0,67
Manufacture of other non-metallic mineral products	pre-crisis	102	1,00	1,18	1,22	-53,45	>0,97	0,54	0,36	0,10	2,90	>0,67
	crisis	159	0,92	1,37	0,52	-109,22	>0,94	0,46	0,37	0,04	5,19	>0,37
Metallurgy and manufacture of fabricated metal products	pre-crisis	66	0,80	4,58	1,78	-958,36	>0,99	0,82	0,17	0,03	1,82	>0,91
	crisis	114	1,07	4,82	0,00	-451,78	>0,96	0,87	0,23	0,00	1,07	>0,50
Manufacture of machinery and equipment	pre-crisis	56	2,17	0,00	9,59	-494,19	>0,96	0,12	0,80	0,15	1,89	>0,46
	crisis	40	0,89	3,57	0,00	-290,22	>0,96	0,86	0,27	0,01	0,79	>0,79
Manufacture of electrical, electronic and optical equipment	pre-crisis	79	1,22	1,11	0,71	-163,24	>0,91	0,60	0,41	0,00	2,17	>0,31
	crisis	64	1,07	1,48	0,40	-28,99	>0,92	0,30	0,52	0,06	7,07	>0,62
Manufacture of transport equipment	pre-crisis	8	0,46	0,73	1,27	-3,20	>0,96	0,25	0,91	0,12	0,41	>0,94
	crisis	6	0,70	1,73	0,00	-86,60	>0,94	0,76	1,93	0,00	0,00	>0,88
Other industries	pre-crisis	97	1,26	0,92	0,21	-31,31	>0,98	0,92	0,06	0,02	1,88	>0,96
	crisis	136	1,05	1,31	0,05	-3,47	>0,97	0,90	0,16	0,00	1,33	>0,89
Electricity, gas and water	pre-crisis	69	0,99	0,28	1,21	2402,08	>0,69	0,52	0,00	0,38	12,77	>0,22
	crisis	119	0,66	2,15	0,81	-568,86	>0,98	0,00	1,03	0,06	1,92	>0,35
Building	pre-crisis	292	0,68	2,04	0,87	40,45	>0,96	0,76	0,14	0,08	2,74	>0,83
	crisis	310	0,62	3,44	1,58	-404,50	>0,98	0,56	0,19	0,09	6,81	>0,24
Sale of motor vehicles and motorcycles, maintenance and repair	pre-crisis	151	0,90	0,97	1,05	-37,94	>0,99	0,14	0,03	0,63	10,92	>0,43
	crisis	101	0,21	2,15	0,94	171,03	>0,98	0,03	0,36	0,59	4,43	>0,94
Wholesale trade and mediation in trade	pre-crisis	865	1,41	1,02	1,05	-120,21	>0,99	0,06	0,00	0,86	2,87	>0,57
	crisis	580	0,31	1,72	1,03	136,36	>0,97	0,00	0,20	0,73	3,90	>0,76
Retail trade, repair of household goods and personal use	pre-crisis	476	1,05	1,45	1,00	-20,07	>0,99	0,09	0,08	0,74	3,66	>0,62
	crisis	397	0,00	1,77	0,98	18,86	>0,99	0,02	0,24	0,69	3,17	>0,59
Hotels and restaurants	pre-crisis	245	1,08	0,11	0,69	64,87	>0,76	0,29	0,25	0,29	6,98	>0,67
	crisis	240	0,32	1,59	0,56	51,40	>0,67	0,22	0,30	0,22	9,89	>0,20
Ground-based transport	pre-crisis	232	0,94	0,51	0,91	42,23	>0,92	0,33	0,10	0,28	14,15	>0,17
	crisis	207	0,95	0,79	0,22	59,78	>0,89	0,20	0,42	0,20	8,50	>0,52
Water transport	pre-crisis	0										
	crisis	0										
Business Aircraft	pre-crisis	7	model is inadequate					model is inadequate				
	crisis	6	model is inadequate					model is inadequate				
Additional transport services and auxiliary operations	pre-crisis	76	1,20	0,76	0,93	4,33	>0,99	0,16	0,25	0,39	10,15	>0,19
	crisis	61	1,02	1,03	0,88	-20,36	>0,99	0,18	0,46	0,21	9,65	>0,48

1	2	3	4	5	6	7	8	9	10	11	12	13
Post and telecommunication	pre-crisis	17	1,59	0,58	1,59	-13,50	>0,98	0,03	0,54	0,43	3,15	>0,84
	crisis	32	1,14	1,57	1,09	-60,15	>0,97	0,85	0,27	0,25	0,82	>0,48
Financial activity	pre-crisis	55	0,00	5,89	3,65	-132,52	>0,62	0,15	0,16	0,64	6,66	>0,23
	crisis	42	3,48	6,84	0,47	-144,12	>0,76	0,04	0,77	0,38	2,29	>0,72
Real estate	pre-crisis	412	0,33	1,59	1,02	47,80	>0,36	0,20	0,13	0,07	42,73	>0,03
	crisis	500	0,07	1,41	1,17	111,94	>0,83	0,19	0,23	0,14	31,94	>0,13
Renting of machinery and equipment, rental of household goods and personal consumption	pre-crisis	80	2,90	0,00	1,43	-17,38	>0,75	0,15	0,30	0,13	14,34	>0,15
	crisis	61	1,75	0,00	0,37	36,56	>0,67	0,44	0,33	0,00	6,75	>0,18
Computer and related activities	pre-crisis	63	1,22	0,43	0,92	28,66	>0,91	0,48	0,03	0,26	10,36	>0,40
	crisis	65	0,74	1,17	1,02	2,75	>0,90	0,30	0,22	0,19	11,89	>0,35
Research and development	pre-crisis	23	0,00	0,88	2,11	58,13	>0,94	0,48	0,37	0,00	7,26	>0,63
	crisis	21	0,00	1,47	1,75	-148,64	>0,94	0,04	1,06	0,12	0,50	>0,49
Industry: legal, accounting, engineering, services for entrepreneurs	pre-crisis	301	0,98	1,10	1,25	-5,87	>0,96	0,09	0,22	0,28	19,70	>0,03
	crisis	346	0,47	1,15	0,96	10,56	>0,80	0,00	0,56	0,17	7,15	>0,25
Governance	pre-crisis	8	1,04	0,95	0,48	161,11	>0,98	0,13	0,34	0,10	33,09	>0,98
	crisis	0										
Education	pre-crisis	26	0,65	1,14	0,76	26,68	>0,88	0,42	0,10	0,25	12,45	>0,86
	crisis	46	0,83	1,22	1,56	-25,43	>0,94	0,08	0,68	0,22	2,91	>0,65
Health care and social assistance	pre-crisis	33	1,17	0,67	0,98	5,77	>0,97	0,35	0,50	0,27	1,90	>0,89
	crisis	49	0,69	1,48	1,10	-8,08	>0,90	0,16	0,59	0,20	4,40	>0,62
Sanitary services, scavenging and waste destruction	pre-crisis	58	1,03	0,90	1,01	-57,69	>0,92	0,61	0,18	0,11	4,78	>0,65
	crisis	82	1,09	0,83	0,18	-3,01	>0,99	0,11	0,82	0,08	1,98	>0,60
Activities of NGOs	pre-crisis	0										
	crisis	0										
Activities in culture and sport, recreation and entertainment	pre-crisis	39	0,45	1,41	1,44	0,54	>0,92	0,00	0,55	0,58	2,64	>0,75
	crisis	43	1,12	1,15	1,02	13,62	>0,97	0,24	0,00	0,20	125,70	>0,45
Individual services	pre-crisis	96	1,10	1,09	1,39	9,08	>0,82	0,05	0,64	0,15	6,44	>0,44
	crisis	87	1,34	0,67	0,93	6,07	>0,93	0,15	0,44	0,33	5,50	>0,69

As shown in table 2, in inspection subjects of managing with such types of economic activity, as «Production of energy minerals», «Production of coke, products of oil processing and nuclear materials», «Activities of a water transport» (because of backwardness of these industries didn't get to areas) and «Activities of public organizations», «Public administration» in 2009-10. For industries because of a small amount of data it was impossible to construct adequate model. Production functions for «Fishery» during the pre-crisis period, and for «Activities of an air transportation» weren't tested on adequacy by Fischer's criterion. On the verge of adequacy by Fischer's criterion there were multiplicative models during the pre-crisis period for «Production of foodstuff, drinks» and «Activities in spheres of the right, financial accounting, engineering; provision of services to entrepreneurs» (about it witnesses also small coefficient of determination) that is connected with big dispersion of observed data.

Small selection (to 30 data sets) doesn't allow to tell with confidence that production functions are constructed reflect all industry of area in such types of economic activity, as «Agricultural industry, hunting and the related services», «hunting» during the crisis period, «Production of skin, products from skin and other materials», «Production of paper stock, paper, a cardboard and products from them», «Production of vehicles and the equipment», «Researches and developments», «Public administration» during the pre-crisis period. Though nevertheless separate conclusions can be drawn and for these spheres of managing.

After listing all restrictions on an analysis of the modified production function for industry in Chernovitska region, in general it can be argued that the statistics is quite possible to build a credible approximation of the relationship between the factors.

Exploring the modified linear production functions, factor analysis feasible *b*. In linear production functions of type (2 ') it determines the maximum efficiency (marginal product) workforce. In this modified case it indicates how many thousand. increase in average quarterly sales of products (works, services)

companies within the industry, if labor costs and other deductions for social activities increased by one thousand.

In the pre-crisis period, the greatest impact of social spending has been in the financial sector and in the field of metallurgical enterprises in production and manufacture of fabricated metal products. Increase by 1 thousand. social spending led to increased respectively by 5.89 thousand and at 4.58 thousand sales of goods and services.

In the crisis period returns in these areas of social spending increased by 6.84 thousand and to 4.82 thousand. In addition, in 2009-10 it increased significantly impact companies in the production of pulp, paper and paperboard of which (up to 4.17 thous.), the production of machinery and equipment (up to 3.57 thousand) and construction companies (up to 3.44 thous.).

On subjects of managing in above-mentioned spheres it is reasonable to increase «social investments», after all they not only increase sales proceeds amounts, but also increase profitability of production, create positive psychological climate in collectives, to increase motivation of workers to high-quality and productive work.

Absolutely other situation was at the entities on production of paper stock, paper, a cardboard and products from them in the 2007-first half of 2008. The increase in social expenses at 1 thousand uah at that time led to a growth in volumes of sales of products only for 480 uah. The situation at that time at hotels and restaurants (110 uah was even worse. Returns), at the entities on production and distribution of the electric power, gas and water (280 uah), In the informatization sphere (430 uah). Also noticeably the negative effect from growth of expenses on compensation and social actions was observed in activities of the land transport (losses on the average constituted 490 uah. On each additional one thousand expenses), mails and communications (losses - 420 uah), In a chemical industry (370 uah), in healthcare institutions and provisions of the public assistance (330 uah).

Financial crisis peculiar I affected change of the specified indicator. In all mentioned spheres of economic activities he grew, in the majority received value, it is more than unit that specifies a positive effect of social expenses. Low return of social expenses reached value only in publishing and printing activities, replication of the written-down data carriers (coefficient - 0,44) and at the entities on provision of individual services (0,67).

As it was stated above, analyzing level of coefficient b in linear production functions it is possible to determine peculiar «profitability of social expenses». Comparing values of a multiplier to number unit, it is possible to approve with high level of reliability that during the pre-crisis period on the average subjects of managing of Chernovitska region in 16 types of activity had positive this «profitability», i.e. additional expenses on social actions returned to a salary and assignments by a bigger amount of increase of proceeds from sales of goods (works or services). In 22 main types of economic activity social expenses on the average for subjects were unprofitable.

In 2009 - the first half of 2010 «profitable» social expenses were already in 32 areas, «unprofitable» - only in 6 areas.

Let's notice that the concept of «profitability of social expenses» is absolute on correlates with general profitability of the entity or an industry as other expenses aren't considered.

As a whole the situation with efficiency of additional social investments in 2009-10 in comparison with 2007-08 improved in 31 types of economic activity for which adequate linear production functions were constructed, and worsened in 6 types. The greatest positive shift happened as it is described above, at the entities of Bukovina on production of paper stock, paper, a cardboard and products from them (the coefficient of return grew on 3,69), and also on production of machines and the equipment (the coefficient increased on 3,57), on production and distribution of the electric power, gas and water (on 1,87) and at hotels and restaurants (on 1,48).

B coefficient in linear production functions noticeably decreased only at the entities on mining, except fuel and energy (on 0,48), on provision of individual services (on 0,41) and in publishing and printing activities, replication of the written-down data carriers (on 0,38). And, in the first case in both periods return remained positive (coefficient more unit), in the second case - with positive became negative, in the third - was negative (coefficient less unit) and still worsened. Also negative indicator in the pre-crisis period worsened in 2009-10 in the sphere of sanitary services, cleaning of streets and handling of waste (from an indicator 0,9 to 0,83) some more.

Increase of efficiency of return of social expenses in 2009-10 concerning 2007-08 can be explained with several reasons. Financial crisis forced employers to review items of expenditure, including concerning wages policy. Increase of efficiency of these expenses was implemented differently:

- reduction of individual staff reallocation of responsibilities between the part of the remainder, and preserving her wages at pre-crisis level (thus often used in finance and other services sectors);

- transfer of some employees to work part-time - the most common method in the real sector;

- the refusal of bonuses and additional payments - used especially in areas such as education, public administration, health and social assistance.

In any case retrenchment policy of means on the one hand reduced the income of hired employees, with another led to more effective use of a manpower and expenses on their attraction. These changes confirm researches of the modified production functions for the majority of industries of economy of Chernovitska region.

Increase of efficiency of social expenses together with the high level of unemployment (which significantly I suspended a staff turnover because of dismissal of workers at own will) is final, stated affected positively a work gain in productivity. However recently noticeably I grew in the state social tension (including increased outflow of labor power abroad became a rise in prices for

utilities, products and essential goods), for Chernovitska region again characteristic.

If it is possible to state unambiguously increase of level of «profitability» social services in the crisis period in comparison with pre-crisis, it absolutely can't be told concerning other expenses. Analyzing the constructed models, we see that in the majority of types of economic activity model coefficients for material and others (a and c coefficients) decreased. Certainly, it doesn't mean that during financial crisis of the entity don't pay attention of economy of means and reduction and these expenditure items. It means that financial crisis has in Chernovitska region not only signs of manifestations of the main component - credit and financial, but also through a conclusion from real economy cheap credit (and, as a result, and current assets), efficiency of operating activity of subjects of managing decreased. So, the Chernovitska region, as well as all country was bypassed by a financial and economic component of crisis.

The special attention in our analysis needs to be paid to zero value of coefficient b in three linear models of production functions: for the pre-crisis period at the entities on production of machines and for both periods in the car lease sphere; hire of household products and subjects of private consumption. Zero value of a multiplier (in case of formal calculation it could purchase even negative values) means that the result (amount of the implemented goods and services) in these types of economic activity didn't depend on personnel social policy of employers, and was determined by other factors.

Comparison of level of return of social expenses in comparison with coefficients of return of material expenses and other expenses also is interesting. During the pre-crisis period social expenses owe big efficiency, than material costs and than other expenses, in 16 types of economic activity (is more often in same). During the crisis period of such industries already 30.

Besides from the analysis of the modified production functions it is possible to draw certain conclusions on profitability of types of economic activity. As each of multipliers in linear model in case of an indicator of a separate expense category

specifies on how many monetary units the sales amount if to increase these expenses by one monetary unit will increase, general profitability of subjects of a type of activity it is possible with probability to determine comparing the amount of these coefficients to number 3. During the pre-crisis period in 17 types from for what a linear production function, this amount more than three is constructed; there is a general return is positive and types of economic activity can be considered profitable. During crisis quantity of such types of activity increased to 19, and 5 from them with unprofitable became profitable (production of foodstuff, drinks, production of skin, products from skin and other materials, production of paper stock, paper, a cardboard and products from them, production and distribution of the electric power, gas and water, trade in cars and motorcycles, their maintenance and repair), 3 - on the contrary, had profitable operating activities in 2007-08 and became unprofitable during the crisis period (production of other nonmetallic mineral products, production of the electric and optical equipment; retail trade, repair of household products and subjects of private consumption).

Above drawing attention that the linear production functions describe economic processes characterized by constant values of the marginal efficiency of each resource, regardless of scale. That is, the result of the manufacturing process is directly proportional (linear) to each of the spent resources. Besides manufacturing processes described by linear functions with constant elasticity of output, which is always equal to one. This means that such processes by changing all factors of production by 1% output also increases by 1%, and this pattern holds for arbitrary parameters spent resources.

The elasticity of production is the sum of elasticities of each resource. And if linear production functions, this amount is constant (equal to unity), then the multiplicative production function elasticity of each resource value is constant. If we consider the model (1'), it is the value of a , b and c determined by the elasticity of production of material, social and other costs. For example, in a modified degree multiplicative production function b determines the percentage increase volume of

sales of goods (works, services), if the expenditure on wages and on other social areas increase from the current value to 1%.

Comparing the coefficients of determination of the mathematical models, we found that a higher level of adequacy for industries Chernovitska region in the pre-crisis and the crisis periods have linear production functions. Less likely modified multiplicative production functions of the 44 main economic activities have been built to the edge of the pre-crisis period in 37 cases for the crisis period - in 38 cases. However, the multiplicative model explains the relationship between the parameters at a high level (coefficient of determination more than 0.8) in only two periods respectively for 12 and 11 economic activities at a sufficient level (coefficient of determination of 0.67 to 0.8) - respectively for 5 and 7 species in the mediocre level (0.5 to 0.66) - also according to 5 and 7 species. These categories were together 33 economic activities, mainly of the real sector and social services. According to mathematical models for these fields will make further conclusions.

In 83% of these areas coefficient of elasticity of social spending (powers b) increased. Elasticity material costs and other expenses increased by only 32% and 29% activities. This confirms the conclusions drawn from the analysis of linear production functions: the impact of spending aimed at labour or social events during the crisis compared to the pre-crisis grew, from material costs, depreciation, funds directed to the purchase of goods for resale, and other costs - on the contrary, decreased.

Most of the growth elasticity of social spending took place in the following areas: «Manufacture of transport equipment» (at 1.02), «Research and development» (in 0.69), «Sanitary services, scavenging and waste destruction» (0, 63), «Financial intermediation» (0.61), «Education» (for 0.58) and «Manufacture of pulp, paper and paperboard of them» (in 0.55.) And in the business of manufacturing of transport equipment and facilities sector R & D elasticity of social spending in 2009 - the first half of 2010 reached values greater than one - 1.93 and 1.06 respectively. This defines the growing impact of expanding the scale of production in these areas at the expense of social spending. You can recommend

companies and institutions of these species to increase investment in human capital - a positive impact on financial performance.

Also great elasticity of social spending during the crisis was in financial institutions, educational institutions (the study did not participate in public educational institutions) and in production of pulp, paper, paperboard and articles. With an increase of spending 1% of the total sales of goods and services will grow from them respectively 0.77%, 0.68% and 0.6%. In the pre-crisis period most elastic social expenditures were as in production of transport vehicles and equipment (elasticity coefficient - 0.91), and the production of machinery and equipment (0.8) and individual services (0,64). However, two years latter two of these industry decreased the elasticity of goods and services for social spending.

Conclusions. Summarizing the data described in the last two paragraphs, and combining them with previous findings can note the following. Conducting anti-crisis measures in enterprises Chernovitska region prevented the negative impact of the financial crisis on the efficiency of their core business. However, these activities are usually confined to tighten its personnel policy and social spending cuts. The most effective of these measures offset effects of the situation in activities such as «Food, drinks», «Machinery and equipment», «Sale of motor vehicles and motorcycles, maintenance and repairs», «Hotels and restaurants». Three types of even these unpopular measures are not allowed to keep the profits.

Of course the effectiveness of such actions in the region's economy may have only temporary. Later preserve profitability without further internal forces can be associated only with positive changes in market conditions, access to cheap credit.

The most effective measures associated with structural changes, innovations in technology and forms of business organization. However, they do not depend on the mediocrity of entrepreneurial talent and resources to stimulate legislative power.

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