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## PROSPECTS OF DEVELOPMENT OF THE CONDUCTING CHEMICAL ENTERPRISES OF UKRAINE

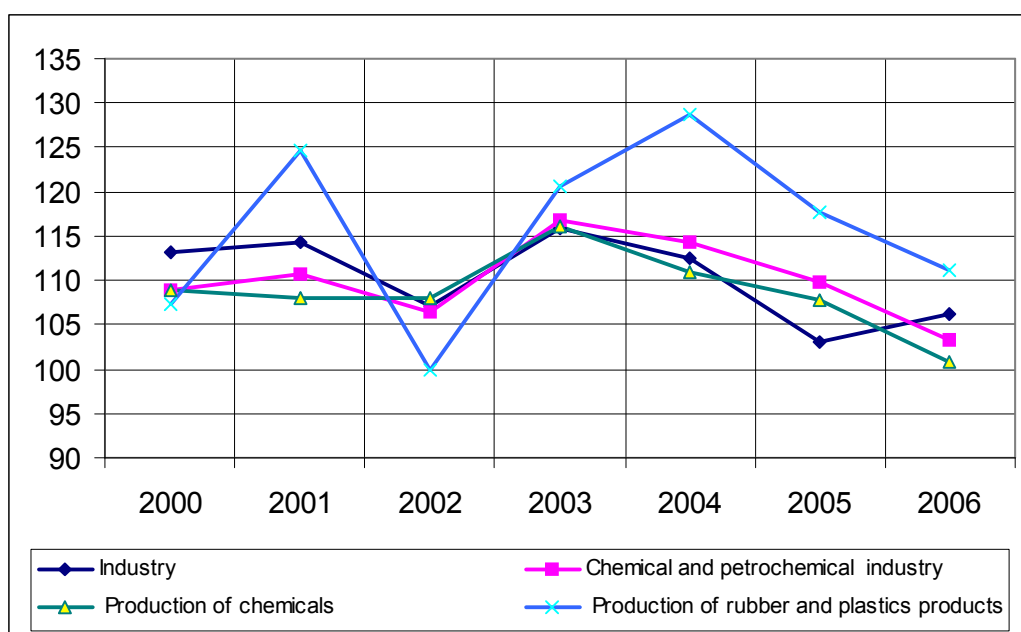
### Introduction

The chemical branch is one of the basic industries of Ukraine and for the last 7 years it has demonstrated fast enough rates of development. Its roles in economy of Ukraine and its dynamic changes are testified by the data submitted in the tables and figures of the annex.

The annual rate for the period 2000—2005 has made more than 11 % for the chemical and petrochemical industry. But in 2006 the growth rate of this branch is

decreased. The dynamics of annual growth rate in the industry and in chemical and petrochemical branches is shown in fig.1.

Production of the chemical and petrochemical industry makes almost 7 % in total amount of manufacture of the industrial goods (see table 1). The demand on the chemical and petrochemical products is high and most of the Ukrainian chemical and petrochemical products were sold (table A.1, Annex A.1).



**Figure 1. Annual growth rate in industry and chemical branch in Ukraine**

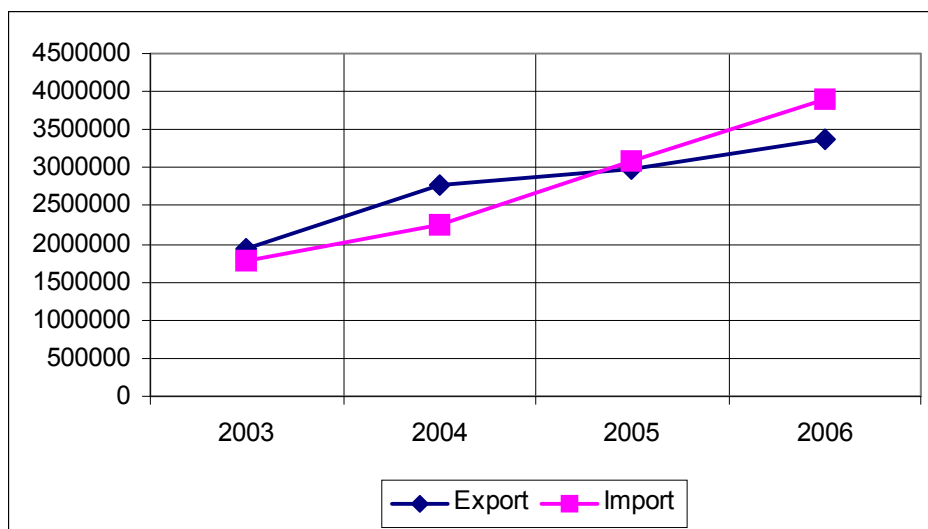
Source: State Statistics Committee of Ukraine

Table 1

**Industrial output of chemical and petrochemical industry (%)**

	2000	2001	2002
All industry	100,0	100,0	100,0
chemical and petrochemical industry	6,7	6,9	6,7
manufacture of chemicals	5,3	5,4	5,2
manufacture of rubber and plastics products	1,4	1,5	1,5

Source: State Statistics Committee of Ukraine



**Figure. Trends of export and import of products of chemical and allied industries in Ukraine (thsd. USD)**  
 Source: State Statistics Committee of Ukraine

Table 2

**Financial results in chemical and petrochemical industry**

Year	Financial result of general activity before taxation	Profitable enterprises		Loss-making enterprises	
		in % to the total	financial result	in % to the total	financial result
2003	945,1	60	1448,9	40	503,8
2004	1354,0	64,4	2378,1	35,6	1024,1
2005	2646,0	72,2	3062,2	27,8	416,2
2006* (January–November)	1257,4	64,9	1745,2	35,1	487,8
2007* (January-February)	138,5	65,1	277,1	34,9	138,6

Source: State Statistics Committee of Ukraine

At the same time the current output of the chemical and petrochemical industry of Ukraine for the present is much less than output of 1990 (table A.2, Annex A.1). For the period 2003—2005 the tendencies of significant growth of export both import of production of chemical and allied industries are observed, that testifies to increase of external economic relations of the Ukrainian chemical enterprises.

At the same time the chemical and petrochemical branch is faced with a lot of risks and unsolved problems:

1). state control and problem of the proprietors expressed in the non-transparent or slow privatization, in increase of the corporate conflicts, inefficient state management;

2). dependence of the branch upon the external markets conjuncture and weak competitiveness of

Ukrainian enterprises, especially in connection with sharp increase of the gas prices;

3). low capitalization of the enterprises and weak financial management;

4). weak uses of innovations and out-of-date fixed capital;

5). low productivity of labour and motivation.

For instance only 60—65% of enterprises in chemical and petrochemical industry are profitable in Ukraine (see table 2). Market conjuncture for Ukrainian enterprise in 2007 was pleasant and the share of profitable enterprises is increased till 72%. But most of big chemical and petrochemical enterprises are stayed under governmental control and their financial plans are coordinated by Ministry of Economy.

Ukraine prepares for joining WTO and further expansion of integration connections with EU. At the same time due to many factors, the industry of the country is focused on a home market or markets of the CIS countries. For western investors the enterprises of chemical industry of Ukraine are not so known so far. Though, according to the experts, a number of the chemical enterprises, controlled to large Ukrainian financial and industrial groups (FIG), will be sold; other enterprises of chemical branch will search for the target investors abroad or go to AIM. In particular, the sale of one of the leading Ukrainian chemical enterprises «DNEPROAZOT», belonging to structure FIG «PRIVAT», one of the most powerful financial and industrial groups, and «AZOT» (Cherkassy), belonging large group «UKRSIB» is expected. Other leading enterprises, such as «CRIMEAN TITAN», were able to attract the large foreign investments from Germany. The concern «STIROL», being the leader of the chemical enterprises and included in listing PFTS (First Securities Trading System in Ukraine), plans IPO in AIM (London) for attraction of the large investments. Taking into account the arising new problems of the Ukrainian chemical enterprises in connection with the opening of a home market and attraction of the foreign investors, it is important to carry out the analysis of the leading Ukrainian chemical enterprises and to introduce prospects of the development.

The purpose of the given research was the study of parameters of activity for 2001—2005 of basic, large enterprises of chemical industry, which were included in national ratings; development of a technique of their internal competitiveness rating and analysis of competitiveness level for some leading enterprises.

#### **The data and methods of research**

In order to study the activity of the major chemical enterprises of Ukraine included in the national branch ratings «100 leading Enterprises of Ukraine» the published data on their net income and profit for the period of 2001—2005 were used. Also we used the information on their balances and financial results given on the site [www.smida.gov.ua](http://www.smida.gov.ua).

For realization of the comparative analysis the basic parameters and factors describing financial and economic activity of the enterprises were calculated on the basis of balance and financial reports. Then these parameters were used for calculations of complex indexes and for internal competitiveness rating of the enterprises.

Features of statistical distribution of the net income and profits values of the leading enterprises of chemical branch and change of some statistical characteristics in dynamics were also investigated; the classes estimating

strategic positions of the enterprises in coordinates «net income» and «profit» are offered.

The parameter of internal competitiveness of the enterprises was calculated on the basis of one of the taxonomy methods offered in the works of V.Plyuta. The algorithm of calculation for this index is given in the application. The idea of construction of this taxonomical index consists in the initial standardization of the data and the calculation of deviations from a certain artificial standard (etalon) constructed on the basis of the best selective values for attributes — stimulants and destimulants. Best for attributes — stimulants will be maximal values, and best for attributes — destimulants will be minimal values. As a measure of a deviation from the etalon the Euclid metrics was chosen and the distances of coordinates of the enterprise to the given attributes from the etalon were determined. If the distance is smaller, the better position of the enterprise in relation to the standard is. As the distance is not absolutely convenient value for comparison, since this value has no top restriction, the rather simple transformation allowing to receive the value of a complex index in limits from 0 up to 1 was used. The greater the distance of the researched object (enterprise) from the etalon, the less value of a complex index, the worse position of the enterprise on the given set of attributes. And on the contrary, the smaller the distance of the researched object (enterprise) from the etalon, the higher value of a complex index, the better position of the enterprise on the given set of attributes.

For the forecast of internal competitiveness index of the enterprises of chemical enterprises regression equation were constructed and the close dependence between internal competitiveness index and expected income of the enterprise is shown.

#### **Results of research**

1. Construction of a matrix of enterprises strategic positions in coordinates of net income and profit.

For the analysis of strategic positions of the leading enterprises of chemical industry of Ukraine such important parameters were used, as the net income of the enterprise and profit. This information may be received in the public reports. Figure A.1 (Annex A.1) shows, that on the whole the enterprises with higher level of the net income had the greater profit, however frequently cases are observed, when the enterprises with rather high level of the net income have received rather small profit, or even had losses. And on the contrary, it is possible to see the cases of the enterprises with rather low, in comparison with others, level of the income and rather high value of the profit. The ratio between the received net income and profit at the majority of the enterprises submitted in the given research was different. It can testify to some

Table 3

## Values of internal competitiveness for some leading chemical enterprises for 2003—2005

Title of enterprise	Internal Competitiveness Index		
	2003	2004	2005
SUMYCHIMPROM	1,7	1,691	1,494
AZOT, Cherkassy	2,187	1,726	1,416
DNEPROPETROVSKY LAKOKRASOCHNY	3,521	3,145	2,662
DNEPROSZINA	2,155	2,295	1,947
TITAN	2,212	2,743	2,685
DNEPROAZOT	2,268	2,029	1,964
ROVNOAZOT	1,491	1,654	1,651
KRYMSKY SODOVY	2,017	2,543	2,487
STIROL	3,51	3,492	3,36
Mean	2,34	2,369	2,185

differences in strategy of enterprises development. The low profit level can be explained not only by adverse market condition for the given enterprise, but also by the fact, that the expenses on manufacture capacities increase were too large. It is interesting to study of the individual diagrams of the enterprises positions in coordinates «net income» and «profit» which demonstrate for some enterprises the presence of the steady tendency of parameters growth, and for other enterprises — unstable tendencies (see fig.A.2-A.3, Annex A.1).

Then the initial statistical analysis of distribution of the net income and profits values in leading chemical enterprises included in national branch ratings was carried out. The results of the analysis of the statistical characteristics samples for 2001—2005 are given in the table A.4 (Annex A.1). On the basis of the analysis of distribution features of the net income and profit the considerable difference of empirical distributions from the normal and the asymmetry are clearly seen. The distinct tendency of increase of the maximal values and estimated sample means for the period 2001—2005 is observed for net income values distribution. At the same time such tendency for profit values distribution is not exhibited. For the analysis of features of net incomes and profit values in dynamics see fig.A.4-A.9, Annex A.1.

For construction of a strategic positions matrix of the chemical enterprises the following annual statistical characteristics for net income and profit were used: (minimal value; lower quartile; median; upper quartile; the maximal value). The classes determining the positions of the enterprises according to the net income and profit values were formed with consideration for statistical distribution properties of the data on the chemical industry enterprises. The rules of classes designation are given in fig.A.10, Annex A.1. The results of the enterprises

classification according to the given classes are shown in the table A.5, Annex A.1.

2. We calculated the taxonomical indexes for some selected leading enterprises and called the complex indexes as internal competitiveness level for these enterprises. The index of internal competitiveness was calculated as sum for taxonomical indexes according the following groups of factors:

2.1. Productivity of labour and motivation (net income per 1 worker; average month wages per one worker; expenditures for social help and motivation per 1 worker);

2.2. Property status of the enterprise (fixed capital depreciation rate; share of long-term financial investments in assets; share of turnover assets)

2.3. Business activity (fixed assets productivity; assets turnover; turnover of current assets; turnover of production; turnover of equity)

2.4. Profitability (profitability of the equity; profitability of the sold production)

2.5. Financial stability (manoeuvrability of own current means; financial independence or coefficient of autonomy; financial stability)

2.6. Liquidity (current ratio; quick liquidity; absolute liquidity ratio).

The taxonomic indexes were calculated for each group of parameters. The algorithm of taxonomical indexes calculation is given in Annex A.2. The results of calculated taxonomical indexes characterized the productivity of labour and motivation, property status, business activity, profitability, financial stability and liquidity of the chemical enterprises are given in table A.6-A.8, Annex A.3.

Then the index of internal competitiveness of the enterprise was determined as the sum of complex

parameters values describing such components, as productivity of work and motivation; a property status of the enterprise; business activity; profitability; financial stability; liquidity.

The results of internal competitiveness indexes of selected leading chemical enterprises are given in table 3.

As it is seen from the data given in the table 3, the best values of internal competitiveness index are observed at such enterprises, as: STIROL, TITAN, DNEPROPETROVSKY LAKOKRASOCHNY.

3. The close connection between the calculated internal competitiveness index and the received income is observed.

As the dependent variable the ratio between the enterprise net income and maximum net income for each year sample was used.

It's to allow problems of scales for dependent and independent variables. Besides due to this regression equation we estimated the approximate future level of internal competitiveness of certain enterprise using the forecasting data of possible leader-enterprise in sample. So by predicting values of the net income of the given enterprise and enterprise-leader it is possible to determine a level of competitiveness.

The values for dependent variable (net income and profit ratio) are calculated in table A.9 (Annex 3). The results for regression estimations and coefficient of correlation are given in table A.10 (Annex 3).

The regression model is shown below:

$$INC\_RAT_t = 0,1469 \cdot ICI_t + \varepsilon_t,$$

where  $INC\_RAT_t$  — is the value of ratio between net income of certain enterprise and maximum net income in sample for period  $t$ ;  $ICI_t$  — is the value of internal competitiveness index for period  $t$ ,  $\varepsilon_t$  — is *i.i.d.* The correlation coefficient for this model is 0.8.

The result for dependency between profit ratio and  $ICI_t$  is not so good, but also convenient (see table A.11).

For forecasting estimation of competitiveness level it is also possible to use regression equation, where the factor variables represent relations of individual values of the enterprise specified attributes to forecasting values of etalon. It means that the forecasting value of a set of enterprise attribute for each equation and forecasting attributes for etalon corresponding to the enterprise — leader it is possible to receive competitiveness level for each component.

In this way we can construct the regression equations for forecasting of separated values of internal competitiveness index components.

As values for independent variables in these regressions we calculate the ratio between individual

values for set attributes and values for etalon. So using the determined ratio for set attributes and calculated earlier values for each component of internal competitiveness index (tables A.6-A.8, Annex 3) we estimated the following dependencies:

1. Equation for forecast of first *ICI* component (labour productivity and motivation)

$$I_{1t} = -0,246 + 0,337 \cdot x_{1\_1t}^* + 0,415 \cdot x_{1\_2t}^* + 0,459 \cdot x_{1\_3t}^*$$

where  $x_{1\_1t}^*$  — is ratio for net income per 1 worker;  $x_{1\_2t}^*$  — is ratio for average month wages per one worker;  $x_{1\_3t}^*$  — is ratio for expenditures for social help and motivation per 1 worker).

2. Equation for forecast of second *ICI* component (property status)

$$I_{2t} = -0,097 + 0,258 \cdot x_{2\_1t}^* + 0,247 \cdot x_{2\_2t}^* + 0,386 \cdot x_{2\_3t}^*$$

where  $x_{2\_1t}^*$  — is ratio for fixed capital depreciation rate;  $x_{2\_2t}^*$  is ratio for share of long-term financial investments in assets;  $x_{2\_3t}^*$  is ratio for share of turnover assets.

3. Equation for forecast of third *ICI* component (business activity)

$$I_{3t} = -0,220 + 0,152 \cdot x_{3\_1t}^* + 0,220 \cdot x_{3\_2t}^* +$$

$$+ 0,268 \cdot x_{3\_3t}^* + 0,091 \cdot x_{3\_4t}^* + 0,223 \cdot x_{3\_5t}^*$$

where  $x_{3\_1t}^*$  is ratio for fixed assets productivity;  $x_{3\_2t}^*$  is ratio for assets turnover;  $x_{3\_3t}^*$  is ratio for turnover of current assets;  $x_{3\_4t}^*$  is ratio for turnover of production;  $x_{3\_5t}^*$  is ratio for turnover of equity.

4. Equation for forecast of fourth *ICI* component (profitability)

$$I_{4t} = 0,270 + 0,430 \cdot x_{4\_1t}^* + 0,287 \cdot x_{4\_2t}^*$$

where  $x_{4\_1t}^*$  is ratio for profitability of the equity;  $x_{4\_2t}^*$  is ratio for profitability of the sold production.

5. Equation for forecast of fifth *ICI* component (financial stability)

$$I_{5t} = -0,011 + 0,188 \cdot x_{5\_1t}^* + 0,316 \cdot x_{5\_2t}^* + 0,259 \cdot x_{5\_3t}^*$$

where  $x_{5\_1t}^*$  is ratio for manoeuvrability of own current means;  $x_{5\_2t}^*$  is ratio for financial independence;  $x_{5\_3t}^*$  is ratio for financial stability.

5. Equation for forecast of sixth *ICI* component (liquidity)

$$I_{6t} = 0,291 + 0,353 \cdot x_{6\_1t}^* + 0,005 \cdot x_{6\_2t}^* + 0,311 \cdot x_{6\_3t}^*$$

where  $x_{6\_1t}^*$  is ratio for current ratio;  $x_{6\_2t}^*$  is ratio for quick liquidity;  $x_{6\_3t}^*$  is ratio for absolute liquidity ratio.

So we can determine the approximate internal competitiveness index using the forecasts from equations 1—6. It's more simple and fast way into comparison of the difficulties of many calculations according the algorithm in Annex A.2.

**Conclusions:**

The development of chemical industry of Ukraine, as well as other branches, is occurring in conditions of unstable dynamic environment and severe competition on external and home markets. Difficult transformation period, accompanied by structural reorganization of economic territorial and inter-branch connections and introduction of new principles of managing, has made many leading enterprises of chemical industry of Ukraine face the problem of survival and introduce new methods of management in order to be effective in conditions of the competition. Hence for many enterprises of chemical branch arose an urgent problem of introduction of strategic management allowing to carry out the complex analysis of the enterprise positions in the market, estimation of its competitiveness potential in the given conditions and to choose the most acceptable strategy for purposes achievement.

The results of the given research can be used for comparison of leading enterprises of chemical branch of

Ukraine as for their level of internal competitiveness and attraction of the foreign investors.

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## Annex A.1

Table A.1.

## Volume of industrial products (operations and services) sold in 2001—2005

(at current prices of the relevant year)

	2001		2002		2003		2004		2005	
	mln. UAH	% of the total	mln. UAH	% of the total	mln. UAH	% of the total	mln. UAH	% of the total	mln. UAH	% of the total
Industry	210842,7	100	229634,4	100	289117,3	100	400757,1	100	468562,6	100
Chemical and petrochemical industry	12598,9	6,0	13297,6	5,8	18519,7	6,4	24948,7	6,2	30161,6	6,4
Production of chemicals	9782,4	4,7	10061,8	4,4	14433,6	5,0	18909,9	4,7	22045,3	4,7
Production of rubber and plastics products	2816,5	1,3	3235,8	1,4	4086,1	1,4	6038,8	1,5	8116,3	1,7

Source: State Statistics Committee of Ukraine

Table A.2.

## Output of major products in chemical and petrochemical industry

	1990	1995	1999	2000	2001	2002
Mineral fertilizers (on 100 nutrient base), mln. t	4,8	2,2	2,3	2,3	2,2	2,3
Plant protection chemicals (on 100% active agent base), thsd. pcs	50,5	4,1	1,8	1,1	2,7	1,9
Sulphuric acid (monohydrate), mln. t	5	1,6	1,4	1	1	0,9
Caustic soda, thsd. pcs	445	213	99,4	134	134	133
Soda ash, mln. t	1,1	0,5	0,5	0,6	0,7	0,7
Synthetic tar and plastic, thsd. t	827	178	119	152	231	276
Chemical fibre and thread, thsd. t	179	41,3	22,8	30,3	26,5	25,3
Tyres, mln. pcs	11,2	5,8	7,9	6,8	7,2	6,6
Synthetic detergents, thsd. t	301	76,4	62,6	68,2	91,1	117

Source: State Statistics Committee of Ukraine





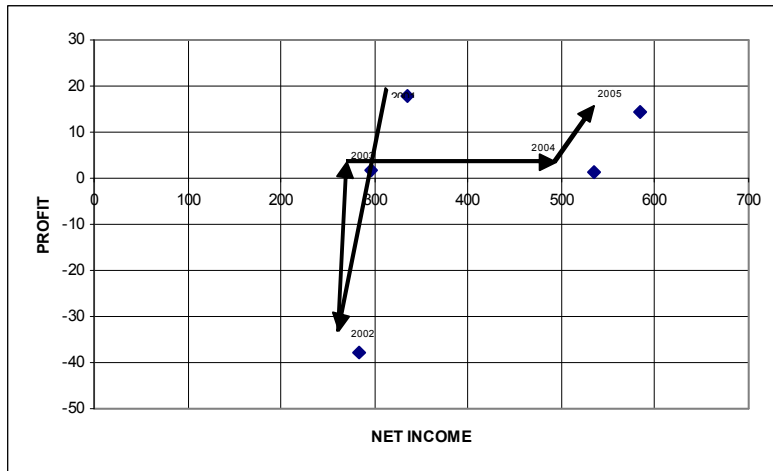


Figure A.2. Trajectory of dynamics net income and profit for enterprise SUMYCHIMPROM

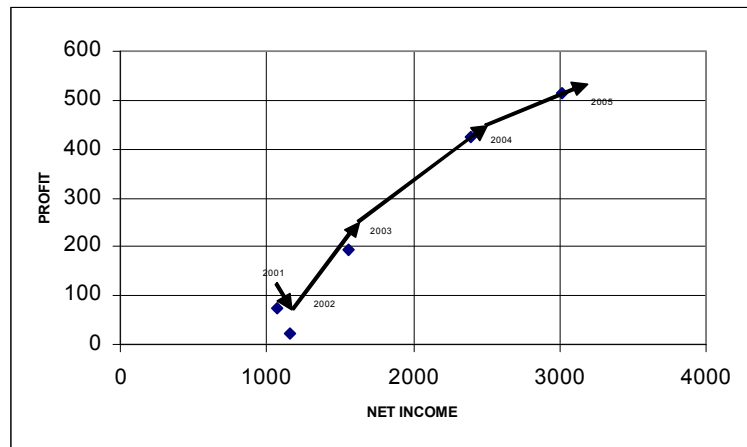
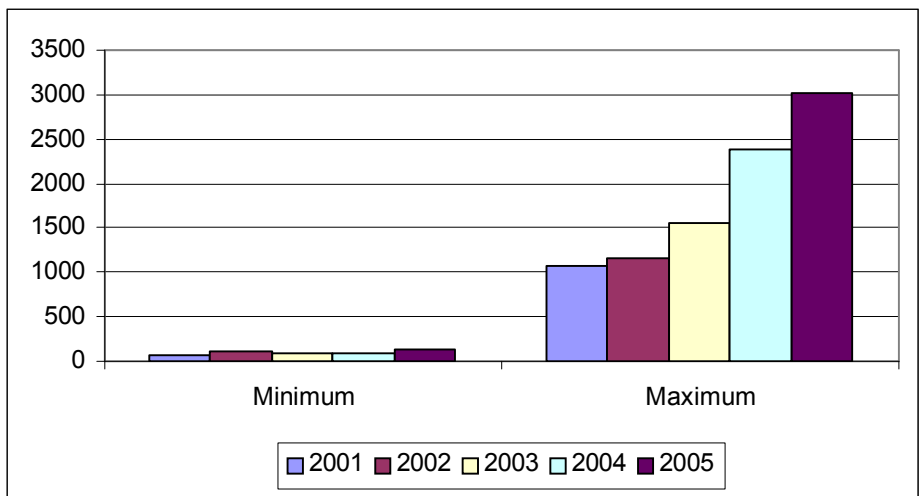


Figure A.3. Trajectory of dynamics net income and profit for enterprise STIROL

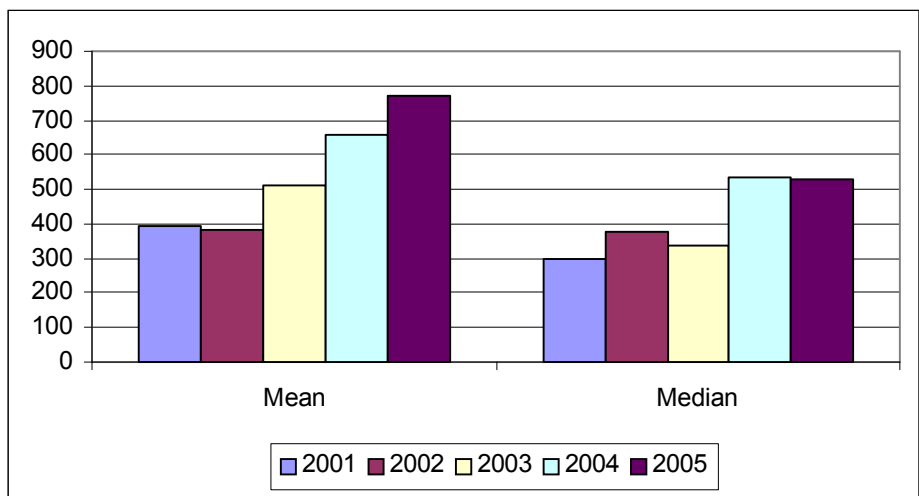
Table A.4

Descriptive Statistics for Chemical Enterprises Samples

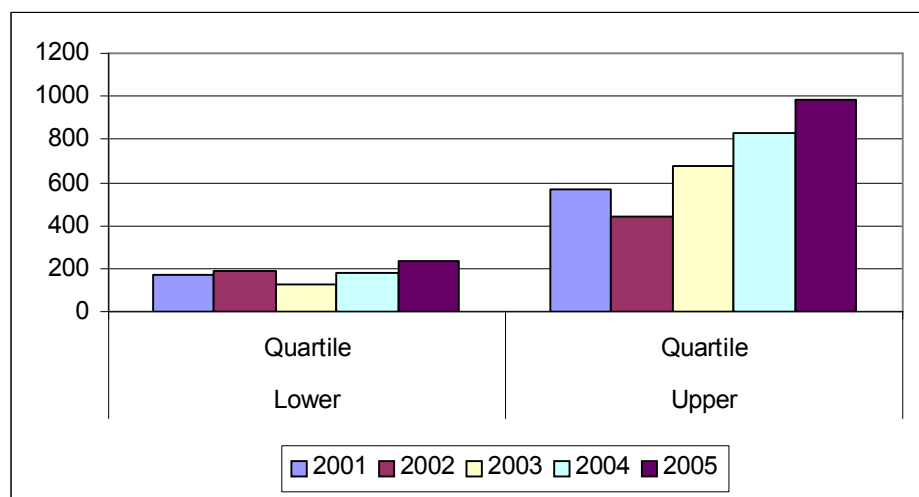
Year	Name of index	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Variance
2001	NET INCOME	392,0759	299,054	69,092	1072,263	172,344	571,891	79685,28
	PROFIT	5,314895	7,983	-87,001	75,724	-15,412	28,813	1153,066
2002	NET INCOME	383,8595	376,564	110,137	1164,491	190,954	445,078	67105,14
	PROFIT	-7,80132	0,551	-128,522	28,411	-7,697	11,51	1473,733
2003	NET INCOME	512,9984	337,6965	80,402	1553,297	123,705	675,368	215018,6
	PROFIT	28,47578	2,8135	-53,968	195,154	0,915	10,53	5047,343
2004	NET INCOME	660,4684	534	93,7	2387,4	178	830,7	376861,8
	PROFIT	43,18316	6,47	-382,47	423,36	-1,01	56,46	24775,09
2005	NET INCOME	530,29	137,56	3009,95	237,29	983,9	552168,6	530,29
	PROFIT	11,135	-51,47	513,13	-3,35	71,985	23044,07	11,135



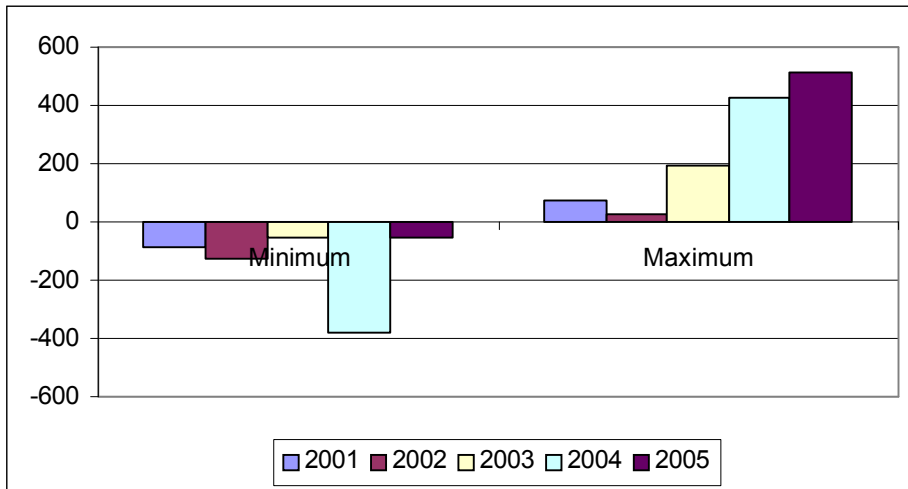
**Figure A.4. Dynamics of minimum and maximum values of net income for Ukrainian leading chemical enterprises sample**



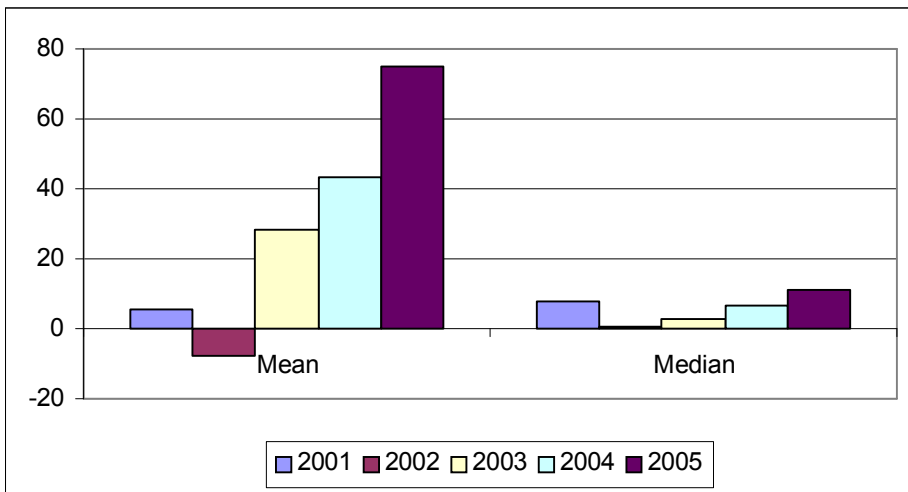
**Figure A.5. Dynamics of mean and median values of net income for Ukrainian leading chemical enterprises sample**



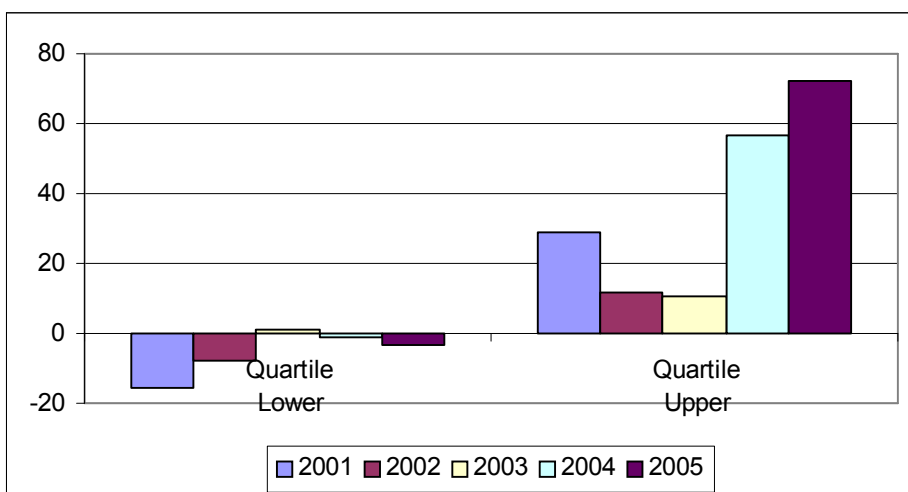
**Figure A.6. Dynamics of lower and upper quartiles of net income for Ukrainian leading chemical enterprises sample**



**Figure A.7. Dynamics of minimum and maximum values of profit for Ukrainian leading chemical enterprises sample**



**Figure A.8. Dynamics of mean and median values of profit for Ukrainian leading chemical enterprises sample**



**Figure A.9. Dynamics of lower and upper quartiles values of profit for Ukrainian leading chemical enterprises sample**

Max. of profit	<b>bA</b>	<b>BA</b>	<b>aA</b>	<b>AA</b>
Upper quartile	<b>ba</b>	<b>Ba</b>	<b>aa</b>	<b>Aa</b>
Median of profit	<b>bB</b>	<b>BB</b>	<b>aB</b>	<b>AB</b>
Lower quartile	<b>bb</b>	<b>Bb</b>	<b>ab</b>	<b>Ab</b>
Min. of profit				
	Min. of net income	Lower quartile	Median of net income	Upper quartile
				Max. of net income

**Figure A.10. The matrix of strategy position in coordinates net income and profit**

*Table A.5.*

**Results of strategy position classification for Ukrainian leading chemical enterprises**

Name of enterprise	Code	2001	2002	2003	2004	2005
STIROL	KST	<b>AA</b>	<b>AA</b>	<b>AA</b>	<b>AA</b>	<b>AA</b>
AZOT, Cherkassy	ACH	<b>AB</b>	<b>Aa</b>	<b>AB</b>	<b>AB</b>	<b>Aa</b>
ODESSKY PRIPORTOVY	OPZ	<b>AA</b>	<b>AB</b>	<b>AA</b>	<b>AA</b>	<b>AA</b>
AZOT, Severodonetsk	ASD	<b>aA</b>	<b>AA</b>	<b>AA</b>	<b>AA</b>	<b>AA</b>
AMTEL-UKRAINA	AMU	<b>AB</b>	<b>Aa</b>	N.A.	N.A.	N.A.
ROSAVA	ROS	<b>AB</b>	<b>ab</b>	<b>aa</b>	<b>ab</b>	<b>Ab</b>
DNEPROAZOT	DNA	<b>ab</b>	<b>ab</b>	<b>AA</b>	<b>AA</b>	<b>aA</b>
LUKOR	LUK	<b>Bb</b>	<b>aB</b>	<b>ab</b>	<b>ab</b>	<b>BB</b>
DNEPROSZINA	DNS	<b>aA</b>	<b>aB</b>	<b>aB</b>	<b>aa</b>	<b>aB</b>
DZERELO	DZH	<b>BB</b>	<b>aA</b>	N.A.	N.A.	N.A.
SUMYCHIMPROM	SUM	<b>aa</b>	<b>Bb</b>	<b>BB</b>	<b>aB</b>	<b>aa</b>
ROVNOAZOT	ROV	<b>Bb</b>	<b>Bb</b>	<b>Bb</b>	<b>Ba</b>	<b>aa</b>
KRYMSKY SODOVY	KSZ	<b>Ba</b>	<b>Ba</b>	<b>Ba</b>	<b>BA</b>	<b>Ba</b>
TITAN	TIT	<b>aA</b>	<b>Ba</b>	<b>aA</b>	<b>aa</b>	<b>aA</b>
RUBEZHANSKY CHEMICAL PLANT "ZORYA"	RUB	<b>Ba</b>	<b>BB</b>	<b>BB</b>	<b>BB</b>	<b>BB</b>
CHERKASSKOYE CHIMVOLOKNO	CHKH	<b>bb</b>	<b>bB</b>	<b>Bb</b>	<b>bb</b>	<b>bb</b>
ZIP	ZIP	<b>bB</b>	<b>bA</b>	N.A.	N.A.	N.A.
DNEPROPETROVSKY LAKOKRASOCHNY	DNLK	<b>ba</b>	<b>ba</b>	<b>ba</b>	<b>ba</b>	<b>bB</b>
JOHNSON	CKJ	<b>ba</b>	<b>bA</b>	N.A.	N.A.	N.A.
CHERNIGOVSKOYE CHIMVOLOKNO	CHNH	N.A.	N.A.	<b>bb</b>	<b>Bb</b>	<b>BB</b>
KREMENCHUGSKY PLANT	KRM	N.A.	N.A.	<b>ba</b>	<b>bB</b>	<b>bb</b>
KREMNIY POLIMER	KRP	N.A.	N.A.	<b>bB</b>	<b>bB</b>	N.A.
NPO "INKOR"	NPO	N.A.	N.A.	N.A.	<b>Ba</b>	<b>ba</b>
CARPATNEFTECHIM	KRP	N.A.	N.A.	N.A.	N.A.	<b>Bb</b>
LISICHANSKAYA SODA	LIS	N.A.	N.A.	N.A.	N.A.	<b>bb</b>

N.A. — data is not available, because this enterprise was not included in national branch rating

Appendix A.2

**Annex A.2.**

Algorithm for complex index calculation

1. Description of initial values for matrix X

$$X = (x_{ij}), i = \overline{1, n}; j = \overline{1, k}$$

i — number of object

j — number of attribute

 $x_{ij}$  — value of j attribute for i object

2. Procedure of standardization

$$\tilde{x}_{ij} = \frac{x_{ij} - \bar{x}_j}{s_j}, \text{ where}$$

$\tilde{x}_{ij}$  — standardized values for  $x_{ij}$ ,  $\bar{x}_j$  — mean for j attribute,  $s_j$  — standard deviation for j attribute

3. Construction of artificial etalon

$$x_j^e = \max_i \tilde{x}_{ij} \text{ for attribute — stimulant}$$

$$x_j^e = \min_i \tilde{x}_{ij} \text{ for attribute — non-stimulant}$$

(destimulant)

4. Calculation of Euclid distances for i object

$$d_i = \sqrt{\sum_{j=1}^k \left( \tilde{x}_{ij} - x_j^e \right)^2}$$

5. Definition of value for taxonomic complex index

$$I_i = 1 - \frac{d_i}{\bar{d} + 2 \cdot s_d},$$

where  $\bar{d}$  — mean for distances,  $s_d$  — its standard deviation.

**Annex A.3.**

Table A.6

**Components of internal competitiveness for some leading chemical enterprises in 2003**

Title of enterprise	Productivity of labour and motivation	Property status	Business activity	Profitability	Financial stability	Liquidity
	$I_1$	$I_2$	$I_3$	$I_4$	$I_5$	$I_6$
SUMYCHIMPROM	0,248	0,348	0,22	0,317	0,241	0,326
AZOT, Cherkassy	0,655	0,22	0,579	0,327	0,059	0,347
DNEPROPETROVSKY LAKOKRASOCHNY	0,533	0,563	0,294	0,559	0,572	1
DNEPROSZINA	0,393	0,378	0,476	0,342	0,236	0,33
TITAN	0,268	0,563	0,233	0,419	0,351	0,378
DNEPROAZOT	0,488	0,103	0,113	0,8	0,386	0,378
ROVNOAZOT	0,249	0,194	0,134	0,317	0,261	0,336
KRYMSKY SODOVY	0,501	0,289	0,348	0,367	0,174	0,338
STIROL	1	0,226	0,394	1	0,412	0,478
Mean	0,482	0,32	0,31	0,494	0,299	0,435

Table A.7

**Components of internal competitiveness for some leading chemical enterprises in 2004**

Title of enterprise	Productivity of labour and motivation	Property status	Business activity	Profitability	Financial stability	Liquidity
	$I_1$	$I_2$	$I_3$	$I_4$	$I_5$	$I_6$
SUMYCHIMPROM	0,196	0,312	0,365	0,243	0,252	0,323
AZOT, Cherkassy	0,541	0,151	0,351	0,261	0,091	0,331
DNEPROPETROVSKY LAKOKRASOCHNY	0,412	0,4	0,308	0,391	0,634	1
DNEPROSZINA	0,284	0,303	0,67	0,469	0,234	0,335
TITAN	0,459	0,595	0,527	0,314	0,49	0,358
DNEPROAZOT	0,465	0,14	0,06	0,548	0,323	0,493
ROVNOAZOT	0,307	0,241	0,17	0,417	0,195	0,324
KRYMSKY SODOVY	0,488	0,26	0,37	0,695	0,392	0,338
STIROL	1	0,175	0,379	1	0,499	0,439
Mean	0,461	0,286	0,356	0,482	0,346	0,438

Table A.8

**Components of internal competitiveness for some leading chemical enterprises in 2005**

Title of enterprise	Productivity of labour and motivation	Property status	Business activity	Profitability	Financial stability	Liquidity
	$I_1$	$I_2$	$I_3$	$I_4$	$I_5$	$I_6$
SUMYCHIMPROM	0,097	0,339	0,262	0,333	0,204	0,259
AZOT, Cherkassy	0,373	0,077	0,245	0,246	0,225	0,25
DNEPROPETROVSKY LAKOKRASOCHNY	0,337	0,498	0,226	0,306	0,524	0,771
DNEPROSZINA	0,196	0,471	0,6	0,307	0,115	0,258
TITAN	0,41	0,666	0,255	0,511	0,439	0,404
DNEPROAZOT	0,382	0,123	0,058	0,648	0,304	0,449
ROVNOAZOT	0,214	0,364	0,343	0,394	0,099	0,237
KRYMSKY SODOVY	0,31	0,376	0,366	0,686	0,434	0,315
STIROL	0,686	0,343	0,251	1	0,377	0,703
Mean	0,334	0,362	0,29	0,492	0,302	0,405

Table A.9

**The values for regression between net income ratio (profit ratio) and internal competitiveness indexes**

Title of enterprise	2003		2004		2005	
	Net income ratio	Profit ratio	Net income ratio	Profit ratio	Net income ratio	Profit ratio
SUMYCHIMPROM	0,191	0,009	0,224	0,003	0,194	0,028
AZOT, Cherkassy	0,799	0,005	0,521	0,015	0,455	0,053
DNEPROPETROVSKY LAKOKRASOCHNY	0,079	0,035	0,055	0,015	0,046	0,005
DNEPROSZINA	0,315	0,005	0,258	0,073	0,236	0,015
TITAN	0,163	0,017	0,157	0,133	0,158	0,126
DNEPROAZOT	0,435	0,454	0,348	0,25	0,317	0,296
ROVNOAZOT	0,203	-0,189	0,218	0,066	0,195	0,044
KRYMSKY SODOVY	0,163	0,017	0,157	0,133	0,158	0,126
STIROL	1	1	1	1	1	1

Table A.10

**Results of regression for net income and internal competitiveness index**

Regression Summary for Dependent Variable: INC_RAT						
R= ,80150231 RI= ,64240595 Adjusted RI= ,62865233						
F(1,26)=46,708 p<,00000 Std.Error of estimate: ,26649						
		St. Err.		St. Err.		
	BETA	of BETA	B	of B	t(26)	p-level
ICI	0,801502	0,117276	0,146869	0,02149	6,834336	2,97E-07

Table A.11

**Results of regression for profit and internal competitiveness index**

Regression Summary for Dependent Variable: PR_RAT						
R= ,62142817 RI= ,38617297 Adjusted RI= ,36256424						
F(1,26)=16,357 p<,00042 Std.Error of estimate: ,28651						
		St. Err.		St. Err.		
	BETA	of BETA	B	of B	t(26)	p-level
ICI	0,621428	0,153651	0,093442	0,023104	4,044405	0,000416

Table A.12

**Results of regression for first ICI component**

Regression Summary for Dependent Variable: I_1						
R= ,98843919 RI= ,97701202 Adjusted RI= ,97401359						
F(3,23)=325,84 p<,00000 Std.Error of estimate: ,03504						
		St. Err.		St. Err.		
	BETA	of BETA	B	of B	t(23)	p-level
Intcpt			0,246413674	0,043459	-5,67006	8,99E-06
X1_1	0,447486372	0,04580478	0,337415449	0,034538	9,769425	1,18E-09
X1_2	0,283182515	0,051217099	0,41542177	0,075134	5,529062	1,27E-05
X1_3	0,416040776	0,041299066	0,459765939	0,04564	10,07385	6,65E-10

Table A.13

**Results of regression for second ICI component**

Regression Summary for Dependent Variable: I2						
R= ,88435555 RI= ,78208473 Adjusted RI= ,75366100						
F(3,23)=27,515 p<,00000 Std.Error of estimate: ,07890						
		St. Err.		St. Err.		
	BETA	of BETA	B	of B	t(23)	p-level
Intcpt			-0,097564408	0,059534	-1,63881	0,114861
X2_1	0,363345433	0,10376728	0,258405288	0,073798	3,501541	0,001921
X2_2	0,558604839	0,105019363	0,247316717	0,046496	5,319065	2,12E-05
X2_3	0,674581755	0,100428064	0,386014772	0,057468	6,717064	7,49E-07

Table A.14

**Results of regression for third ICI component**

Regression Summary for Dependent Variable: I3						
R= ,95752699 RI= ,91685794 Adjusted RI= ,89706221						
F(5,21)=46,316 p<,00000 Std.Error of estimate: ,05012						
	BETA	St. Err. of BETA	B	St. Err. of B	t(21)	p-level
Intercpt			-0,22014	0,040036	-5,49855	1,87E-05
X3_1	0,272180186	0,113616	0,152088	0,063486	2,395618	0,02599
X3_2	0,273333834	0,151973	0,220399	0,122541	1,798569	0,086478
X3_3	0,444138111	0,118088	0,268246	0,071321	3,761088	0,001149
X3_4	0,180324225	0,086508	0,091978	0,044125	2,084486	0,049512
X3_5	0,366376946	0,082903	0,223358	0,050541	4,41935	0,000238

Table A.15

**Results of regression for fourth ICI component**

Regression Summary for Dependent Variable: I4						
R= ,99207477 RI= ,98421235 Adjusted RI= ,98289671						
F(2,24)=748,09 p<,00000 Std.Error of estimate: ,03077						
	BETA	St. Err. of BETA	B	St. Err. of B	t(24)	p-level
Intercpt			0,270503	0,008213	32,9374	1,72E-21
X4_1	0,57292094	0,08629	0,430088	0,064777	6,639518	7,23E-07
X4_2	0,430322279	0,08629	0,28781	0,057713	4,986958	4,3E-05

Table A.16

**Results of regression for fifth ICI component**

Regression Summary for Dependent Variable: I5						
R= ,96039993 RI= ,92236803 Adjusted RI= ,91224212						
F(3,23)=91,090 p<,00000 Std.Error of estimate: ,04550						
	BETA	St. Err. of BETA	B	St. Err. of B	t(23)	p-level
Intercpt			-0,0115	0,035196	-0,32687	0,746719
X5_1	0,440754348	0,059188	0,188928	0,025371	7,446687	1,43E-07
X5_2	0,422626022	0,068062	0,316091	0,050905	6,209471	2,46E-06
X5_3	0,513911157	0,067045	0,259784	0,033892	7,665172	8,86E-08

Table A.17

**Results of regression for sixth ICI component**

Regression Summary for Dependent Variable: I6						
R= ,97142665 RI= ,94366974 Adjusted RI= ,93632231						
F(3,23)=128,44 p<,00000 Std.Error of estimate: ,05178						
	BETA	St. Err. of BETA	B	St. Err. of B	t(23)	p-level
Intercpt			0,291896	0,013966	20,90032	1,85E-16
X6_1	0,515256318	0,12529	0,353229	0,085891	4,112522	0,000425
X6_2	0,009469332	0,114613	0,005529	0,066918	0,08262	0,934869
X6_3	0,492789321	0,089153	0,311941	0,056435	5,527465	1,27E-05