Composite indicator ECAICI and positioning of Georgia's innovative capacities in Europe-Central Asia Region

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Abstract

ECAICI indicator introduced in the present article enables to analyze innovative capacities dynamics of the ECA region (by The World Bank classification) countries in 1996-2010. Thorough research reveals four leading unobservable factors, affecting innovative processes in ECA region. These factors may be referred as Knowledge creation, Economy sophistication, Knowlege Absorption-Diffusion, Human Capital Production. We show that there is a close link between ECAICI indicator and other well-known innovation indicators and show also that there is a close link between ECAICI indicator and GDP per capita. Indicator ECAICI may be applied as an instrument for innovative capacities assessment and analysis. Presented brief analysis of current innovative capacities of Georgia, carried out by means of this indicator serves as illustration of the fact. ECAICI indicator may prove to be useful and interesting also for other post-USSR countries.

Key words:
JEL Classification: ***C43, C81, O18, O3***

1.Introduction

In the present-day economical literature innovations are regarded to be a leading factor of economical development and increaseof competitive ability (e.g. see. Klenow & Rodriguez-Clare, 1997). Due to the current working definition: *"An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations"* (see OECD, EUROSTAT, 2005, p.46). Hence, innovative capacities of the countries should depend upon various factors: human capital, research activity, infrastructure, business environment,foreign economic relations, etc. Consequently, measurement of innovative capacities of certain country needs to work out special instruments, which consider complicated and multidimensional nature of innovative processes and adequatly reproduce them. At a present, this kind of special instruments appear to be composite indicators.

In recent times by common efforts of various organizations and researchers had been gathered impressive experiencein the scope of working out composite indicators[1]. Composite indicators, elaborated by EU with a view of assessment of progress achieved within Lisbon strategy is a striking example of their practical use (see for example: European Commission, 2008, European Commission, 2007).

Based on the composite indicators elaboration experience, we come to conclusion that within existing theoretical and methodological framework (see (Nardo at al, 2005)), troubles, connected with availability of high quality initial statistical data are the main obstacle in the process of

[1] see for example http://composite-indicators.jrc.ec.europa.eu

working out certain composite indicators. It should be noted as well that restricted availability of statistical data leads to the methodological difficulties, particularly in the cases, when it is necessary to compare countries on the different level of development (Archibugi & Coco, 2005).

Statistical data unavailability is a daunting problem especially for developing countries (see Tijssen, R., & Hollanders, H. 2006; Bhutto, Rashdi, & Abro, 2012). At the same time, these are the right ones which need composite indicators, reflecting their innovative capacities, in order to make it possible to compare developed and developing countries. Such kind of indicators enable developing countries to position their innovative capacities, devise measures, aimed to bridge a gap with developed countries and monitor own progress.

In this century we observe increasing interest to the problem of introducing composite indicators, reflecting their innovative capacities of the countries with developing and transitional economies. Thus, in Archibugi & Coco, 2004;Chen & Dahlman, 2005;UNIDO, 2005; UNCTAD, 2005; WEF, 2009; INSEAD, 2011; offered meybe themost known and widely applicable composite indicators, reflecting innovative capacities of the countries with developing and transitional economies (for comparative analysis of various indicators see (Archibugi & Coco, 2005; Archibugi, Denni, & Filippetti, 2009)). Above mentioned indicators are entirely "global" and unfortunately, usually represented by short time sequences. At the same time developing countries need also to position their innovative capacities within their regional space (or, in other words - historically and politically determined "neighborhood") for quite long time interval. Particularly, Georgia based on her post-USSR experience and due to strong European ambitions utterly needs to analyze the way of her development into Europe-Central Asia region. Georgia is also a useful case study because of its small scale developing economy presents special challenges for employing composite indicators. In the present article we shall design special composite indicator ECAICI and with its help give a brief analysis of Georgia's innovative capacities evolution.

Article is arranged as follows: next paragraph includes methodological issues, constructing of ECAICI composite indicator, results of comparison with other indicators and links with GDPpc. The third paragraph gives current assessment of Georgia's innovative capacities, carried out by means of ECAICI indicator and there are some conclusions at the end of the article.

2. Methodology and Data Processing

2.1. Initial Indicators

Initial indicators were selected in consideration of ECAICI indicator based on the experience of designing similar composite indicators. In addition to that, we carried out diversified tests by the

different time intervals and countries in order to trace initial data representativeness and cross-correlation level (see next clause). Following this procedure 17 initial indicators were chosen. Brief review of these indicators is given below (detailed definitions see in the Annex A1.).

In order to describe functioning of educational system we use following indicators:

LFT – Labor force with tertiary education (%);

GTA– Total graduates in all programmes tertiary per 100 inhabitants;

PSE – Public expenditure on education (share in GDP, %);

TST – Teaching staff in total tertiary per 1 million inhabitants;

In order to describe functioning of research and development (R&D) system we use following indicators:

RRD – number of researchers per 1 million inhabitants;

RDE – Expenditures for research and development (% of GDP);

STA – number of articles in scientific and technical jornals per 1 million inhabitants;

PAT – number of patent applications per 1 million inhabitants;

TRM - number of trademark applications per 1 million inhabitants;

HTE – high-tech export (% of GDP;

In order to describe economical environment we use following indicators:

DCP – volume of domestic credit for private sector (% of GDP);

MCP–market capitalization (% of GDP);

EPC- Electric power consumption (kWh per capita)

IUS - number of internet users per 100 inhabitants;

DIO–openness by foreign direct investments(% of GDP;

SSO - openness by special services (% of GDP);

FIO - openness by factor incomes (% of GDP);

2.2. Data

We used pablyc accessible data bases of World Bank to obtain initial data needed for ECAICI composite indicator constructing. Those initial data are based upon the common definitions and methodology as by time as well by countries. Pilot analysis, carried out on the preliminary stage showed, that at a moment of writing this article data relating to the years, earlier 1995 inclusive and 2011 would not be available for a number of ECA region countries (particularly, for former USSR countries). Further, we shall investigate 1996-2010 time interval. We also find it reasonable to sort out 13 countries of ECA region by reason of population size (population didn't exceed 750.000 by 2000) or due to special status: Andorra, Channel Islands, Faeroe Islands, Gibraltar, Greenland, Iceland, Isle of Man, Liechtenstein, Luxembourg, Monaco, Montenegro, San Marino and Kosovo. Henceforward, the rest 45 states of ECA region will be referred to as ECA region research set (see, Table 1).

Table 1

On the preliminary stage we also tested data applying following criteria: 1. Percentage of omitted data must not exceed 40%; 2. Absolute value of cross-correlation factor must be less than 0.9. Restriction of time interval and number of states subject to research considerably diminished sharpness of omitted data problem. In order to reconstitute omitted data we used special statistical procedure, known as multiple imputation method see (Honaker J., K. G, 2011).

2.3. Construction of ECAICI Composite Indicator

Let's introduce following notations: C designates (finite) set of countries with power $|C|=M$ and functions $x_{ti}: C \to R, 1 \le i \le N$, $t = 1,\cdots,T$,where N is a number of initial indicators, T – length of time interval, R – set of real numbers. Hence $x_{ti}(c): C \to R$ designates value of i-th indicator at the moment t for the country $c \in C$. Further we mean that initial indicators have the "same direction", that is, their lesser value corresponds to the "worse" and greater value corresponds to the "better". Symbols

$$\bar{x}_i = \frac{1}{MT}\sum_t \sum_{c \in C} x_{ti}(c), \quad \sigma_i = \left(\frac{1}{MT-1} \sum_t \sum_{c \in C} \left(x_{ti}(c) - \bar{x}_i \right)^2 \right)^{1/2}$$

designate mean and standard deviation of i-th indicator.

Though initial indicators may be given in different scales of measurement, they should be normalized. For this purpose we use standardization procedure (z-scores) and introduce functions $I_{ti}: C \to R$ defined by the following equation:

$$I_{ti}(c) = \frac{x_{ti}(c) - \bar{x}_i}{\sigma_i},$$

$c \in C$, $1 \le i \le N$, $t = 1, \cdots, T$. Further, these functions will be referred to as normalized initial indicators.

Choosing of aggregation procedure within composite indicator construction is very important. Because this problem has not an ambiguous solution, we use most simple and widely applied method of linear aggregation:

$$I_t(c) = \sum_{1 \le i \le N} w_i I_{ti}(c); \; c \in C, t = 1, \cdots, T .$$

where w_i is a weight of i-th normalized initial indicator $1 \le i \le N$ and

$$w_i \ge 0, 1 \le i \le N; \sum_{1 \le i \le N} w_i = 1$$

Our decision reduces problem of choosing of aggregation procedure to the problem of weight selection. Although this greatly simplifies the problem, the choice of weights is essentially non trivial and ambiguous task. In order to select weights we apply factor analysis method. Results of analysis of the main components, applied for normalized initial indicators showed that four principal unobservable factors (corresponding eigenvalues >1) explained about 72% of data variation.. Further, after factors' rotation, we conferred initial indicators weights and aggregated them in sub indicators which correspond to the revealed factors (see Table 2). In the course of this process we used sub indicators' formation procedure, introduced in (Nicoletti, Scarpetta & Boylaud, 2000)

Table 2

Sub indicators, corresponding to the revealed factors may be interpreted following to their composition. Particularly, we will use following names and abbreviations to denote them: Knowledge creation (KNCR), Economy sophistication (ESPH), Knowledge Absorption-Diffusion (KNAD), Human Capital Production (HCPR). Values of ECAICI composite indicator and its sub indicators for 2010 are given in the Annex A2.

2.4. Comparison with Other Indicators and Links with GDPpc

In order to test ECAICI composite indicator's capacities we compared it with other known indicators where available. Indicators subjected to comparison include: ArCo (Archibugi & Coco, 2004), Summary Innovation Index - SII (INNO METRICS, 2011), Innovation Capability Index - ICI (UNCTAD, 2005), TechAchv (UNIDO, 2005), TechRead (WEF, 2009) and Global Innovation Index - GII(INSEAD, 2011) . Though given indicators are constructed by the

different organizations/authors and used different compositions of initial indicators, available data show close links between them and ECAICI (see Fig.1 and Table 3).

Fig.1. Links of ECAICI Indicator with Other Innovative Indicators

Note: **Horizontal axis** -ECAICI, **Vertical axis** – various indicators, square refers to Georgia

Table 3

According to modern economic views, the technological (or rather the inovative) capabilities have a direct impact on the main economic indicators (Klenow & Rodriguez-Clare, 1997). Taking this into consideration, the connection of ECAICI indicator with GDP per capita (2005PPP) has been considered. Fig.2. shows that exist close connection between ECAICI and GDP per capita (2005PPP).

Fig.2. Links of ECAICI Indicator with GDPpc (PPP2005)

Note: **Horizontal axis** -ECAICI, **Vertical axis** – GDPpc(PPp2005), square refers to Georgia

3. Results: Positioning of Georgia's Innovative Capacities within ECA Region

Ranking of ECA country by ECAICI indicator for 2010 is given in the Fig.3.(see also Annex A.2.). Fig. 3 shows that Georgia's rank (by decrease) following to ECAICI indicator is 36 among 45 countries. It means that Georgia's innovative capacities are rather modest.

Fig.3. Ranking of ECA country

In order to scrutinize problem, we carried out cluster-analysis of ECA countries by the ECAICI indicator for 2010. The cluster-analysis identified following groups of countries (see Fig.4 and Fig. 5.):

CLS1= {FIN, NOR,DEU,SWE,DNK}

CLS2= {CHE, GRB,FRA,NDL,BEL,SVN, AUT,ESP, PRT,CYP,IRL}

CLS3={HUN,ITA,CZE,SVK,GRC,HRV,BGR,RUS,UKR,BLR,POL,LTU,LVA,EST,KAZ,ARM}

CLS4= {TUR, MKD,BIH,SRB,ROM,MDA,GEO,AZE,TKM,KGZ,TJK,UZB,ALB}

Owing to this fact and taking into account composition of the clusters, we can referee representatives of CLS1 cluster as innovation leaders, CLS2 cluster members – innovation followers, CLS3 members – moderate innovators, CLS4 members –innovation adapters.

Fig.4. Cluster analisyes of ECA countries

Note: Vertical axise – distance**, Horizontal axise-**objects; Vards metthod, Euclidean distance

Fig.5. Innovation clasters in ECA countries

We see, that Georgia is in CLS4 cluster. To have a clear idea of this fact, we shall analyze Fig.5. First of all, it shows, that above mentioned clusters differ due to the values of ECAICI indicator (see Fig.6.panel A).

Fig.6. Mean values of ECAICI indicator and its sub indicators by clusters. 2010

Note now that Fig.6. panel B can be interpreted in the following way: each country has its unique evolutionary track of innovation development. Supposedly, on the first stage of innovative process human capital is being accumulated –CLS4 members are in this state; After accumulation of "enough" amount of human capital they begin to expand innovative capacities through the knowledge generation, absorption/diffusion and upgrading economy – this phase corresponds to CLS3 cluster; CLS2 includes countries which reached definite limit value of knowledge absorption/diffusion and upgrading economy; And inherent feature of the last stage is intense development of knowledge generation – this refers to CLS1 representatives. Thus, following to our assessments by 2010 Georgia is considered to be in the first phase of her innovation capacities development.

Fig.6. Evolution of mean values of ECAICI indicator and its sub indicators by clusters in 1996-2010

Fig.7. represents evolution of mean values of ECAICI indicator and its sub indicators by clusters in 1996-2010. Following to it CLS4 shows clear trend to the growth of innovative capacities on the whole. It's evident particularly in the case of growth of human capital and upgrading economy sophistication direction, but less evident when it concerns to knowledge generation. Take note, that dynamics of Georgia's innovation capacities development is slightly inconsistent with main trends of CLS4 (see Fig.8). Particularly, it shows increase only in economy sophistication direction, but on the other hand, in all other directions we have stagnation (knowledge absorption/diffusion and knowledge generation) or decline (human capital production).

Fig.7. Evolution of mean values of ECAICI indicator and its sub indicators for Georgia in 1996-2010

Fig.8. Comparison of Georgia and CLS3 mean values of ECAICI initial indicators, 2010

More detailed analysis (see Fig.9.) shows the ways which deserve careful study to provide further growth of Georgia's innovation capacities. Particularly, in the nearest future Georgia

must make every effort in order to increase human capital, upgrade economy and improve knowledge generation. Nowadays, Georgia face those challenges.

5. Conclusion

Measuring of innovation capacities of the country needs to work out special instruments which enable to consider complicated and multidimensional nature of innovation processes and adequately describe them. Nowadays, composite indicators represent such type of instruments. Problem of statistical data availability in the developing countries is a serious obstacle on the way of elaborating composite indicators which reflect innovation capacities. Those difficulties exert severe influence upon the methodological and practical aspects of constructing composite indicators, particularly in the cases when the countries with different level of development are to be compared.

In the present article we presented ECAICI composite indicator which allows analyzing innovation capacities of ECA countries involving 1996-2010 time interval. Research revealed four leading factors, affecting innovative processes in ECA region. These factors may be referred as Knowledge creation, Economy sophistication, Knowledge Absorption-Diffusion, Human Capital Production.

There is a close link between ECAICI indicator and other well-known indicators. ECAICI indicator also closely relate with GDP per capita. It may be applied as an instrument for innovative capacities assessment and analysis. We hope, that due to its capability ECAICI composite indicator may be useful for other countries from post-Soviet space.

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ANNEXES

A1. Initial Indicators of ECAICI Composite Indicator

#	Initial Indicator	Code	
1	**Labor force with tertiary education (% of total)**	**LFT**	Labor force with tertiary education is the proportion of labor force that has a tertiary education, as a percentage of the total labor force.
2	**Total graduates in all programmes tertiary (per 100 of population)**	**GTA**	Total graduates in all programmes tertiary, is the total number of graduates in all programmes in tertiary institutions.
3	**Public spending on education, total (% of GDP)**	**PSE**	Public expenditure on education consists of current and capital public expenditure on education includes government spending on educational institutions (both public and private), education administration as well as subsidies for private entities (students/households and other privates entities).
4	**Teaching staff in total tertiary (per million people)**	**TST**	Teaching staff in total tertiary. Public and private. Full and part-time. All programmes. Total is the total number of teachers in public and private tertiary education institutions . Teachers are persons employed full time or part time in an official capacity to guide and direct the learning experience of pupils and students, irrespective of their qualifications or the delivery mechanism. This definition excludes educational personnel who have no active teaching duties and persons who work occasionally or in a voluntary capacity in educational institutions.
5	**Researchers in R&D (per million people)**	**RRD**	Researchers in R&D are professionals engaged in the conception or creation of new knowledge, products, processes, methods, or systems and in the management of the projects concerned. Postgraduate PhD students (ISCED97 level 6) engaged in R&D are included.
6	**Domestic credit to private sector (% of GDP)**	**DCP**	Domestic credit to private sector refers to financial resources provided to the private sector, such as through loans, purchases of nonequity securities, and trade credits and other accounts receivable, that establish a claim for repayment. For some countries these claims include credit to public enterprises.
7	**Market capitalization of listed companies (% of GDP)**	**MCP**	Market capitalization (also known as market value) is the share price times the number of shares outstanding. Listed domestic companies are the domestically incorporated companies listed on the country's stock exchanges at the end of the year. Listed companies does not include investment companies, mutual funds, or other collective investment vehicles.
8	**Electric power consumption (kWh per capita)**	**EPC**	Electric power consumption measures the production of power plants and combined heat and power plants less transmission, distribution, and transformation losses and own use by heat and power plants.
9	**Internet users (per 100 of population)**	**IUS**	Internet users are people with access to the worldwide network.
10	**Direct investment openness(% of GDP)**	**DIO**	Direct investment openness is the sum of foreign direct investment net inflows and foreign direct investment net outflows . Foreign direct investment are the flows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments.

11	**Spetial services opennes (% of GDP)**	**SSO**	Spetial services opennes is the sum of exports and imports of special servises. Special servises are communications, computer, information, and other services cover international telecommunications and postal and courier services; computer data; news-related service transactions; construction services; royalties and license fees; miscellaneous business, professional, and technical services; personal, cultural, and recreational services; and government services not included elsewhere.
12	**Factor income openness**	**FIO**	Factor income opennes is the sum of factor income payments and receipts. Factor income is refer to employee compensation paid to nonresident workers and investment income (payments on direct investment, portfolio investment, other investments). Income derived from the use of intangible assets is excluded from income and recorded under business services.
13	**Research and development expenditure (% of GDP)**	**RDE**	Expenditures for research and development are current and capital expenditures (both public and private) on creative work undertaken systematically to increase knowledge, including knowledge of humanity, culture, and society, and the use of knowledge for new applications. R&D covers basic research, applied research, and experimental development.
14	**High-technology exports (% of GDP)**	**HTE**	High-technology exports are products with high R&D intensity, such as in aerospace, computers, pharmaceuticals, scientific instruments, and electrical machinery. Data are in current U.S. dollars.
15	**Patent applications, residents (per million people)**	**PAT**	Patent applications are worldwide patent applications filed through the Patent Cooperation Treaty procedure or with a national patent office.
16	**Trademark applications, direct resident (per million people)**	**TRM**	Trademark applications filed are applications to register a trademark with a national or regional Intellectual Property (IP) office. Direct resident trademark applications are those filed by domestic applicants directly at a given national IP office.
17	**Scientific and technical journal articles (per million people)**	**STA**	Scientific and technical journal articles refer to the number of scientific and engineering articles published in the following fields: physics, biology, chemistry, mathematics, clinical medicine, biomedical research, engineering and technology, and earth and space sciences.

A4. Values of ECAICI Indicator by States, 2010

Table 4.

TABLES

Table 1.Research Set of ECA Region States

ALB	Albania	EST	Estonia	LTU	Lithuania	ESP	Spain
ARM	Armenia	FIN	Finland	MKD	Macedonia, FYR	SWE	Sweden
AUT	Austria	FRA	France	MDA	Moldova	CHE	Switzerland
AZE	Azerbaijan	GEO	Georgia	NLD	Netherlands	TJK	Tajikistan
BLR	Belarus	DEU	Germany	NOR	Norway	TUR	Turkey
BEL	Belgium	GRC	Greece	POL	Poland	TKM	Turkmenistan
BIH	Bosnia and Herzegovina	HUN	Hungary	PRT	Portugal	UKR	Ukraine
BGR	Bulgaria	IRL	Ireland	ROM	Romania	GBR	United Kingdom
HRV	Croatia	ITA	Italy	RUS	Russian Federation	UZB	Uzbekistan
CYP	Cyprus	KAZ	Kazakhstan	SRB	Serbia		
CZE	Czech Republic	KGZ	Kyrgyz Republic	SVK	Slovak Republic		
DNK	Denmark	LVA	Latvia	SVN	Slovenia		

Table 2. Weights of Initial Indicators and sub Indicators

qveindikatori	pirveladi indikatori	pirveladi indikatoris wona qveindikatorSi	qveindikatoris wona	pirveladi indikatoris wona indikatorSi
Knowledge creation (KNCR)	PAT	0.27604871	0.3784369	0.10446702
	RRD	0.22850693		0.08647545
	RDE	0.20697372		0.07832649
	EPC	0.18781536		0.07107626
	STA	0.10065528		0.03809167
Economy sophistication (ESPH)	DCP	0.30974646	0.2930011	0.09075604
	TRM	0.26376279		0.07728278
	MCP	0.24826056		0.07274060
	IUS	0.14256781		0.04177252
	PSE	0.03566238		0.01044912
Knowlage Absorpton-Diffusion (KNAD)	SSO	0.51601671	0.1851862	0.09555918
	HTE	0.24862114		0.04604121
	FIO	0.19162185		0.03548573
	DIO	0.04374000		0.00810000
Human Capital Production (HCPR)	TST	0.36931500	0.1433758	0.05295084
	GTA	0.33977500		0.04871557
	LFT	0.29091000		0.04170942

Table 3. Correlation and Regression of ECAICI Indicator

with Various Other Innovative Indicators

Technologi Index	Reference Year	Correlation	Regression y=ax+b; y=ECAICI referenseyear		
			a	b	R2
WEF TechRead	**2009**	0.9130	0.5885	-2.3665	0.8336
UNIDO TechAchv	**2002**	0.7712	3.4221	-1.518	0.5947
UNCTAD ICI	**2001**	0.8579	3.5772	-2.5172	0.7359
EC SII	**2006**	0.8949	3.1811	-0.9672	0.8009
GII	**2010**	0.9444	0.0617	-2.3771	0.8920
ArCo	**2000**	0.9402	4.3214	-21437	0.8839

Table 4.Values of ECAICI indicator and its sub Indicators, 2010

Country	ECAICI 2010		Sub Indicators							
			KNCR		ESPH		KNAD		HCPR	
	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score
CHE	1	1.486	7	0.449	1	0.720	4	0.184	9	0.134
IRL	2	1.480	13	0.178	12	0.254	1	0.848	6	0.201
SWE	3	1.456	2	0.779	3	0.466	7	0.103	18	0.108
FIN	4	1.379	1	1.003	14	0.196	11	0.059	14	0.120
DNK	5	1.239	5	0.597	4	0.459	9	0.070	17	0.113
NOR	6	1.060	3	0.702	11	0.274	18	-0.048	11	0.132
BEL	7	0.997	12	0.212	2	0.483	3	0.184	15	0.118
GBR	8	0.945	9	0.358	5	0.450	14	0.019	16	0.118
DEU	9	0.921	4	0.661	13	0.219	15	-0.014	22	0.055
NLD	10	0.880	11	0.253	6	0.440	6	0.113	20	0.074
FRA	11	0.827	8	0.379	10	0.369	19	-0.049	12	0.128
AUT	12	0.707	6	0.486	15	0.179	13	0.024	29	0.017
ESP	13	0.519	15	0.070	7	0.434	29	-0.082	19	0.096
EST	14	0.416	18	0.022	16	0.146	10	0.066	7	0.183
PRT	15	0.412	20	-0.020	8	0.433	22	-0.063	21	0.062
CYP	16	0.375	36	-0.217	9	0.427	5	0.169	33	-0.003
SVN	17	0.370	10	0.253	18	0.141	23	-0.065	26	0.042
RUS	18	0.332	14	0.152	30	-0.012	40	-0.123	2	0.316
HUN	19	0.219	24	-0.085	25	0.027	2	0.244	28	0.033
CZE	20	0.151	16	0.043	20	0.069	12	0.043	34	-0.004
UKR	21	0.146	27	-0.100	29	-0.009	27	-0.074	1	0.328
LTU	22	0.102	25	-0.089	22	0.048	33	-0.091	3	0.234
LVA	23	0.050	28	-0.129	19	0.105	21	-0.059	10	0.133
POL	24	0.033	22	-0.063	26	0.023	31	-0.085	8	0.158
ITA	25	0.030	17	0.038	17	0.144	37	-0.106	38	-0.046
BLR	26	0.025	19	0.006	36	-0.085	41	-0.124	4	0.228
SVK	27	-0.033	21	-0.042	24	0.032	24	-0.066	25	0.043
BGR	28	-0.131	29	-0.133	27	0.020	25	-0.070	23	0.052
HRV	29	-0.133	26	-0.096	23	0.040	32	-0.091	30	0.015

GRC	30	-0.143	23	-0.064	21	0.056	44	-0.133	32	-0.002
ARM	31	-0.181	33	-0.197	38	-0.118	35	-0.093	5	0.227
KAZ	32	-0.207	30	-0.149	35	-0.082	36	-0.102	13	0.125
MDA	33	-0.263	32	-0.188	34	-0.072	16	-0.036	27	0.033
SRB	34	-0.344	31	-0.176	33	-0.069	26	-0.071	36	-0.028
ROM	35	-0.374	34	-0.202	32	-0.059	30	-0.084	37	-0.029
GEO	36	-0.444	35	-0.203	40	-0.175	38	-0.115	24	0.048
MKD	37	-0.468	39	-0.261	31	-0.033	28	-0.078	42	-0.096
TUR	38	-0.501	38	-0.251	28	-0.004	45	-0.163	40	-0.083
AZE	39	-0.521	37	-0.225	41	-0.175	42	-0.125	31	0.004
BIH	40	-0.526	42	-0.295	37	-0.092	39	-0.117	35	-0.021
TKM	41	-0.534	40	-0.280	45	-0.252	8	0.087	41	-0.090
KGZ	42	-0.603	44	-0.310	42	-0.189	17	-0.041	39	-0.063
ALB	43	-0.683	43	-0.301	39	-0.140	34	-0.092	45	-0.151
UZB	44	-0.685	41	-0.287	43	-0.195	20	-0.052	44	-0.150
TJK	45	-0.806	45	-0.334	44	-0.214	43	-0.127	43	-0.130
Average		**0.200**		**0.043**		**0.104**		**-0.009**		**0.062**
Median		**0.050**		**-0.064**		**0.040**		**-0.065**		**0.052**
Min		**-0.806**		**-0.334**		**-0.252**		**-0.163**		**-0.151**
Max		**1.486**		**1.003**		**0.720**		**0.848**		**0.328**

FIGURES

Fig. 1.

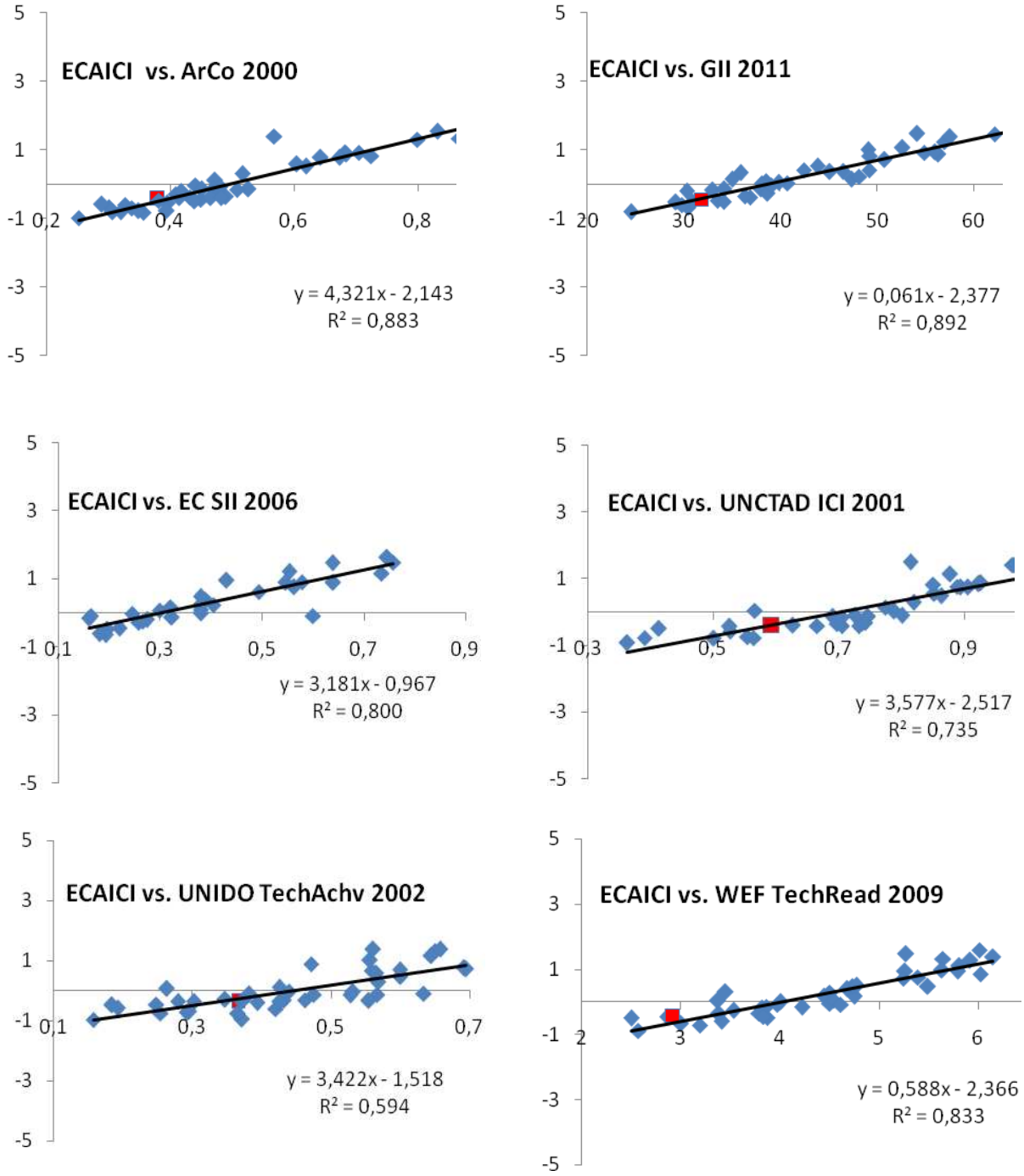


Fig. 2.

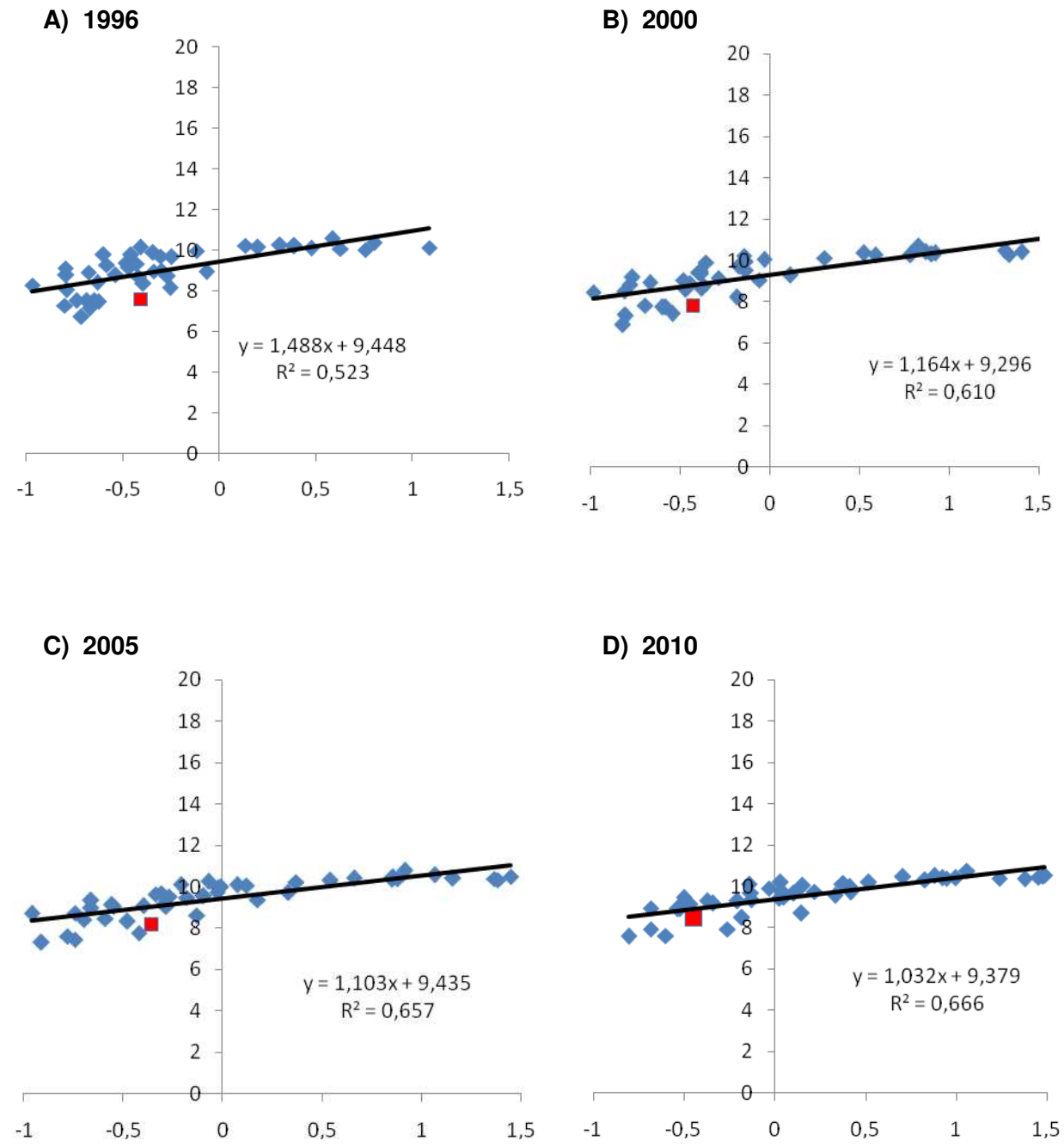

A) 1996
y = 1,488x + 9,448
R² = 0,523
B) 2000
y = 1,164x + 9,296
R² = 0,610
C) 2005
y = 1,103x + 9,435
R² = 0,657
D) 2010
y = 1,032x + 9,379
R² = 0,666

Fig. 3.

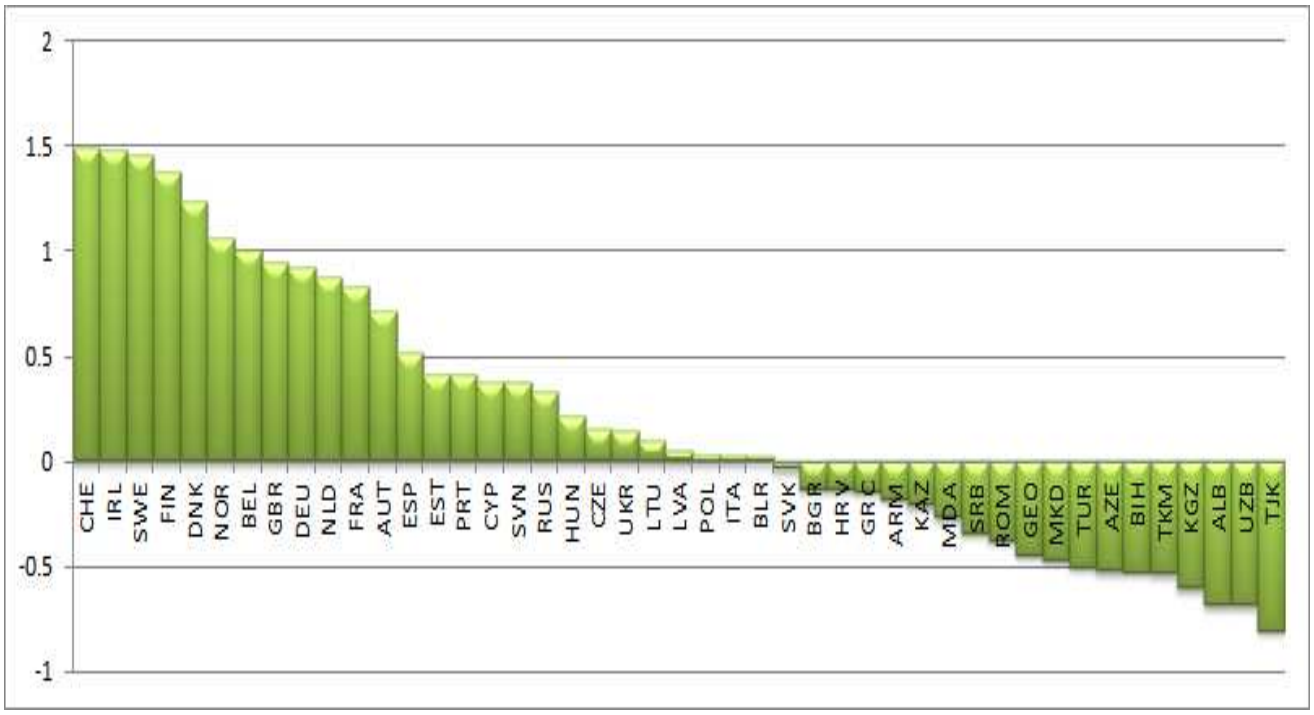

2
1.5
1
0.5
0
-0.5
-1
CHE
IRL
SWE
FIN
DNK
NOR
BEL
GBR
DEU
NLD
FRA
AUT
ESP
EST
PRT
CYP
SVN
RUS
HUN
CZE
UKR
LTU
LVA
POL
ITA
BLR
SVK
BGR
HRV
GRC
ARM
KAZ
MDA
SRB
ROM
GEO
MKD
TUR
AZE
BIH
TKM
KGZ
ALB
UZB
TJK

Fig. 4.

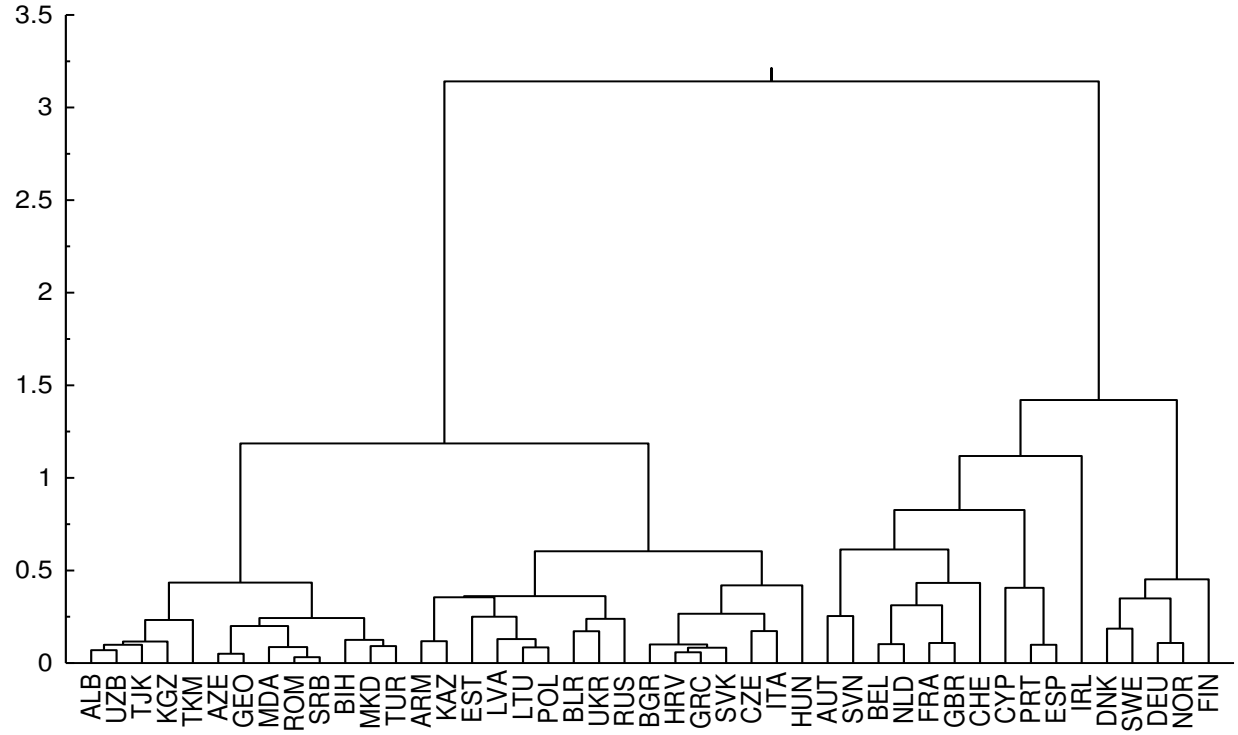

3.5
3
2.5
2
1.5
1
0.5
0
ALB
UZB
TJK
KGZ
TKM
AZE
GEO
MDA
ROM
SRB
BIH
MKD
TUR
ARM
KAZ
EST
LVA
LTU
POL
BLR
UKR
RUS
BGR
HRV
GRC
SVK
CZE
ITA
HUN
AUT
SVN
BEL
NLD
FRA
GBR
CHE
CYP
PRT
ESP
IRL
DNK
SWE
DEU
NOR
FIN

Fig. 5.

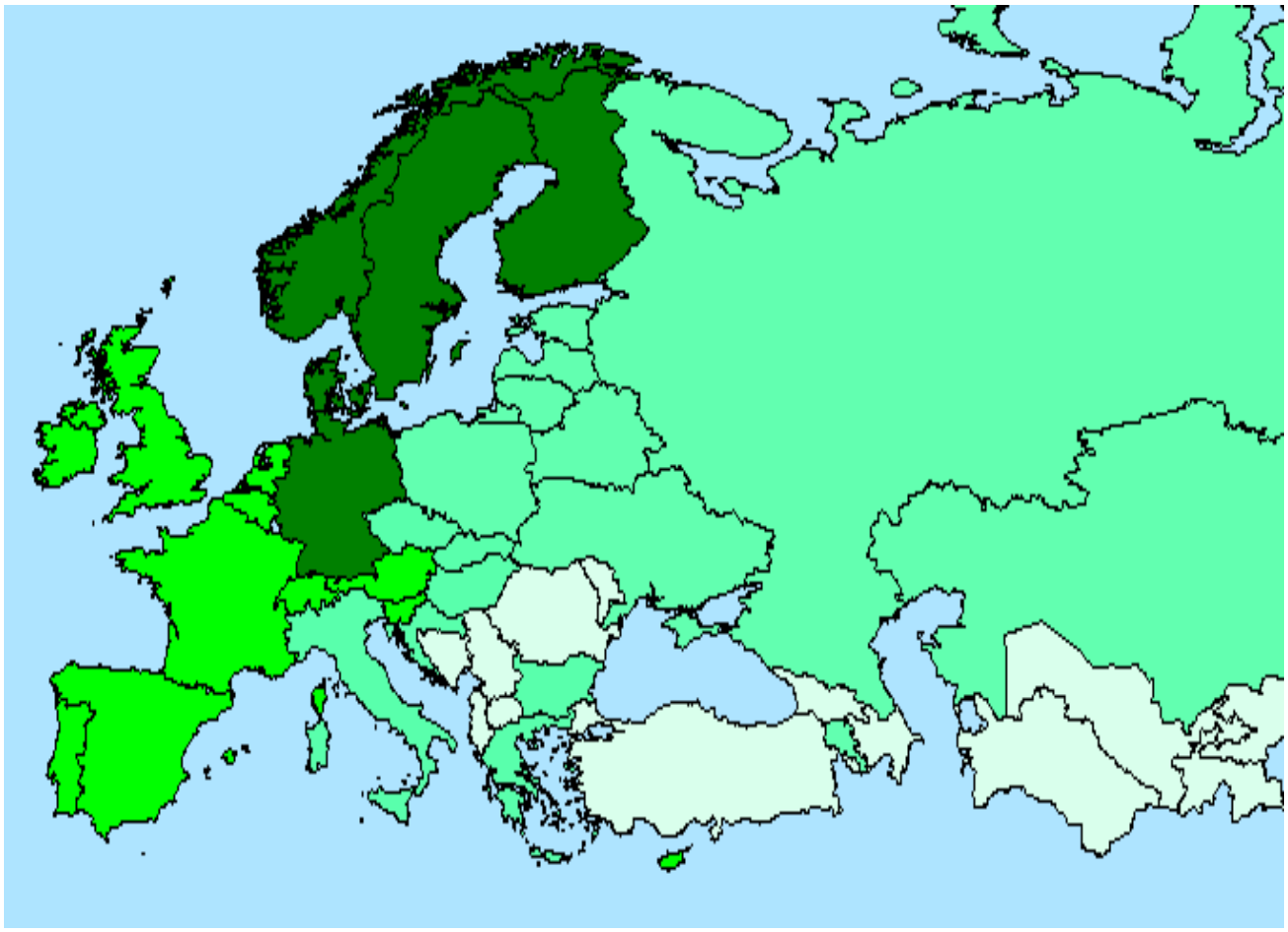


Fig. 6.

A)


1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
CLS1
CLS2
CLS3
CLS4

B)

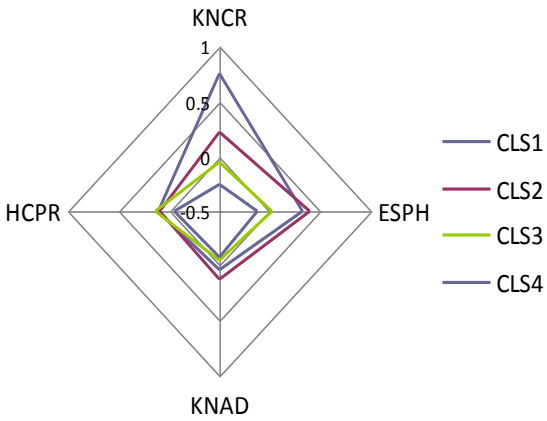
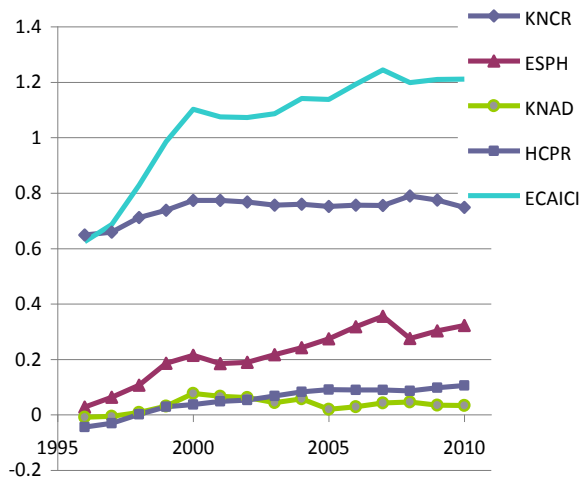
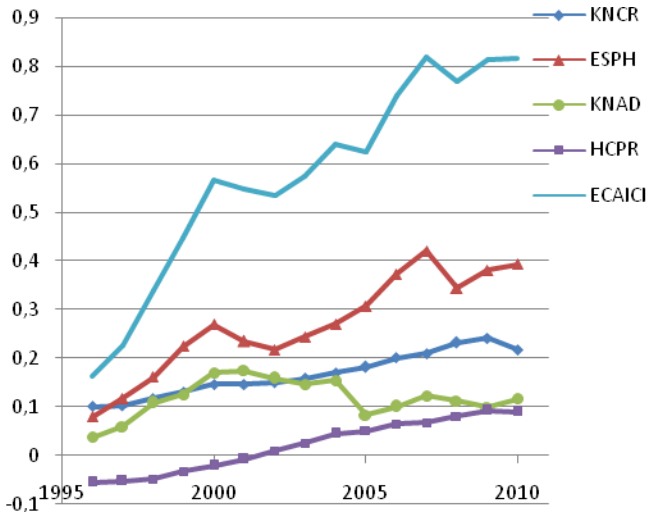

KNCR
1
0.5
0
-0.5
HCPR
ESPH
KNAD
CLS1
CLS2
CLS3
CLS4

Fig. 7.

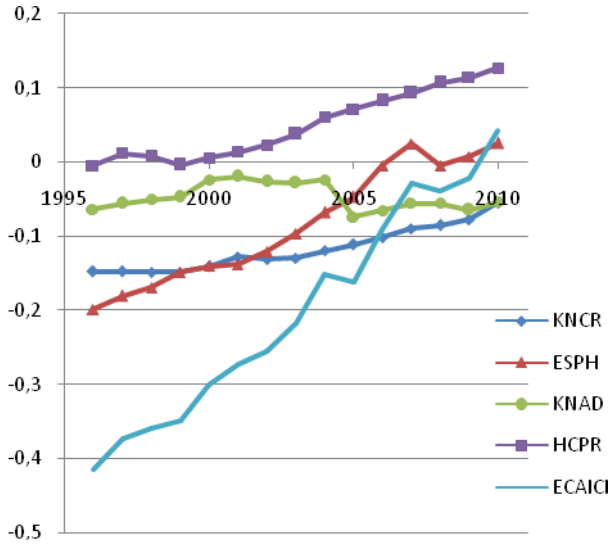
A) CLS1



B) CLS2



C) CLS3



D) CLS4

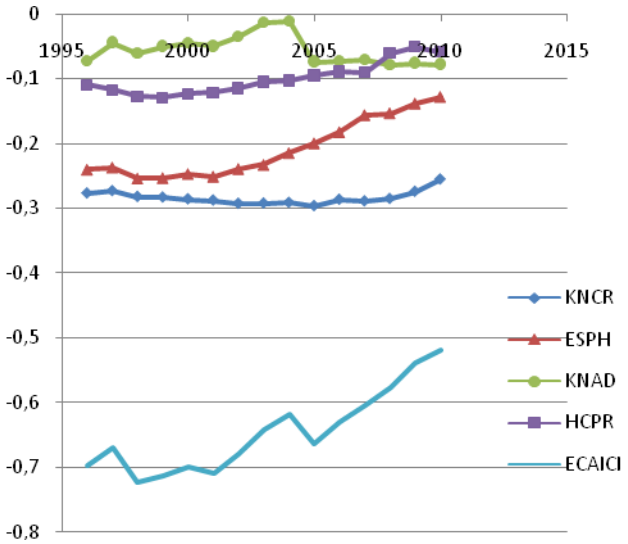


Fig. 8.

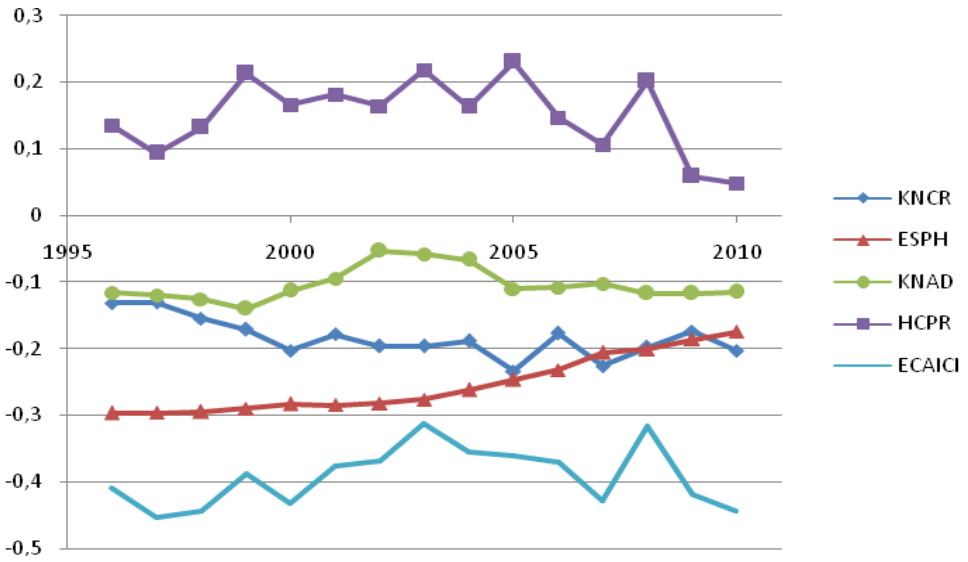
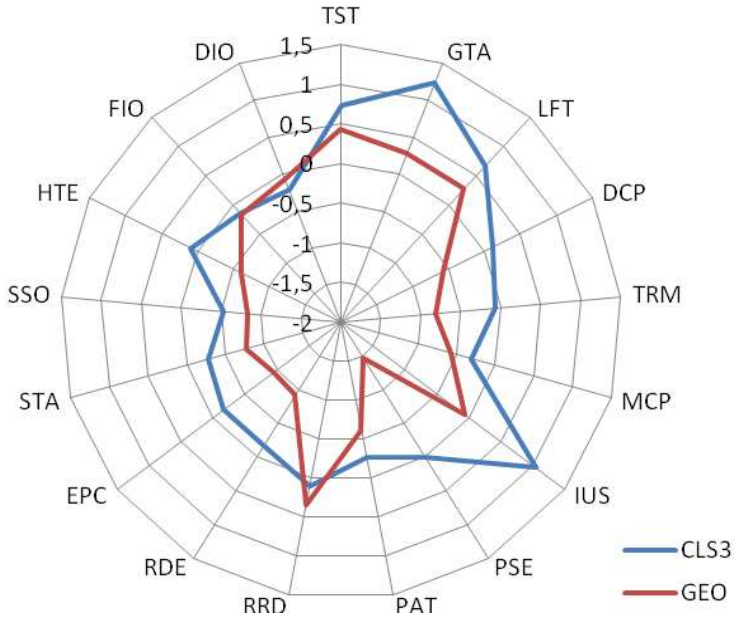

0,3
0,2
0,1
0
-0,1
-0,2
-0,3
-0,4
-0,5
1995
2000
2005
2010
KNCR
ESPH
KNAD
HCPR
ECAICI

Fig. 9.


TST
GTA
LFT
DCP
TRM
MCP
IUS
PSE
PAT
RRD
RDE
EPC
STA
SSO
HTE
FIO
DIO
1,5
1
0,5
0
-0,5
-1
-1,5
-2
CLS3
GEO