

WARSAW SCHOOL OF ECONOMICS (POLAND)

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Institutions and Economic Growth: In Search of Robustness

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MOTIVATION

- Many papers on the impact of the regulatory framework on economic growth have emerged in recent years. The conclusions obtained by various authors depend on the analyzed sample, model specification, and the estimation method.
- Some questions are not solved yet (whether the relationship is linear or nonlinear; what freedoms contribute the most to economic growth; or what is the strength of the impact)?
- **Sala-i-Martin, Doppelhofer, and Miller (SDM, 2004) use Bayesian averaging of classical estimates (BACE) approach.** Instead of using one model, they estimate a large number of equations corresponding to numerous possible sets of explanatory variables chosen from an initially selected group of 'candidate-variables'. The results are then averaged using specified weights.
- This study applies the SDM approach to the Blundell and Bond's GMM system estimator.

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THE AIMS OF THE ANALYSIS

- To analyze the relationship **between regulatory variables** (economic freedom, quality of governance, democracy level, doing business indicators, transition indicators) **and economic growth.**
- Focus on:
 - ✓ **nonlinear** impact;
 - ✓ **level of and change in** the regulatory variables;
 - ✓ **components** of the aggregated indices.
- The analysis is mostly based on **'overlapping' panel data** in the form of **5- or 10-year subperiod averages.**
- The analysis covers the **1970-2012 period** and the following groups of countries:
 - ✓ **world** economies (max. 171);
 - ✓ **EU27** countries;
 - ✓ **post-socialist** countries.

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BACKGROUND – empirical evidence (1/4)

- **De Haan et al. (2006)**: wide review of empirical studies on the relationship between economic freedom and economic growth (more than 30 empirical studies).
 - ⇒ Economic freedom is important in explaining differences in economic performance, however most studies have serious **drawbacks**, including **lacking sensitivity analysis** and **poor specifications of the growth model**.
- **Pääkkönen (2010)**: 25 transition economies, 1998-2005, relationship between economic freedom and economic growth.
 - ⇒ Growth researchers should test for the presence of nonlinearities.
- **Bergh and Karlsson (2010)**: 29 OECD countries, 1970-1995.
 - ⇒ Unexpectedly, the idea that economic freedom matters has little support.

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BACKGROUND – empirical evidence (2/4)

- **Justesen (2008)**: causal relationship between economic freedom and economic growth using the Granger causality tests.
 - ⇒ At least some aspects of economic freedom are important determinants of GDP growth; the analysis **raises doubts as to whether all dimensions** of economic freedom matter.
 - ⇒ Hence, analysis of **component indicators** is important.
- **Aixalá and Fabro (2009)**: causality between economic growth and: economic freedom, civil liberties and political rights.
 - ⇒ **Bilateral causality** between economic freedom, civil liberties and growth; when the analysis works with changes (not levels), only the relation between changes in economic freedom and growth is significant and also **bilateral**.
 - ⇒ It is appropriate to analyze **both the level of and the change in** institutional variables; bilateral relationship justifies the treatment of regulatory variables as **endogenous**.

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BACKGROUND – empirical evidence (3/4)

- **Peev and Mueller (2012):** the interrelationships between democracy, economic freedoms, and economic growth.
 - ⇒ Trade freedom, monetary freedom and freedom from corruption are the most important economic growth determinants in transition countries; **democracy** can have also **an adverse effect on economic growth**, by producing larger public sectors and public deficits.
 - ⇒ It is worth to carry out a more advanced analysis covering more countries and aiming **to find which areas of freedom** affect mostly economic growth and **whether some negative effects** between institutional variables (like democracy) and economic growth are indeed evidenced.

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BACKGROUND – empirical evidence (4/4)

- **Some other studies described in the report:**
 - ✓ Heckelman and Knack (2009)
 - ✓ Azman-Saini, Baharumshah, and Law (2010)
 - ✓ Compton, Giedeman, and Hoover (2011)
 - ✓ Williamson and Mathers (2011)
 - ✓ Fabro and Aixalá (2012)

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ECONOMETRIC SOLUTION

- **Problem 1:** in growth models there are hardly any „sure“ independent variables and no single specification is obvious.
 - Apply Bayesian Model Averaging: estimate models with all possible subsets of the candidate independent variables, then average the results using posterior probability weights.
- **Problem 2:** the relationship need not be linear.
 - Introduce squares of institutional environment variables.
- **Problem 3:** equations are autoregressive.
 - Use Blundell and Bond method of estimation.
- **Problem 4:** series in the panel of countries are short and there are few observations to use GMM in a reasonable way.
 - Use overlapping periods: e.g. t=1 covers period 1991-1995, t=2 covers period 1992-1996, t=3 covers 1993-1997; since for the dependent variable we use only the starting and ending value these are not redundant.

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MAIN FORMULAS OF BAYESIAN MODEL AVERAGING

- Prior probability of model M_j (assumption!):

$$P(M_j) = \left(\frac{k}{K}\right)^{K_j} \left(1 - \frac{k}{K}\right)^{K-K_j}$$

- Posterior probability with the use of dataset D:

$$P(M_j | D) = \frac{P(M_j)P(D | M_j)}{\sum_{i=1}^J P(M_i)P(D | M_i)}$$

- Problem with computation:

$$P(D | M_j) = \int L(D, \theta_j) P(\theta_j | M_j) d\theta_j$$

- Finally with GMM estimation:

$$P(M_j | D) = \frac{P(M_j) n^{-K_j/2} \exp[-0.5nQ(\hat{\theta}_j)]}{\sum_{i=1}^J P(M_i) n^{-K_i/2} \exp[-0.5nQ(\hat{\theta}_i)]}$$

- Estimates of „influence“ parameters:

$$\hat{\beta}_r = \sum_{j=1}^J P(M_j | D) \hat{\beta}_{r,j}$$

$$\text{Var}(\hat{\beta}_r) = \sum_{j=1}^J P(M_j | D) \cdot \text{Var}(\hat{\beta}_{r,j}) + \sum_{j=1}^J P(M_j | D) \cdot (\hat{\beta}_{r,j} - \hat{\beta}_r)^2$$

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MAIN FORMULAS

- The classical Barro regression:

$$\Delta \ln GDP_{it} = \beta_0 + \beta_1 \ln GDP_{i,t-1} + x'_{it} \beta + \alpha_i + \varepsilon_{it}$$

- The transformed model:

$$\ln GDP_{it} = \beta_0 + (\beta_1 + 1) \ln GDP_{i,t-1} + x'_{it} \beta + \alpha_i + \varepsilon_{it}$$

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DATA

Regulations (institutions) are measured by the following indicators:

- the Heritage Foundation **index of economic freedom**,
- the Fraser Institute **index of economic freedom**,
- the World Bank **worldwide governance indicators**,
- the Freedom House **democracy index**,
- the World Bank **doing business indicators**,
- the EBRD **transition indicators**.

Institutional variables are included:

- as the **overall** indicator or the **component** indicators,
- as the **level** (arithmetic average of the values recorded over a given subperiod) or the **change** (between the initial and the final year of a given subperiod).

All the institutional variables are also included in a **squared** form.

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DATA

- The explained variable - economic growth:**

Change in GDP per capita at purchasing power parity (PPP) in constant prices.

Source: PWT.

- All the regression equations include regulatory variables:**

- the aggregated index or the component indicators (the latter ones randomly chosen).**

- Since it is believed that there does exist the **beta-convergence**, initial GDP per capita also appears in **each** estimated equation.

Table 1
Analyzed models (in the BMA sense)

Model no.	Regulatory variable(s)	Data transformation
<i>Heritage Foundation</i>		
1	Level of the index of economic freedom	5-year overlapping panel
2	Levels of the components of the index of economic freedom	
3	Change in the index of economic freedom	
4	Changes in the components of the index of economic freedom	
<i>Fraser Institute</i>		
5	Level of the index of economic freedom	10-year overlapping panel
6	Change in the index of economic freedom	
7	Levels of the components of the index of economic freedom	
8	Changes in the components of the index of economic freedom	
<i>World Bank</i>		
9	Level of the worldwide governance indicator	5-year overlapping panel
10	Levels of the components of the worldwide governance indicator	
11	Change in the worldwide governance indicator	
12	Changes in the components of the worldwide governance indicator	
<i>Freedom House</i>		
13	Level of the democracy index	10-year overlapping panel
14	Levels of the components of the democracy index and freedom of the press	
15	Change in the democracy index	
16	Changes in the components of the democracy index and freedom of the press	
<i>World Bank</i>		
17	Levels of the doing business indicators	Cross-sectional data
18	Changes in the doing business indicators	
<i>EBRD</i>		
19	Level of the transition indicator	5-year overlapping panel
20	Levels of the components of the transition indicator	
21	Change in the transition indicator	
22	Changes in the components of the transition indicator	

Table 2
The list of control variables

Name	Description	Type ^a
lngdp0	Lagged log GDP per capita at PPP (constant prices)	E
inv	Investment (% of GDP)	E
school_tot	Average years of total schooling (population ages 15+)	E
school_ter	Percentage of population (ages 15+) with completed tertiary education	E
edu_exp	Education expenditure (% of GNI)	E
gov_cons	General government consumption expenditure (% of GDP)	E
gov_rev	General government revenue (% of GDP)	E
gov_bal	General government balance (% of GDP)	E
open	Openness ((exports + imports) / GDP)	E
cab	Current account balance (% of GDP)	E
fdi	Net FDI inflow (% of GDP)	E
cred	Annual change (in % points) of the domestic credit provided by banking sector in % of GDP	E
inf	Inflation (annual %)	E
serv	Services value added (% of GDP)	E
life	Log of life expectancy at birth (years)	X
fert	Log of fertility rate (births per woman)	X
pop_15_64	Population ages 15-64 (% of total)	X
pop_den	Log of population density (people per sq. km of land area)	X
pop_gr	Population growth (annual %)	X
pop_tot	Log of population, total	X

^a E – endogenous variable; X – exogenous variable.

Table 3
Control variables included in the respective BMA models

Variable	Model 1-4	Model 5-8	Model 9-12	Model 13-16	Model 17-18	Model 19-22
lngdp0	x	x	x	x	x	x
inv	x	x	x	x	x	x
school_tot	x	x		x		
school_ter	x	x		x		
edu_exp	x		x	x		
gov_cons	x	x	x	x	x	x
gov_rev			x		x	
gov_bal			x		x	
open	x	x	x	x	x	x
cab				x		
fdi	x		x	x	x	
cred	x		x	x		
inf	x	x	x	x	x	
serv				x		
life	x	x	x	x	x	
fert	x	x	x	x	x	
pop_15_64	x	x	x	x	x	x
pop_den	x		x	x	x	x
pop_gr	x	x	x	x	x	x
pop_tot	x	x	x	x	x	x

“x” means that a given variable is included.

Table 5
Data coverage of the respective BMA models

Model	Number of observations	Number of countries	Number of observations per country (avg.)	Maximum period ^a
1	1856	134	13.9	(1992)1997-2012
2	1856	134	13.9	(1992)1997-2012
3	1500	129	11.6	(1995)2000-2012
4	1500	129	11.6	(1995)2000-2012
5	2584	111	23.3	(1970)1980-2010
6	2584	111	23.3	(1970)1980-2010
7	2136	110	19.4	(1970)1980-2010
8	2136	110	19.4	(1970)1980-2010
9	1985	160	12.4	(1993)1998-2012
10	1985	160	12.4	(1993)1998-2012
11	1557	160	9.7	(1996)2001-2011
12	1557	160	9.7	(1996)2001-2011
13	2726	123	22.2	(1970)1980-2012
14	1569	122	12.9	(1988)1998-2012
15	2535	123	20.6	(1972)1982-2011
16	989	119	8.3	(1993)2003-2011
17	154	154	1	2005-2012
18	154	154	1	2005-2012
19	456	27	16.9	(1989)1994-2012
20	456	27	16.9	(1989)1994-2012
21	456	27	16.9	(1989)1994-2012
22	456	27	16.9	(1989)1994-2012

^a The earliest year for which initial GDP is included (in the case of panel data) is given in brackets.

RESULTS – ECONOMIC FREEDOM

- **Economic freedom contributes to economic growth.**
- **Countries with greater scope of economic freedom record on average the more rapid output growth.**
- **This relationship is nonlinear and statistically significant.**
- **The most beneficial effect on economic growth appears in the countries with low scope of economic freedom: making the country more economically free has greater benefit in terms of output acceleration if the level of economic freedom is low.**

Table 6
Estimation results for the level of the Heritage Foundation index of economic freedom (model 1)

Regressor	World countries			EU27 countries			20 post-socialist countries		
	beta	st. dev.	pseudo t	beta	st. dev.	pseudo t	beta	st. dev.	pseudo t
EF	0.0285	0.0034	8.37	0.0718	0.0050	14.36	0.0408	0.0131	3.10
(EF) ²	-0.0002	0.0000	-5.69	-0.0005	0.0000	-12.69	-0.0003	0.0001	-2.47
lngdp0	0.8281	0.0071	117.21	0.7734	0.0096	80.40	0.8011	0.0144	55.62
inv	0.0045	0.0003	14.45	0.0187	0.0006	31.98	0.0115	0.0011	10.58
school_tot	0.0321	0.0026	12.49	-0.0411	0.0037	-11.10	0.1013	0.0117	8.69
school_ter	0.0006	0.0005	1.27	-0.0073	0.0008	-8.95	0.0060	0.0018	3.26
edu_exp	-0.0414	0.0020	-20.69	0.0226	0.0034	6.67	-0.0475	0.0070	-6.83
gov_cons	-0.0031	0.0009	-3.68	-0.0233	0.0021	-10.93	-0.0066	0.0030	-2.22
open	0.0005	0.0001	10.32	-0.0003	0.0001	-5.54	-0.0006	0.0002	-3.23
fdi	0.0041	0.0002	17.46	0.0027	0.0002	13.83	-0.0020	0.0014	-1.38
cred	0.0031	0.0003	12.04	0.0059	0.0004	15.49	0.0038	0.0012	3.27
inf	-0.0005	0.0000	-10.21	-0.0011	0.0001	-14.81	-0.0015	0.0002	-8.54
life	0.8036	0.0289	27.77	-0.6578	0.1819	-3.62	0.1600	0.2314	0.69
fert	-0.5024	0.0092	-54.62	0.0763	0.0167	4.58	-0.3143	0.0289	-10.87
pop_15_64	0.0090	0.0005	19.12	-0.0134	0.0011	-12.62	0.0166	0.0034	4.88
pop_den	-0.0314	0.0013	-24.91	0.0048	0.0020	2.44	-0.0645	0.0075	-8.56
pop_gr	0.0600	0.0014	42.70	0.0890	0.0044	20.27	-0.0397	0.0091	-4.34
pop_tot	-0.0107	0.0007	-15.03	0.0123	0.0014	8.75	0.0353	0.0058	6.06

EF – the Heritage Foundation index of economic freedom. The remaining variables are defined in Table 2.

Figure 1. The impact of the level of economic freedom (Heritage Foundation index) on economic growth (model 1)

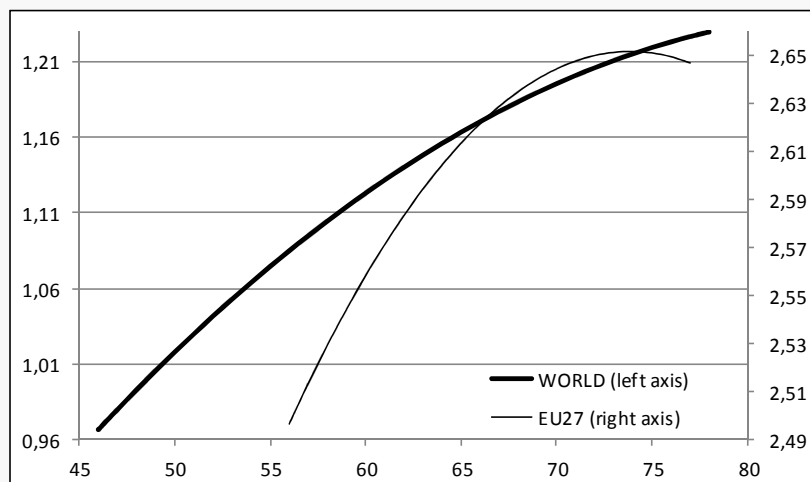


Table 7
Estimation results for the change in the Heritage Foundation index of economic freedom (model 3)

Regressor	World countries			EU27 countries			19 post-socialist countries		
	beta	st. dev.	pseudo t	beta	st. dev.	pseudo t	beta	st. dev.	pseudo t
ΔEF	0.0025	0.0003	7.85	0.0063	0.0009	6.94	0.0144	0.0013	11.10
$(\Delta EF)^2$	-0.0003	0.0000	-6.55	-0.0003	0.0001	-3.01	-0.0010	0.0001	-9.19
lngdp0	0.8225	0.0056	146.16	0.7070	0.0127	55.74	0.8452	0.0096	88.19
inv	0.0034	0.0004	8.59	0.0157	0.0008	20.40	0.0154	0.0009	17.16
school_tot	0.0376	0.0031	12.32	-0.0250	0.0043	-5.81	0.1422	0.0101	14.11
school_ter	0.0008	0.0005	1.60	-0.0064	0.0009	-7.10	0.0121	0.0013	9.22
edu_exp	-0.0330	0.0022	-15.30	0.0130	0.0047	2.75	-0.0275	0.0061	-4.51
gov_cons	-0.0103	0.0009	-10.96	-0.0235	0.0026	-9.19	-0.0115	0.0024	-4.87
open	0.0004	0.0000	8.80	-0.0000	0.0001	-0.30	-0.0004	0.0001	-2.58
fdi	0.0034	0.0002	15.31	0.0033	0.0002	13.94	0.0011	0.0010	1.17
cred	0.0028	0.0003	10.07	0.0057	0.0004	12.69	0.0139	0.0009	14.77
inf	-0.0010	0.0000	-25.97	-0.0013	0.0002	-7.84	-0.0021	0.0002	-9.39
life	0.7296	0.0276	26.41	-1.2265	0.2129	-5.76	1.1420	0.1835	6.22
fert	-0.6441	0.0149	-43.37	0.0561	0.0220	2.55	-0.3050	0.0208	-14.65
pop_15_64	0.0113	0.0005	25.11	-0.0288	0.0016	-17.74	0.0272	0.0025	10.91
pop_den	-0.0254	0.0008	-30.27	-0.0029	0.0022	-1.30	-0.0687	0.0050	-13.60
pop_gr	0.0759	0.0020	37.06	0.1553	0.0068	22.99	-0.0610	0.0072	-8.52
pop_tot	-0.0106	0.0008	-13.78	0.0110	0.0016	7.09	0.0065	0.0030	2.15

EF – the Heritage Foundation index of economic freedom. The remaining variables are defined in Table 2.

Figure 2. The impact of the change in economic freedom (Heritage Foundation index) on economic growth (model 3)

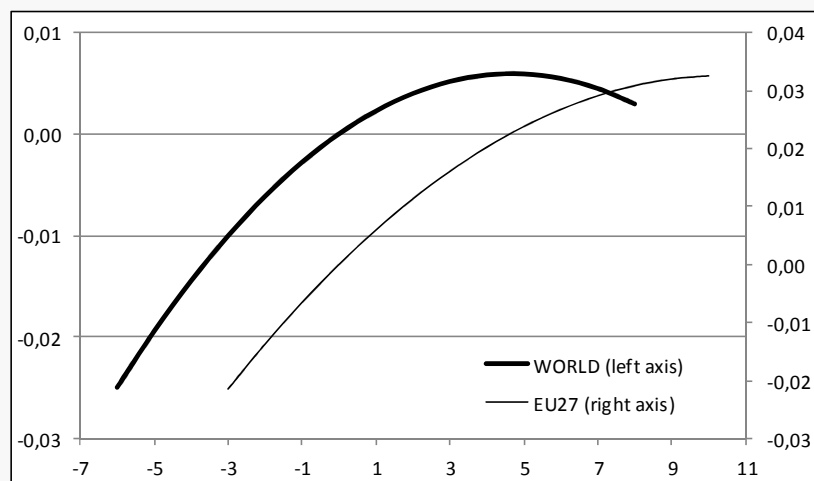


Table 8
Estimation results for the level of the Fraser Institute index of economic freedom (model 5)

Regressor	World countries			EU27 countries			14 post-socialist countries		
	beta	st. dev.	pseudo t	beta	st. dev.	pseudo t	beta	st. dev.	pseudo t
EF	0.5148	0.0122	42.08	0.0451	0.0038	11.99	0.6608	0.0592	11.17
(EF) ²	-0.0418	0.0010	-40.25	0.0064	0.0017	3.67	-0.0404	0.0051	-7.97
lngdp0	0.9034	0.0031	295.58	0.8934	0.0052	170.88	0.7229	0.0126	57.16
inv	0.0083	0.0003	29.14	0.0280	0.0005	50.94	0.0073	0.0015	4.92
school_tot	-0.0111	0.0019	-5.92	0.0291	0.0013	22.45	0.0528	0.0092	5.73
school_ter	0.0041	0.0004	10.48	0.0117	0.0005	21.97	0.0104	0.0013	8.01
gov_cons	-0.0013	0.0006	-2.31	-0.0255	0.0012	-21.64	-0.0349	0.0023	-15.00
open	0.0002	0.0001	2.96	0.0019	0.0000	44.29	0.0013	0.0002	5.35
inf	-0.0002	0.0000	-42.52	-0.0033	0.0001	-56.55	-0.0016	0.0001	-13.67
life	0.8928	0.0222	40.17	0.9593	0.0702	13.66	-0.9919	0.1463	-6.78
fert	-0.5320	0.0092	-57.82	-0.0733	0.0084	-8.69	-0.4211	0.0273	-15.40
pop_15_64	0.0292	0.0005	57.12	0.0142	0.0007	21.27	0.0414	0.0029	14.10
pop_gr	0.0739	0.0019	39.64	0.0073	0.0034	2.14	0.0847	0.0136	6.24
pop_tot	0.0053	0.0008	6.70	-0.0344	0.0010	-33.25	0.0395	0.0048	8.29

EF – the Fraser Institute index of economic freedom. The remaining variables are defined in Table 2.

Figure 3. The impact of the level of economic freedom (Fraser Institute index) on economic growth (model 5)

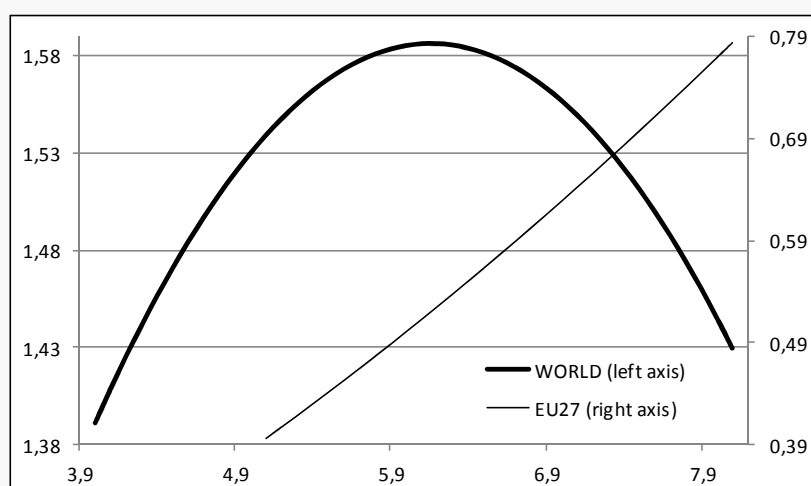
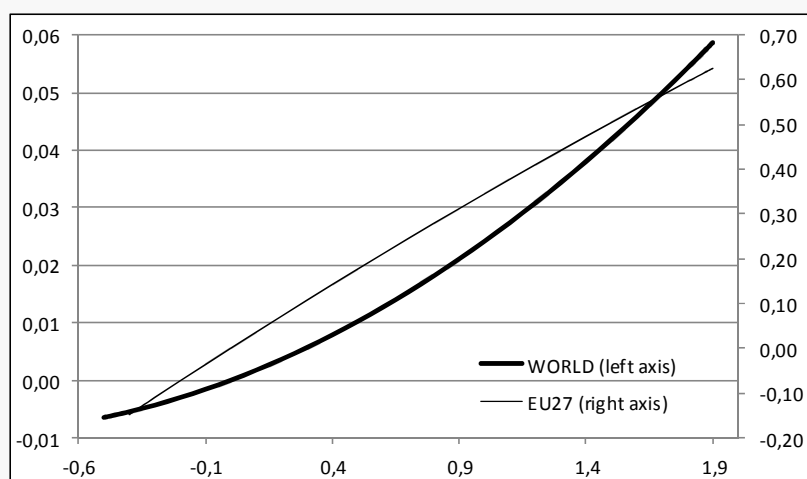


Table 9
Estimation results for the change in the Fraser Institute index of economic freedom (model 6)

Regressor	World countries			EU27 countries			14 post-socialist countries		
	beta	st. dev.	pseudo t	beta	st. dev.	pseudo t	beta	st. dev.	pseudo t
ΔEF	0.0167	0.0021	8.05	0.3627	0.0192	18.91	0.2206	0.0137	16.16
$(\Delta EF)^2$	0.0075	0.0009	8.58	-0.0176	0.0015	-11.73	-0.0431	0.0048	-9.05
lngdp0	0.8902	0.0032	282.08	0.7590	0.0055	139.04	0.7829	0.0157	49.72
inv	0.0102	0.0003	33.74	0.0091	0.0004	21.72	0.0358	0.0010	35.06
school_tot	-0.0108	0.0018	-5.90	-0.0119	0.0013	-8.99	0.2456	0.0075	32.61
school_ter	0.0013	0.0003	3.65	0.0045	0.0005	8.78	0.0288	0.0016	18.35
gov_cons	-0.0081	0.0005	-14.90	-0.0387	0.0009	-44.10	-0.0621	0.0024	-25.78
open	0.0002	0.0000	3.99	0.0012	0.0000	27.80	0.0050	0.0002	31.16
inf	-0.0003	0.0000	-66.08	-0.0028	0.0001	-38.66	-0.0029	0.0001	-30.91
life	0.9090	0.0212	42.84	1.0372	0.0679	15.27	2.0301	0.1528	13.29
fert	-0.5056	0.0087	-57.89	0.0771	0.0071	10.89	-0.5830	0.0317	-18.40
pop_15_64	0.0262	0.0005	52.11	0.0044	0.0007	6.34	0.0655	0.0031	21.30
pop_gr	0.0646	0.0018	35.81	0.0594	0.0025	23.73	0.0572	0.0164	3.49
pop_tot	0.0042	0.0007	5.64	-0.0241	0.0009	-27.40	-0.0297	0.0046	-6.49

EF – the Fraser Institute index of economic freedom. The remaining variables are defined in Table 2.

Figure 4. The impact of the change in economic freedom (Fraser Institute index) on economic growth (model 6)



INTERPRETATION

- The results are in line with the theoretical structural model.
- **The law of diminishing returns:** marginal productivity of the input is decreasing.
- **Economic freedom - the additional input to the production function.**
- Indeed, there are augmentations of theoretical models of economic growth where institutions are accounted for (e.g. Hall and Jones (1999)).
- Regulations, e.g. economic freedom, are another factor of production and they reveal the highest productivity in those countries where they are relatively scarce.

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RESULTS – GOVERNANCE INDICATOR

- The relationship between the level of quality of governance and economic growth is **nonlinear** and **statistically significant**.
- However, the function is **convex**.
- The relationship between the quality of governance and economic growth is **generally positive** – the higher the value of the worldwide governance indicator, the more rapid economic growth.
- **Unlike economic freedom**, a negative relationship, if observed, appears now in the countries with poorly-developed institutions.

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Table 10
Estimation results for the level of the World Bank worldwide governance indicator (model 9)

Regressor	World countries			EU27 countries			24 post-socialist countries		
	beta	st. dev.	pseudo t	beta	st. dev.	pseudo t	beta	st. dev.	pseudo t
WGI	0.0377	0.0087	4.34	0.2237	0.0360	6.21	0.0669	0.0126	5.32
(WGI) ²	0.0400	0.0053	7.53	0.0173	0.0150	1.15	0.1100	0.0161	6.85
lngdp0	0.8304	0.0047	174.96	0.7191	0.0079	91.48	0.8115	0.0102	79.82
inv	0.0041	0.0003	13.75	0.0166	0.0006	27.04	0.0252	0.0008	32.30
edu_exp	-0.0550	0.0024	-22.59	-0.0504	0.0036	-13.89	-0.1061	0.0050	-21.19
gov_cons	-0.0063	0.0005	-11.66	0.0013	0.0020	0.64	0.0050	0.0021	2.43
gov_rev	-0.0018	0.0004	-4.39	-0.0100	0.0006	-17.19	-0.0031	0.0008	-4.00
gov_bal	0.0220	0.0005	46.66	0.0214	0.0007	29.46	0.0448	0.0013	34.93
open	0.0006	0.0000	12.89	0.0008	0.0001	15.30	-0.0009	0.0001	-6.52
fdi	0.0062	0.0003	22.55	0.0026	0.0002	15.03	0.0075	0.0006	12.18
cred	0.0006	0.0003	2.16	0.0056	0.0003	17.27	0.0223	0.0010	23.07
inf	-0.0017	0.0002	-11.36	-0.0056	0.0006	-9.34	-0.0014	0.0002	-6.18
life	0.0570	0.0232	2.46	0.1106	0.1564	0.71	-0.2112	0.1401	-1.51
fert	-0.3961	0.0090	-43.98	-0.1258	0.0191	-6.58	-0.3384	0.0201	-16.85
pop_15_64	0.0043	0.0007	6.05	-0.0070	0.0014	-5.17	0.0091	0.0024	3.78
pop_den	0.0030	0.0012	2.63	0.0115	0.0019	5.90	-0.0381	0.0049	-7.71
pop_gr	-0.0653	0.0018	-36.05	0.1172	0.0052	22.44	0.0356	0.0061	5.87
pop_tot	-0.0172	0.0010	-16.58	0.0203	0.0012	16.38	0.0346	0.0037	9.31

WGI – the World Bank worldwide governance indicator. The remaining variables are defined in Table 2.

Figure 5. The impact of the level of governance quality (the World Bank worldwide governance indicator) on economic growth (model 9)

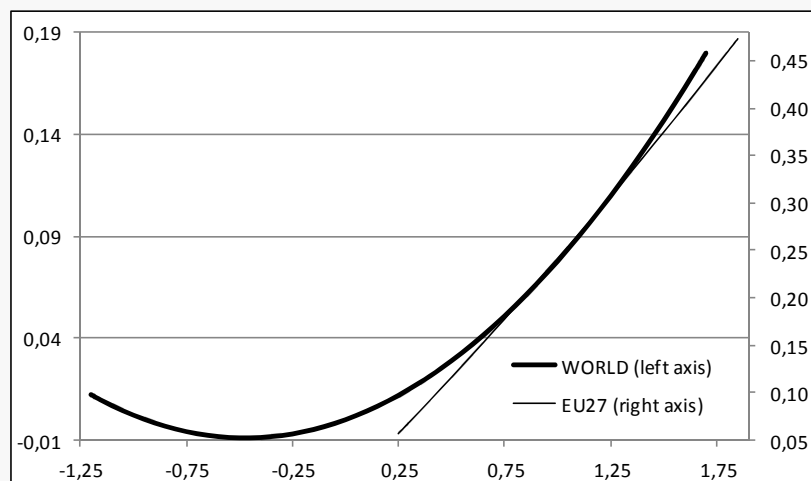
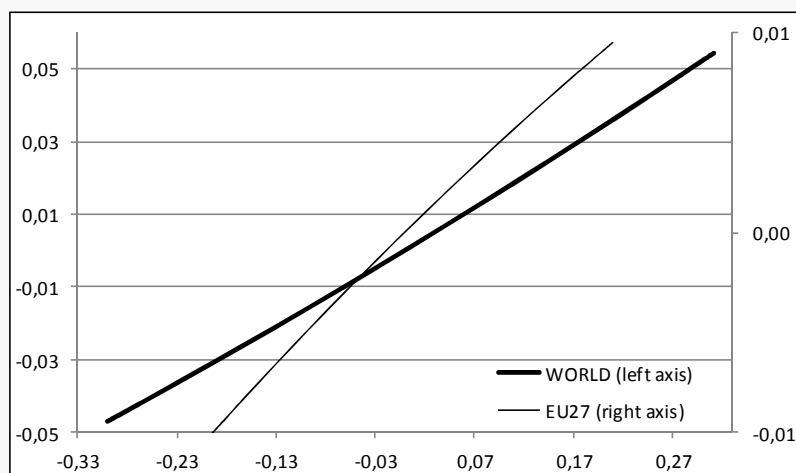


Table 11
Estimation results for the change in the World Bank worldwide governance indicator (model 11)

Regressor	World countries			EU27 countries			24 post-socialist countries		
	beta	st. dev.	pseudo t	beta	st. dev.	pseudo t	beta	st. dev.	pseudo t
Δ WGI	0.1655	0.0109	15.24	0.0487	0.0191	2.54	0.2676	0.0307	8.72
$(\Delta$ WGI) ²	0.0284	0.0340	0.83	-0.0162	0.0784	-0.21	-0.0336	0.0676	-0.50
lngdp0	0.9162	0.0085	107.42	0.7668	0.0104	74.07	0.8785	0.0129	68.23
inv	0.0104	0.0004	24.83	0.0064	0.0009	7.27	0.0201	0.0011	19.00
edu_exp	-0.0502	0.0030	-16.69	-0.0214	0.0049	-4.39	-0.0470	0.0078	-6.03
gov_cons	-0.0001	0.0007	-0.10	0.0027	0.0029	0.93	-0.0088	0.0022	-4.03
gov_rev	-0.0082	0.0005	-15.27	-0.0076	0.0008	-9.41	0.0041	0.0012	3.51
gov_bal	0.0260	0.0007	38.52	0.0249	0.0009	27.40	0.0343	0.0015	23.06
open	0.0015	0.0001	24.78	-0.0003	0.0001	-3.81	0.0004	0.0002	2.15
fdi	0.0034	0.0003	12.31	0.0020	0.0002	8.83	0.0067	0.0008	8.79
cred	0.0031	0.0004	7.65	0.0010	0.0004	2.37	0.0157	0.0013	12.41
inf	-0.0018	0.0002	-11.47	-0.0053	0.0009	-6.18	-0.0003	0.0003	-1.00
life	-0.6847	0.0553	-12.37	-1.0995	0.2410	-4.56	-2.0435	0.1838	-11.12
fert	-0.1744	0.0097	-17.90	-0.0979	0.0255	-3.84	-0.1059	0.0228	-4.64
pop_15_64	0.0095	0.0008	12.70	-0.0232	0.0018	-13.15	0.0057	0.0025	2.30
pop_den	-0.0045	0.0013	-3.61	0.0098	0.0026	3.76	0.0111	0.0075	1.49
pop_gr	-0.0160	0.0012	-12.84	0.0868	0.0067	12.99	0.0355	0.0070	5.08
pop_tot	0.0061	0.0013	4.70	-0.0005	0.0015	-0.31	0.0050	0.0039	1.28

WGI – the World Bank worldwide governance indicator. The remaining variables are defined in Table 2.

Figure 6. The impact of the change in governance quality (the World Bank worldwide governance indicator) on economic growth (model 11)



INTERPRETATION

- The differences between these models and the earlier ones suggest that **the results are not entirely robust to the sample of countries** and to **the exact measure of the regulatory variable**.
- Regulatory variables taken from different sources cover various areas of institutions and they **do not exhibit an identical impact** on economic growth.
- The institutional environment is a very wide economic, political and social concept and even considering relatively similar (but surely not the same) indices measuring regulations we do not obtain the same results.
- **This finding will be reinforced later when considering composite indicators of the aggregated indices, and the democracy index.**

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RESULTS – DEMOCRACY INDEX

- The level of democracy reveals a **statistically significant and nonlinear** impact on GDP dynamics.
- The direction of this relationship is **different in the whole analyzed sample of countries and in the EU27 group**.
- The association between the level of democracy and GDP dynamics is **rather negative in the whole sample** of countries.

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Table 12
Estimation results for the level of the Freedom House democracy index (model 13)

Regressor	World countries			EU27 countries ^a			19 post-socialist countries		
	beta	st. dev.	pseudo t	beta	st. dev.	pseudo t	beta	st. dev.	pseudo t
DEM	-0.0549	0.0099	-5.56	0.3558	0.0314	11.33	-0.2417	0.0277	-8.72
(DEM) ²	0.0049	0.0012	4.13	-0.0251	0.0028	-9.09	0.0313	0.0029	10.74
lngdp0	0.8888	0.0036	247.77	0.8403	0.0070	120.28	0.7997	0.0103	77.99
inv	0.0027	0.0002	11.33	0.0044	0.0004	10.20	0.0105	0.0009	12.10
school_tot	-0.0270	0.0020	-13.73	0.0039	0.0012	3.22	0.1441	0.0072	19.89
school_ter	-0.0001	0.0003	-0.20	0.0051	0.0005	10.21	0.0109	0.0013	8.13
edu_exp	-0.0441	0.0018	-24.18	0.0024	0.0022	1.13	-0.0628	0.0051	-12.26
gov_cons	-0.0101	0.0006	-17.40	-0.0191	0.0011	-17.20	-0.0292	0.0018	-16.00
open	0.0009	0.0000	19.71	0.0001	0.0000	2.09	-0.0013	0.0002	-7.94
cab	0.0049	0.0004	13.67	0.0059	0.0004	13.71	0.0086	0.0014	6.38
fdi	0.0061	0.0005	11.46	0.0052	0.0005	11.39	-0.0019	0.0012	-1.61
cred	0.0019	0.0005	4.02	0.0029	0.0004	6.84	0.0093	0.0008	11.42
inf	-0.0000	0.0000	-2.68	-0.0015	0.0001	-23.51	-0.0008	0.0001	-14.01
serv	-0.0035	0.0003	-11.91	0.0026	0.0003	7.82	0.0025	0.0005	4.64
life	0.6368	0.0204	31.23	0.8363	0.0896	9.34	-0.1246	0.1359	-0.92
fert	-0.3132	0.0068	-46.28	-0.1347	0.0128	-10.51	-0.4783	0.0246	-19.41
pop_15_64	0.0164	0.0004	44.61	-0.0010	0.0007	-1.44	-0.0042	0.0026	-1.63
pop_den	-0.0118	0.0008	-14.69	-0.0028	0.0014	-2.03	-0.1073	0.0063	-16.98
pop_gr	-0.0015	0.0017	-0.90	-0.0243	0.0029	-8.39	-0.0481	0.0071	-6.80
pop_tot	-0.0043	0.0007	-6.29	-0.0052	0.0013	-3.96	0.0268	0.0031	8.60

^a Without Greece.

DEM – the Freedom House democracy index. The remaining variables are defined in Table 2.

Figure 7. The impact of the level of democracy (Freedom House index) on economic growth (model 13)

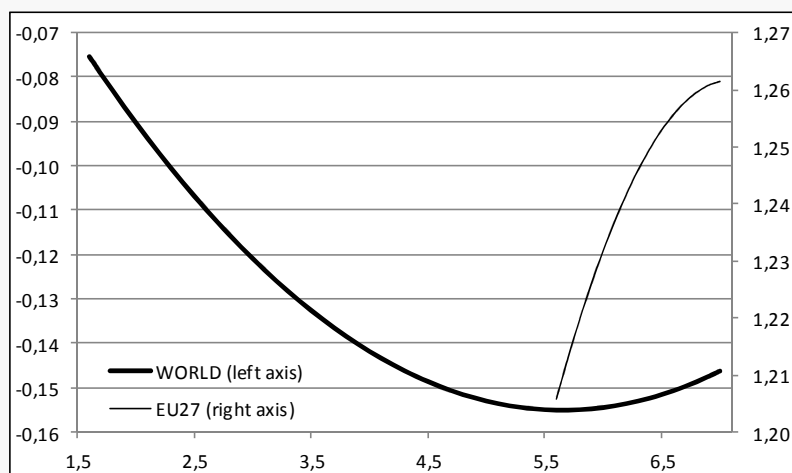


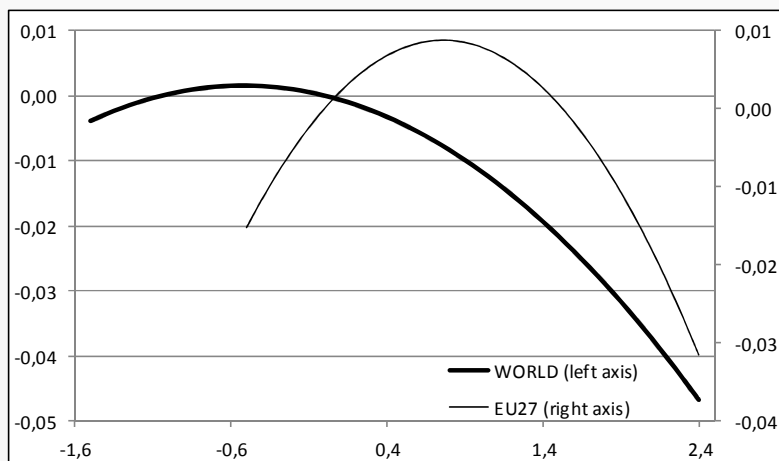
Table 13
Estimation results for the change in the Freedom House democracy index (model 15)

Regressor	World countries			EU27 countries ^a			19 post-socialist countries		
	beta	st. dev.	pseudo t	beta	st. dev.	pseudo t	beta	st. dev.	pseudo t
ΔDEM	-0.0059	0.0018	-3.26	0.0230	0.0031	7.36	-0.0175	0.0064	-2.72
(ΔDEM) ²	-0.0057	0.0006	-9.44	-0.0150	0.0008	-18.54	-0.0045	0.0015	-3.05
lngdp0	0.8776	0.0046	192.82	0.8241	0.0116	71.07	0.9094	0.0107	85.03
inv	0.0015	0.0003	5.18	0.0028	0.0005	6.03	0.0121	0.0011	10.91
school_tot	-0.0136	0.0019	-7.28	0.0090	0.0014	6.67	0.0851	0.0104	8.21
school_ter	-0.0001	0.0004	-0.37	0.0085	0.0006	15.08	0.0038	0.0017	2.26
edu_exp	-0.0292	0.0021	-13.88	0.0175	0.0024	7.20	-0.0203	0.0058	-3.52
gov_cons	-0.0033	0.0005	-6.12	-0.0060	0.0012	-5.17	-0.0198	0.0022	-8.90
open	0.0002	0.0001	4.42	0.0006	0.0001	10.95	-0.0010	0.0002	-5.24
cab	0.0034	0.0004	9.31	0.0082	0.0006	14.80	0.0017	0.0013	1.31
fdi	0.0066	0.0006	10.96	0.0079	0.0005	16.93	-0.0002	0.0015	-0.15
cred	0.0028	0.0005	5.14	0.0022	0.0005	4.50	0.0067	0.0011	5.97
inf	-0.0000	0.0000	-2.12	-0.0012	0.0001	-14.07	-0.0006	0.0001	-6.81
serv	-0.0040	0.0004	-10.71	0.0031	0.0004	8.71	0.0022	0.0007	3.02
life	0.3435	0.0210	16.36	0.4807	0.1278	3.76	0.1029	0.1461	0.70
fert	-0.3617	0.0139	-26.00	-0.0680	0.0083	-8.21	-0.2877	0.0263	-10.93
pop_15_64	0.0037	0.0005	7.14	0.0021	0.0011	1.81	0.0054	0.0030	1.82
pop_den	-0.0115	0.0009	-13.04	-0.0054	0.0015	-3.70	-0.0384	0.0060	-6.42
pop_gr	0.0470	0.0025	18.47	-0.0345	0.0031	-11.08	-0.0616	0.0075	-8.17
pop_tot	-0.0031	0.0007	-4.32	-0.0087	0.0012	-7.03	0.0102	0.0038	2.65

^a Without Greece.

DEM – the Freedom House democracy index. The remaining variables are defined in Table 2.

Figure 8. The impact of the change in democracy (Freedom House index) on economic growth (model 15)



INTERPRETATION

- At the first view, this relationship may be interpreted as **spurious**.
- However, the results might confirm that democracy reveals a **nonlinear** impact on economic growth and **the fastest-growing countries are those which are the most and the least democratic**.
- E.g. some non-democratic countries (United Arab Emirates or China) revealed during the last decades very rapid economic growth, like several democratic countries (Luxembourg or the United States).
- It may be the case that **a medium level of democracy is the most detrimental to growth**.

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RESULTS – TRANSITION INDICATOR

- The progress in structural (market) reforms shows a **positive impact** on output growth.
- The level of the EBRD transition indicator affects GDP dynamics in a **nonlinear** way.

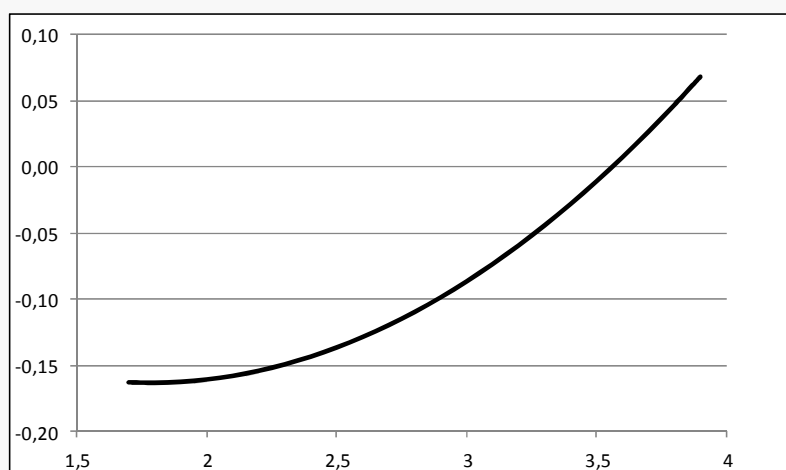
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Table 14
Estimation results for the level of and the change in the EBRD transition indicator (models 19 and 21)

Regressor	Model 19: 27 post-socialist countries			Model 21: 27 post-socialist countries		
	beta	st. dev.	pseudo t	beta	st. dev.	pseudo t
TRAN	-0.1836	0.0506	-3.63			
(TRAN) ²	0.0515	0.0092	5.61			
Δ TRAN				0.0111	0.0209	0.53
(Δ TRAN) ²				-0.1237	0.0135	-9.14
lngdp0	0.8851	0.0110	80.68	0.8755	0.0101	86.39
inv	0.0119	0.0007	16.90	0.0172	0.0009	19.83
gov_cons	-0.0384	0.0018	-21.36	-0.0272	0.0018	-15.10
open	0.0009	0.0002	5.42	0.0015	0.0002	8.05
pop_15_64	0.0656	0.0014	48.28	0.0641	0.0016	40.16
pop_den	-0.1151	0.0039	-29.83	-0.0073	0.0046	-1.58
pop_gr	0.0034	0.0034	1.01	-0.0506	0.0042	-11.94
pop_tot	-0.0123	0.0027	-4.48	-0.0048	0.0031	-1.54

TRAN – the EBRD transition indicator. The remaining variables are defined in Table 2.

Figure 9. The impact of the level in the progress of market reforms (the EBRD transition indicator) on economic growth in the post-socialist countries (model 19)



INTERPRETATION

- **Transition countries**, to accelerate economic growth and to come closer to Western Europe in terms of the level of development, **should undertake market reforms** in the areas of **privatization, enterprise restructuring, international trade and foreign exchange system, price liberalization** etc.
- There is much room to carry out such reforms especially in the non-EU transition countries, namely post-Yugoslav republics (Serbia and Montenegro, Bosnia and Herzegovina, Macedonia) and the CIS countries (Ukraine, Belarus as well as Caucasian and Central Asian republics).

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COMPONENT INDICATORS (1/3)

- **First, the individual component indicators of the aggregated regulatory indices sometimes reveal similar behavior as regards the impact on economic growth.**
- This concerns mainly the component indices of the **Heritage Foundation index of economic freedom** for which the positive relationship with economic growth was evidenced in the case of most of them.
- Component indices of the **EBRD transition indicator** (in levels) also reveal a positive impact on economic growth.
- Some similar tendencies may also be found for component indicators of the **Fraser Institute index of economic freedom** and the **worldwide governance indicator**.

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COMPONENT INDICATORS (2/3)

- **Second, the similarity of the results is not a rule.**
- It may be argued that various areas of regulations affect the pace of economic growth differently, taking into account also the statistical significance of the impact as well as the character of a nonlinear relationship (concave vs. convex functions).
 - ⇒ **The results are not robust to a selected institutional variable.**
- Cause: indices analyzed in this study cover different regulatory environment; and various institutional areas may exhibit different impact on economic growth.
 - ⇒ **The need for further testing of the relationship between regulations (institutions) and economic growth – also with the use of non-econometrical approaches.**

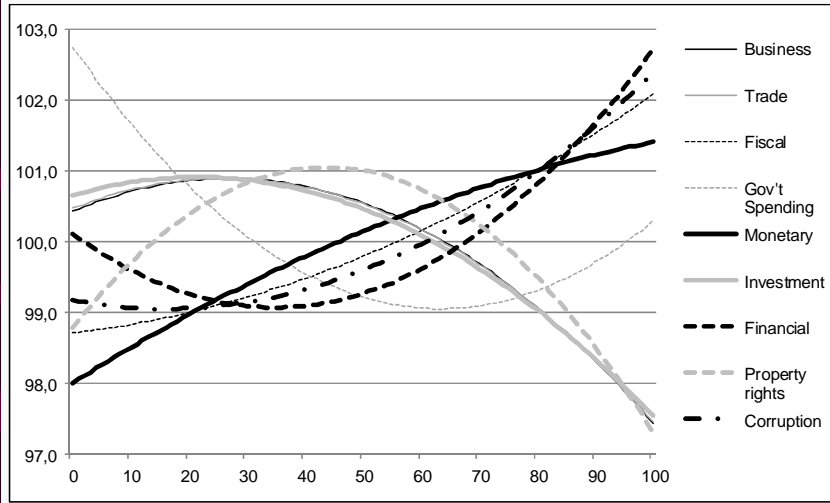
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COMPONENT INDICATORS (3/3)

- **Almost all the doing business indicators do not reveal a statistically significant association with economic growth.**
- ⇒ The analysis based on panel data with the use of overlapping periods is better than that based on cross-sectional data in the sense that the former one leads more often to statistically significant results.
- ⇒ If the whole analysis presented here was carried out based on cross-sectional data, it would be possible to get the majority of insignificant results and the conclusions would be very weak.

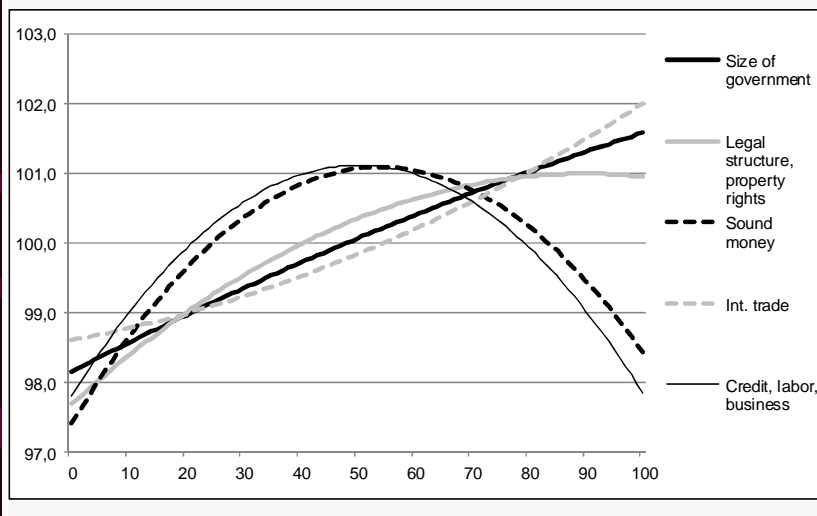
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Figure 11. The impact of the level of component indicators of the Heritage Foundation index of economic freedom on economic growth (standardized functions, world countries) – model 2



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Figure 13. The impact of the level of component indicators of the Fraser Institute index of economic freedom on economic growth (standardized functions, world countries) – model 7



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Figure 15. The impact of the level of component indices of the World Bank worldwide governance indicator on economic growth (standardized functions, world countries) – model 10

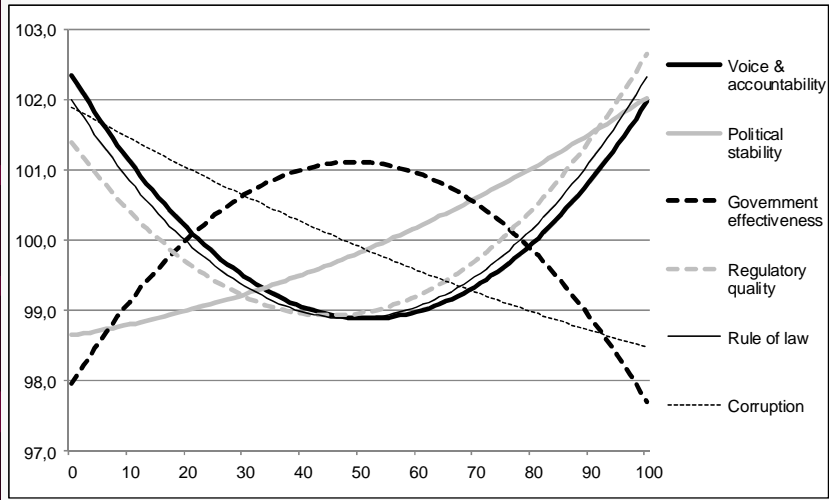


Figure 17. The impact of the level of component indicators of the Freedom House democracy index and freedom of the press index on economic growth (standardized functions, world countries) – model 14

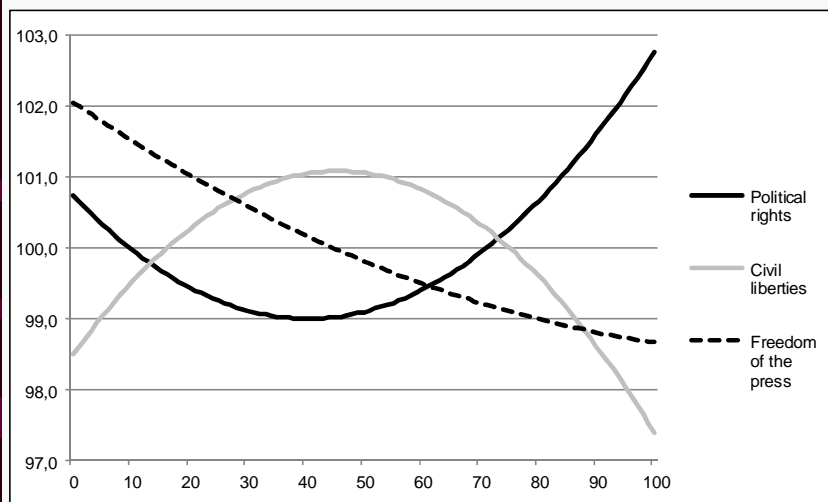


Table 19
Estimation results for the World Bank doing business indicators (models 17 and 18)

Regressor	Model 17: World countries			Regressor	Model 18: World countries		
	beta	st. dev.	pseudo r ²		beta	st. dev.	pseudo r ²
Cost to build a warehouse (% of income per capita)	-0.0000	0.0000	-1.13	Δ...	-0.0000	0.0000	-1.09
(Cost to build a warehouse) ²	0.0000	0.0000	1.02	(Δ...) ²	-0.0000	0.0000	-1.41
Extent of disclosure index (0 to 10)	-0.0126	0.0018	-0.64	Δ...	0.0040	0.0273	0.14
(Extent of disclosure index) ²	0.0008	0.0018	0.46	(Δ...) ²	0.0000	0.0049	0.01
Time to start a business (days)	0.0007	0.0006	1.21	Δ...	-0.0013	0.0005	-2.46
(Time to start a business) ²	-0.0000	0.0000	-1.27	(Δ...) ²	-0.0000	0.0000	-1.79
Credit: Strength of legal rights index (0=weak to 10=strong)	0.0259	0.0269	0.97	Δ...	-0.0206	0.0188	-1.10
(Credit: Strength of legal rights index) ²	-0.0020	0.0023	-0.86	(Δ...) ²	0.0042	0.0037	1.15
Tax payments (number)	-0.0007	0.0019	-0.36	Δ...	-0.0006	0.0016	-0.36
(Tax payments) ²	0.0000	0.0000	0.07	(Δ...) ²	0.0000	0.0000	0.37
Procedures to build a warehouse (number)	0.0059	0.0053	1.11	Δ...	0.0016	0.0043	0.38
(Procedures to build a warehouse) ²	-0.0000	0.0001	-0.37	(Δ...) ²	0.0003	0.0003	1.01
Trade: Cost to import (US\$ per container)	-0.0000	0.0000	-0.02	Δ...	0.0000	0.0000	1.14
(Trade: Cost to import) ²	-0.0000	0.0000	-0.37	(Δ...) ²	-0.0000	0.0000	-1.30
Cost to enforce a contract (% of claim)	-0.0012	0.0018	-0.68	Δ...	-0.0008	0.0039	-0.20
(Cost to enforce a contract) ²	0.0000	0.0000	0.91	(Δ...) ²	0.0000	0.0000	0.17
Time to prepare and pay taxes (hours)	0.0001	0.0001	1.47	Δ...	-0.0004	0.0001	-2.94
(Time to prepare and pay taxes) ²	-0.0000	0.0000	-1.24	(Δ...) ²	-0.0000	0.0000	-2.17
Depth of credit information index (0=low to 6=high)	0.0131	0.0230	0.57	Δ...	0.0535	0.0223	2.40
(Depth of credit information index) ²	0.0011	0.0037	0.30	(Δ...) ²	-0.0067	0.0050	-1.36
Time to build a warehouse (days)	0.0003	0.0002	1.23	Δ...	-0.0001	0.0003	-0.18
(Time to build a warehouse) ²	-0.0000	0.0000	-1.12	(Δ...) ²	-0.0000	0.0000	-0.94
Trade: Documents to export (number)	0.0086	0.0398	0.22	Δ...	-0.0028	0.0173	-0.16
(Trade: Documents to export) ²	0.0004	0.0027	0.16	(Δ...) ²	-0.0015	0.0028	-0.53
Minimum paid-in capital to start a business (% of income per capita)	-0.0003	0.0001	-2.50	Δ...	0.0001	0.0001	0.92
(Minimum paid-in capital to start a business) ²	0.0000	0.0000	1.57	(Δ...) ²	0.0000	0.0000	0.00
Procedures to enforce a contract (number)	0.0038	0.0172	0.22	Δ...	-0.0067	0.0139	-0.48
(Procedures to enforce a contract) ²	-0.0001	0.0002	-0.34	(Δ...) ²	-0.0048	0.0046	-1.04
Trade: Documents to import (number)	-0.0167	0.0272	-0.61	Δ...	0.0108	0.0122	0.89
(Trade: Documents to import) ²	0.0007	0.0015	0.44	(Δ...) ²	0.0012	0.0014	0.85
Cost to register property (% of property value)	-0.0149	0.0068	-2.18	Δ...	0.0044	0.0092	0.48
(Cost to register property) ²	0.0002	0.0003	0.58	(Δ...) ²	0.0002	0.0013	0.17
Total tax rate (% of profit)	-0.0007	0.0010	-0.68	Δ...	-0.0008	0.0012	-0.65
(Total tax rate) ²	0.0000	0.0000	0.12	(Δ...) ²	-0.0000	0.0000	-0.66
Ease of shareholder suits index (0 to 10)	0.0094	0.0247	0.38	Δ...	0.0234	0.0334	0.70
(Ease of shareholder suits index) ²	0.0004	0.0021	0.18	(Δ...) ²	0.0011	0.0021	0.12
Time to enforce a contract (days)	-0.0003	0.0002	-2.30	Δ...	-0.0003	0.0002	-1.44
(Time to enforce a contract) ²	0.0000	0.0000	3.15	(Δ...) ²	-0.0000	0.0000	-1.14
Procedures to register property (number)	0.0113	0.0221	0.51	Δ...	-0.0198	0.0180	-1.10
(Procedures to register property) ²	-0.0008	0.0016	-0.50	(Δ...) ²	0.0004	0.0048	0.09
Trade: Time to export (day)	-0.0039	0.0042	-0.92	Δ...	-0.0019	0.0033	-0.57
(Trade: Time to export) ²	0.0001	0.0000	1.59	(Δ...) ²	0.0001	0.0001	0.52
Cost to start a business (% of income per capita)	-0.0004	0.0003	-1.19	Δ...	0.0000	0.0002	0.10
(Cost to start a business) ²	0.0000	0.0000	0.71	(Δ...) ²	0.0000	0.0000	0.16
Strength of investor protection index (0 to 10)	0.0373	0.0441	0.85	Δ...	0.0335	0.0462	0.72
(Strength of investor protection index) ²	-0.0018	0.0038	-0.47	(Δ...) ²	-0.0047	0.0139	-0.34
Trade: Cost to export (US\$ per container)	0.0000	0.0001	0.17	Δ...	0.0000	0.0000	1.04
(Trade: Cost to export) ²	0.0000	0.0000	0.07	(Δ...) ²	-0.0000	0.0000	-0.56
Extent of director liability index (0 to 10)	0.0190	0.0206	0.92	Δ...	0.0179	0.0312	0.57
(Extent of director liability index) ²	-0.0022	0.0021	-1.05	(Δ...) ²	-0.0031	0.0058	-0.53
Time to register property (days)	0.0006	0.0005	1.21	Δ...	-0.0004	0.0002	-1.80
(Time to register property) ²	-0.0000	0.0000	-0.80	(Δ...) ²	-0.0000	0.0000	-1.89
Procedures to start a business (number)	0.0098	0.0171	0.58	Δ...	0.0029	0.0112	0.26
(Procedures to start a business) ²	-0.0007	0.0009	-0.75	(Δ...) ²	-0.0005	0.0014	-0.36
Trade: Time to import (days)	0.0037	0.0037	1.02	Δ...	0.0007	0.0025	0.29
(Trade: Time to import) ²	-0.0000	0.0000	-0.71	(Δ...) ²	0.0000	0.0001	0.74

Parameter estimates for the other explanatory variables are not reported in the table.

Figure 19. The impact of the level of selected doing business indicators (World Bank) on economic growth (standardized functions, world countries) – model 17

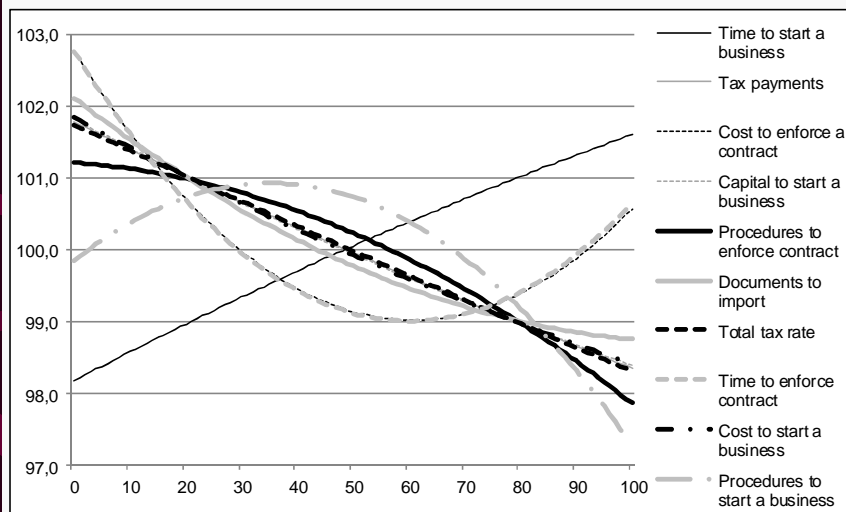
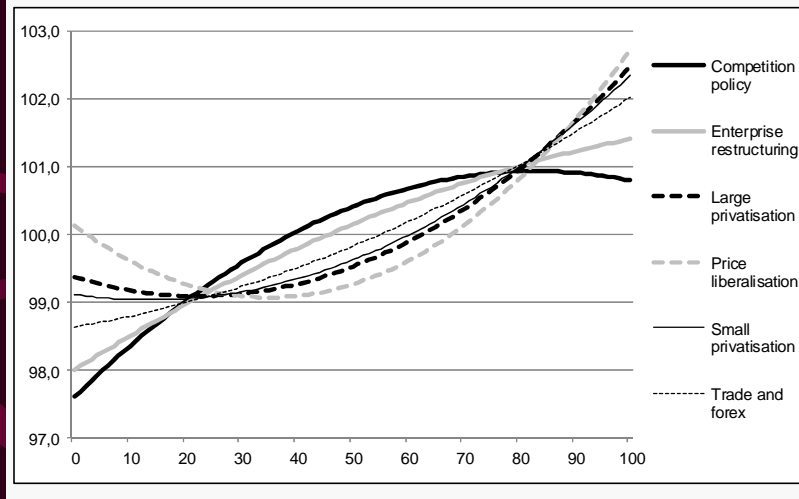


Figure 21. The impact of the level of component indices of the EBRD transition indicator on economic growth (standardized functions, post-socialist countries) – model 20



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THE OTHER EXPLANATORY VARIABLES

- All the models confirm the existence of **conditional β -convergence**: $\beta = 1.0-3.9\%$ for the world, $\beta = 1.1-6.9\%$ for the EU27 countries, and $\beta = 0.9-4.4\%$ for transition economies.
 ⇒ β -coefficients for the EU27 countries are greater than those for the full sample of countries. It is in line with the view that EU countries catch up at a faster rate than the world as a whole. → Positive trends in the EU: development gap between new and old EU members is falling.
- **Government expenditures on consumption** do not contribute to faster economic growth.
- Highly beneficial effects of **investment** on economic growth.
- Negative impact of **inflation** on economic growth.
- For human capital variables, represented by the two enrolment ratios and life expectancy, the results indicate in general the positive impact on economic growth (with some exceptions).

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SUMMARY AND MAIN FINDINGS

1. The study examines the relationship between the regulatory variables and economic growth on the basis of Bayesian model pooling applied to Blundell and Bond's GMM system estimator.
2. The areas of regulations (institutions) are measured by the following indicators: index of economic freedom, worldwide governance indicators, democracy index, doing business indicators, transition indicators.
3. Most of the models are estimated based on overlapping panel data and they include nonlinearities.
4. In general, regulatory environment is an important determinant of economic growth.
5. To achieve rapid growth, it is necessary to increase economic freedom, quality of governance, and market reforms.
6. The association between regulatory variables and GDP dynamics is mostly nonlinear.
7. The countries with greater scope of economic freedom record more rapid GDP growth but a given increase in economic freedom has a higher impact on growth in those countries that are economically not (or partly) free.
8. However, the results are not robust in a lot of areas – with regard to the sample of countries, the exact measure of the regulatory variable, and the type of nonlinear impact (concave vs. convex functions).
9. There are many factors affecting both regulations and GDP dynamics as well as many transmission channels between these areas and the results sometimes are mixed.

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**Thank you
for the attention 😊**



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