

COMPETITION AND ECONOMIC GROWTH. AN ECONOMETRIC ANALYSIS

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Abstract: *This paper is not about reviewing the theoretical approach (from Smith, Schumpeter and others) regarding the relationship between competition and economic growth. Its purpose is just to test the existence of a relationship between the dynamics of gross domestic product and the intensity of competition, on a worldwide sample, made of 142 countries, between 2007 and 2017. We have proved the existence of a positive and significant impact between the intensity of competition and the dynamics of gross domestic product.*

Keywords: Competition, Gross Domestic Product, Dynamic Panel Data

JEL Classification: D4, F63, C33

Introduction

Competition is considered an essential element of the efficiency of the goods market and is assessed on a scale from 1 to 7 (the highest rank). When including competition among the essential factors of competition, World Economic Forum (2017) considers the following:

"Healthy market competition, both domestic and foreign, is important in driving market efficiency, and thus business productivity, by ensuring that the most efficient firms, producing goods demanded by the market, are those that thrive" World Economic Forum 2017. *Global Competitiveness Report 2017–2018 (GCI)*. Appendix A: Methodology and Computation of the GCI 2017–2018, p. 318, accessed on May 6, 2018, available at <http://www3.weforum.org/docs/GCR2017-2018/05FullReport/TheGlobalCompetitivenessReport2017%E2%80%932018.pdf>.

We analyse the relationship between the dynamics of gross domestic product and the intensity of competition, by using data generated by "World Economic Forum" in the context of calculation regarding the "Global Competitiveness Index".

1. Data and methodology

1.1. Gross Domestic Product

The dynamics of gross domestic product is calculated, for each country, as a changes in volume compared to the average value for 2010 (considered to be 100%). The data is retrieved in Annex 2.

All unit root tests applied to GDP series which, as null hypothesis, assume that individual unit root process, *reject* non-stationarity in the model with individual effects and individual linear trends as exogenous variables. The common unit root is rejected by the Levin, Lin, Chu test and is not rejected by Breitung's t -ratio type test statistic. We accept the hypothesis according to which series are generated by stationary innovations around deterministic trends.

1.2. Competition

In order to assess the intensity (level) of competition, we use the data generated by "World Economic Forum" in the context of calculation regarding "Global Competitiveness Index" (data accessed in May 6, 2018, available at <http://reports.weforum.org/global-competitiveness-index-2017-2018/downloads/>).

In World Economic Forum valuations, the *competition* sub-pillar of competitiveness is computed as the weighted average of two constituents: *domestic competition* and *foreign competition*. The components are as follows (Table 1):

Table 1: Indicators of competition

1. Domestic competition	
01	Intensity of local competition, [1 = not intense at all; 7 = extremely intense]
02	Extent of market dominance [1 = dominated by a few business groups; 7 = spread among many firms]
03	Effectiveness of anti-monopoly policy [1 = not effective at all; 7 = extremely effective]
04	Effect of taxation on incentives to invest [1 = to a great extent; 7 = not at all]
05	Total tax rate [profit tax (% of profits), labour tax and contribution (% of profits), and other taxes (% of profits)]
06	Number of procedures required to start a business [number]
07	Time required to start a business [number of days]
08	Agricultural policy costs [1 = excessively burdensome for the economy; 7 = balances well the interests of taxpayers, consumers, and producers]
2. Foreign competition	
09	Prevalence of trade barriers [1 = strongly limit; 7 = do not limit at all]
10	Trade tariffs [average tariff rate, %]
11	Prevalence of foreign ownership [1 = extremely rare; 7 = extremely prevalent]
12	Business impact of rules on FDI [1 = extremely restrictive; 7 = not restrictive at all]
13	Burden of customs procedures [1 = extremely inefficient; 7 = extremely efficient]
14	Imports as a percentage of GDP [%]

Source: World Economic Forum 2017. "The Global Competitiveness Report 2017–2018". *Appendix A: Methodology and Computation of the Global Competitiveness Index 2017–2018*, p.324 and *Appendix D: Technical Notes and Sources*, pp. 346-347. Available at <http://www3.weforum.org/docs/GCR2017-2018/05FullReport/TheGlobalCompetitivenessReport2017%E2%80%932018.pdf>

According to the estimates, the highest level of competition is reached in Singapore, with 6.1 points out of maximum 7. The first European country in this ranking is The Netherlands (ranked the 4th, with 5.7 points), followed by Luxembourg and Ireland.

Romania is ranked the 70th (out of 137 countries) with 4.1 points, with a difference of 25.85% compared to the best performing economy (Singapore).

An excerpt from "The Global Competitiveness Index" World Economic Forum, 2017. *The Global Competitiveness Report 2017–2018* is shown in Table 2.

Table 2. Intensity of Competition

Country	Score 1:7	Dist. from best	Country	Score 1:7	Dist. from best
1 Singapore	6.1	0.00%	...		
2 Hong Kong SAR	5.9	2.05%	57 Hungary	4.6	23.71%
3 United Arab Emirates	5.8	4.97%	...		
4 Netherlands	5.7	5.34%	60 Bulgaria	4.6	24.13%
5 Luxembourg	5.7	6.38%	...	...	...
6 Ireland	5.6	7.79%	63 China	4.5	24.85%
7 New Zealand	5.5	8.93%	64 Albania	4.5	24.85%
8 Switzerland	5.5	9.90%	...	...	...
9 United States	5.4	10.04%	69 Zambia	4.5	25.85%
10 United Kingdom	5.4	10.88%	70 Romania	4.5	25.85%
...			71 Senegal	4.5	25.88%
13 Germany	5.3	12.66%	...	...	...
14 Denmark	5.3	12.86%	81 Italy	4.4	27.47%
15 Belgium	5.3	13.13%	...	...	...
...			88 Croatia	4.3	28.32%
25 Japan	5.1	16.16%	...	...	...
26 Czech Republic	5.0	17.09%	93 Moldova	4.3	28.71%
...			94 Nigeria	4.3	28.94%
33 Austria	4.9	18.68%	95 Russian Federation	4.3	28.95%
...		
40 Portugal	4.8	20.04%	98 Serbia	4.3	29.19%
41 Slovak Republic	4.8	20.73%	...	...	...
...			106 Greece	4.2	31.26%
47 Poland	4.7	22.07%	...	...	...
48 France	4.7	22.20%	134 Argentina	3.3	45.61%
...			135 Haiti	3.3	46.23%
55 Spain	4.7	23.17%	136 Chad	3.2	47.22%
			137 Venezuela	2.6	56.38%

Source: Data extracted from World Economic Forum, 2017. *The Global Competitiveness Report 2017–2018*. Available at http://reports.weforum.org/pdf/gci-2017-2018-scorecard/WEF_GCI_2017_2018_Scorecard_GCI.B.06.01.pdf (accessed May 6, 2018).

Romania's position compared to the main indicators on the basis of which the competitive performances of economies are estimated is presented in Table 3 and shown graphically in Figures 1 and 2.

Its European Union membership has provided a good position for Romania in the international ranking regarding *External competition* (5 points out of 7, ranked 37 out of 137 countries). This position is mainly determined by the "Commercial fees" (6.7 points out of 7, ranked 6 out of 137 countries), "The impact of the FDI rules on business" (5.3 points out of 7, ranked 25/137).

As for *Internal competition*, Romania is positioned in the second half of the international ranking (4.3 points out of 7, ranked 89/137). The lowest score is awarded for "Effect of taxation on incentives to invest". For this criterion, the score = 1 shows that taxation discourages investment, whereas 7 shows that taxation encourages investment.

Romania gets 2.9 points out of 7 and is ranked 121 out of 137 countries. Low scores are also awarded for: "Effectiveness of anti-monopoly policy" (3.4 points/7, ranked 95/137), "Intensity of local competition" (4.9 points/7, ranked 86/137) and "Extent of market dominance" (ranked 76/137, 3.6 points/7; 1 means that the market is dominated by a small number of powerful companies, whereas 7 shows the existence of a large number of companies disputing a relatively small share of the market).

Table 3. Romania's position in international ranking regarding competition (2017-2018)

Competition Index	Romania		Best performance:	
	Score	Rank	Country	Dist. from best
Competition	4.5	70	Singapore (6.1)	25.85%
1. Domestic competition	4.3	89	Singapore (5.8)	25.71%
01 Intensity of local competition, [1 = not intense at all; 7 = extremely intense]	4.9	86	Japan (6.2)	21.74
02 Extent of market dominance [1 = dominated by a few business groups; 7 = spread among many firms]	3.6	76	Switzerland (5.9)	39.32%
03 Effectiveness of anti-monopoly policy [1 = not effective at all; 7 = extremely effective]	3.4	95	Finland (5.7)	40.98%
04 Effect of taxation on incentives to invest [1 = to a great extent; 7 = not at all]	2.9	121	United Arab Emirates (6.1)	53.18%
05 Total tax rate [profit tax (% of profits), labour tax and contribution (% of profits), and other taxes (% of profits)]	38.4%	73	Brunei Darussalam (8.7%)	63.77%
06 Number of procedures required to start a business [number]	6 proc.	53	New Zealand (1)	70.00%
07 Time required to start a business [number of days]	12 days	74	New Zealand (1/2)	94.78%
08 Agricultural policy costs [1 = excessively burdensome for the economy; 7 = balances well the interests of taxpayers, consumers, and producers]	3.8	65	New Zealand (5.7)	33.54%
2. Foreign competition	5.0	37	Singapore (6.4)	22.63%
01 Prevalence of trade barriers [1 = strongly limit; 7 = do not limit at all]	4.6	42	Singapore (5.9)	21.35%
02 Trade tariffs [average tariff rate, %]	1.11%	6	Hong Kong (0.00%)	3.77%
03 Prevalence of foreign ownership [1 = extremely rare; 7 = extremely prevalent]	4.2	93	United Kingdom (6.1)	31.27%
04 Business impact of rules on FDI [1 = extremely restrictive; 7 = not restrictive at all]	5.3	25	Singapore (6.1)	13.92%
06 Burden of customs procedures [1 = extremely inefficient; 7 = extremely efficient]	4.2	68	Singapore (6.3)	33.90%
06 Imports as a percentage of GDP [%]	45.9%	64	Hong Kong (194%)	76.33%

Source: Data extracted from World Economic Forum, 2017. *The Global Competitiveness Report 2017–2018*. Available at:

✓ Competition: http://reports.weforum.org/pdf/gci-2017-2018-scorecard/WEF_GCI_2017_2018_Scorecard_GCI.B.06.01.pdf

- ✓ *Domestic competition*: <http://reports.weforum.org/global-competitiveness-index-2017-2018/competitiveness-rankings/#series=GCI.B.06.01.01>
- ✓ *Intensity of local competition*: <http://reports.weforum.org/global-competitiveness-index-2017-2018/competitiveness-rankings/#series=EOSQ099>
- ✓ *Extent of market dominance*: <http://reports.weforum.org/global-competitiveness-index-2017-2018/competitiveness-rankings/#series=EOSQ105>
- ✓ *Effectiveness of anti-monopoly policy*: <http://reports.weforum.org/global-competitiveness-index-2017-2018/competitiveness-rankings/#series=EOSQ104>
- ✓ *Effect of taxation on incentives to invest*: <http://reports.weforum.org/global-competitiveness-index-2017-2018/competitiveness-rankings/#series=EOSQ398>
- ✓ *Total tax rate*: <http://reports.weforum.org/global-competitiveness-index-2017-2018/competitiveness-rankings/#series=CORPTAXRATE>
- ✓ *Number of procedures required to start a business*: <http://reports.weforum.org/global-competitiveness-index-2017-2018/competitiveness-rankings/#series=STARTBUSPROC>
- ✓ *Time required to start a business*: <http://reports.weforum.org/global-competitiveness-index-2017-2018/competitiveness-rankings/#series=STARTBUSDAYS>
- ✓ *Agricultural policy costs*: <http://reports.weforum.org/global-competitiveness-index-2017-2018/competitiveness-rankings/#series=EOSQ046>
- ✓ *Foreign competition*: <http://reports.weforum.org/global-competitiveness-index-2017-2018/competitiveness-rankings/#series=GCI.B.06.01.02>
- ✓ *Prevalence of trade barriers*: <http://reports.weforum.org/global-competitiveness-index-2017-2018/competitiveness-rankings/#series=EOSQ096>
- ✓ *Trade tariffs*: <http://reports.weforum.org/global-competitiveness-index-2017-2018/competitiveness-rankings/#series=TFDUTY>
- ✓ *Prevalence of foreign ownership*: <http://reports.weforum.org/global-competitiveness-index-2017-2018/competitiveness-rankings/#series=EOSQ094>
- ✓ *Business impact of rules on FDI*: <http://reports.weforum.org/global-competitiveness-index-2017-2018/competitiveness-rankings/#series=EOSQ095>
- ✓ *Burden of customs procedures*: <http://reports.weforum.org/global-competitiveness-index-2017-2018/competitiveness-rankings/#series=EOSQ050>
- ✓ *Imports as a percentage of GDP*: <http://reports.weforum.org/global-competitiveness-index-2017-2018/competitiveness-rankings/#series=IMPGDP>

(All the series was accessed on May 2018).

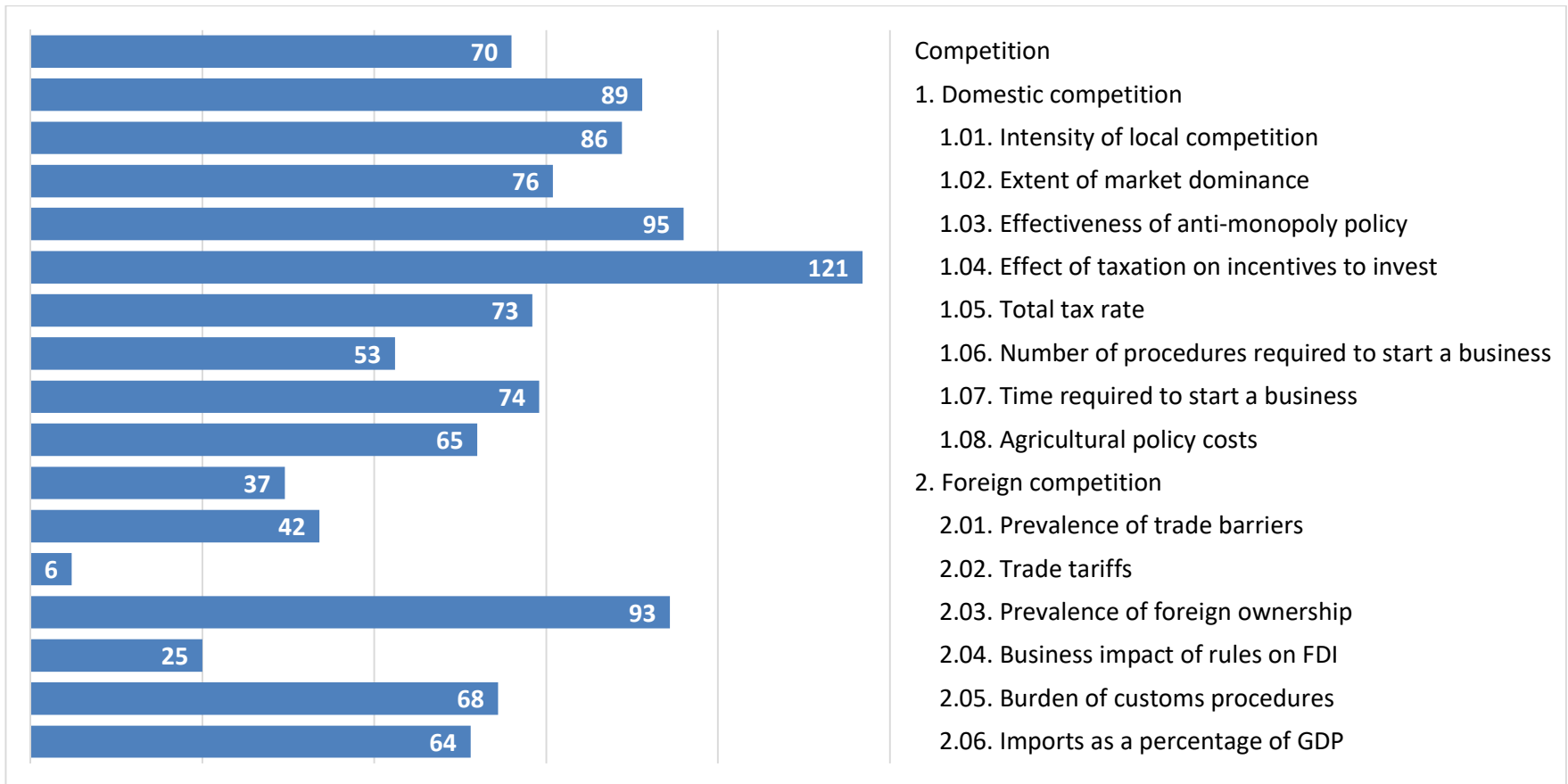


Figure 1. Romania's position in international ranking regarding competition (2017-2018)

Note: Total countries: 137.

Source: Table 3.

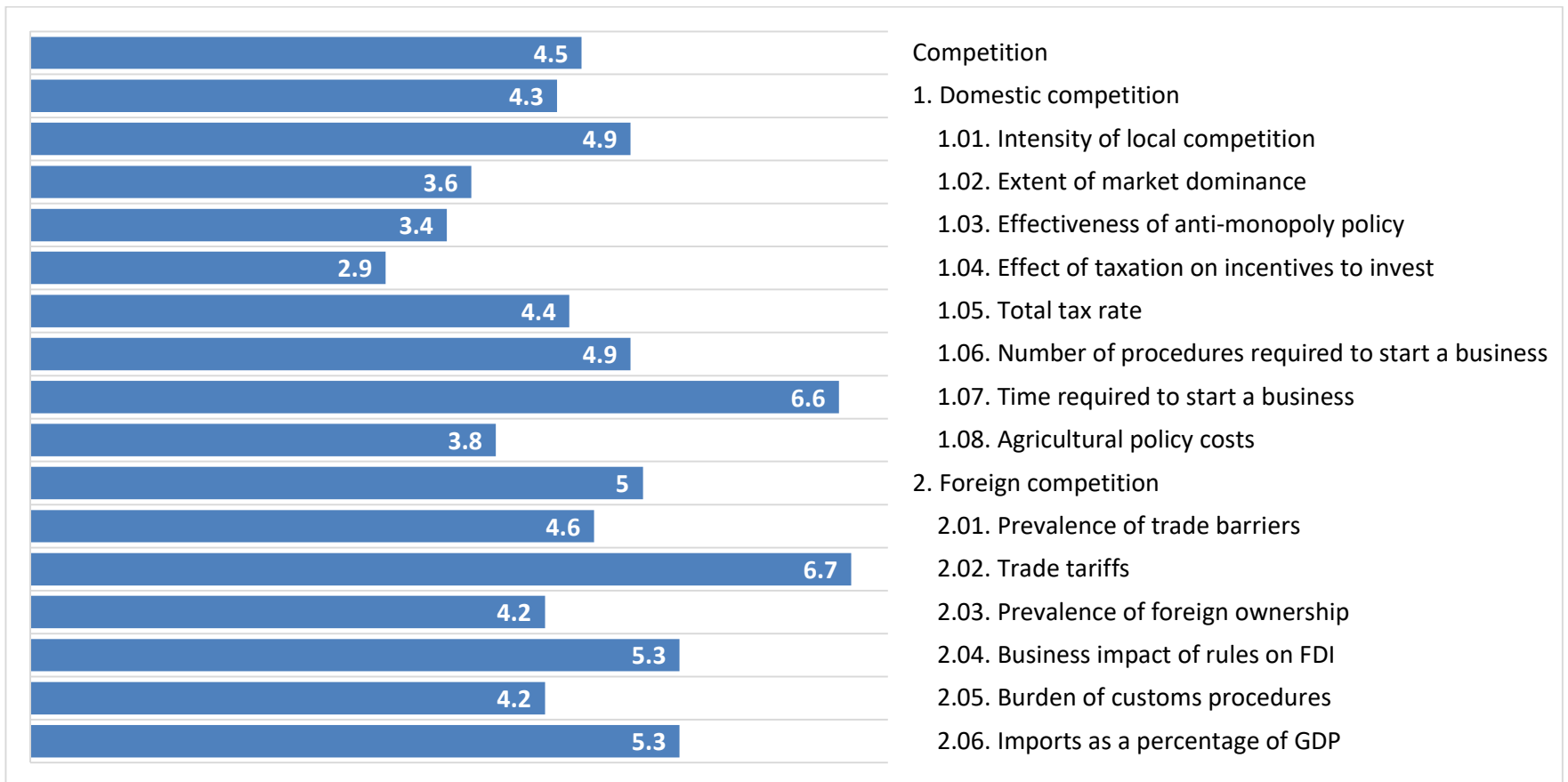


Figure 2. Romania's score in international ranking regarding competition (2017-2018)

Note: Total countries: 137. Score 1 and 7 still correspond to the worst and best possible outcomes.

Source: Table 3.

In order to use time series in econometric analysis, we shall test the nature of the Data Generating Process (DGP), i.e. "the joint probability distribution that is supposed to characterize the entire population from which the data set has been drawn" (Cížek, Härdle and Weron 2005). For this purpose, we apply unit roots panel tests for the data series that estimate the intensity of competition processes in national economies.

As per the data in Annex 2.2., for the model with individual effects, individual linear trends as exogenous variables, two out of three unit roots tests on individual series *reject* the hypothesis of non-stationarity. The common unit root is rejected by the Levin, Lin, Chu test and is not rejected by Breitung's t -ratio type test statistic. We accept the hypothesis according to which series are generated by stationary innovations around deterministic trends.

The series is normally distributed around a mean of 4.42 points (the probability of the null hypothesis in the Jarque-Bera test is 0.06, higher than the standard threshold of 0.05). The distribution normality test is shown in the Figure 3.

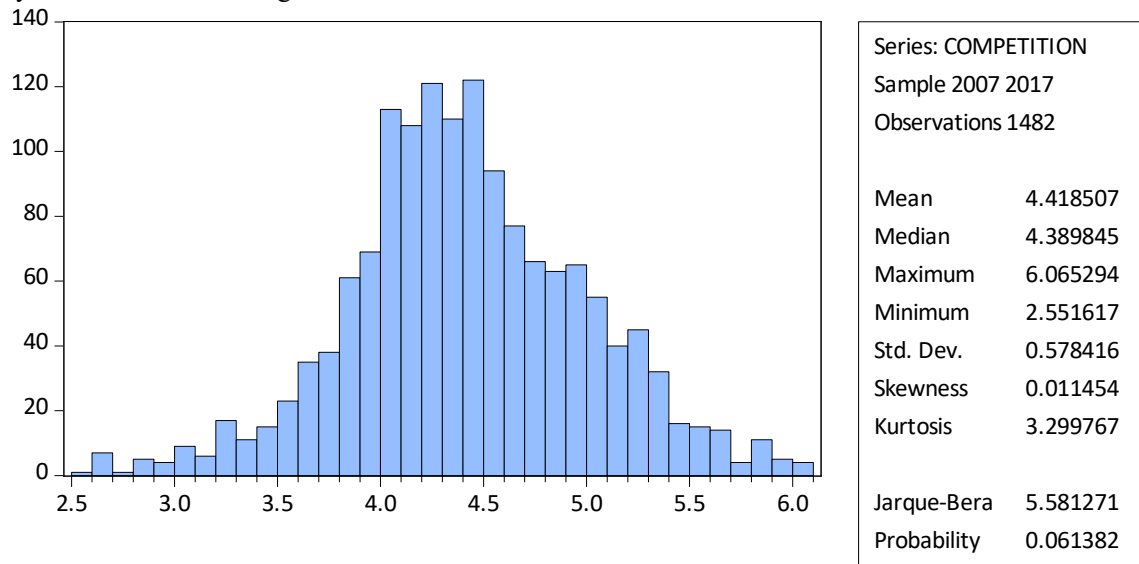


Figure 3. Jarque-Bera test for normality with the distribution of error components in panel data models (2007-2017, 130 countries) for the "competition" series.

Source: Data extracted from World Economic Forum, 2017. *The Global Competitiveness Report 2017–2018*. Available at: http://reports.weforum.org/pdf/gci-2017-2018-scorecard/WEF_GCI_2017_2018_Scorecard_GCI.B.06.01.pdf

2. Modelling the relationship between competition and gross domestic product. Panel data analysis

In order to analyse the relationship between the gross domestic product and the intensity of competition we have used dynamic panel data model (Arellano and Bond 1991), specified as follows:

$$PIB_{it} = \alpha_0 + \sum_{j=1}^p \alpha_j \cdot PIB_{i,t-j} + \sum_{k=0}^q \beta_k \cdot CONC_{i,t-k} + \gamma_i + \delta_t + e_{it}.$$

The meaning of the symbols is the following:

- i – index of sample countries (140 countries);
- t – indexes time ($t = 2007, 2008, \dots, 2017$)
- PIB_{it} – gross domestic product of the country i , in year t ;
- $CONC_{it}$ – an index of competition level of the country i , in year t ;
- p – number of lags from autoregressive description;
- q – number of lags from distributed lag description;

α_0	–	constant term from the regression equation;
α_j	–	autocorrelation coefficients of gross domestic product (p is the number of lags);
β	–	coefficient of impact:
$\beta > 0$	–	suggests a direct relationship (a positive impact) between the level of competition and the dynamics of gross domestic product,
$\beta < 0$	–	suggests a negative impact of the level of competition on the dynamics of gross domestic product,
$\beta = 0$	–	suggests the lack of the relationship between the level of competition and the dynamics of gross domestic product,
γ_i	–	individual specific effect (fixed or random), which evaluates the particularities of each country;
δ_t	–	specific effect in time (fixed or random) in time, which evaluates the particularities of each year;
e_{it}	–	idiosyncratic error.

By testing various specifications of the previous relation ($p, q = 1, \dots, 5$), we have selected the following regression equation (dynamic panel, $p = 3, q = 2$):

$$\text{PIB}_{it} = 0.909460 \cdot \text{PIB}_{i,t-1} - 0.198455 \cdot \text{PIB}_{i,t-2} + 0.170355 \cdot \text{PIB}_{i,t-3} + 2.916072 \cdot \text{CONC}_{i,t} + 5.527289 \cdot \text{CONC}_{i,t-1} + 2.900866 \cdot \text{CONC}_{i,t-2} + u_{it},$$

The results (EViews-10) are detailed in Annex 3. All coefficients are significantly different from zero at the threshold of 0.01. The value of the J-statistic test is 40.2999, lower than 50.9985, level corresponding to the 5% quantile from the unilateral distribution χ^2 by 36 degrees of freedom ($42 - 6$, namely the rank of the instruments' matrix *minus* the number of coefficients in the model). Concretely, if we reject the null hypothesis attached to that test (the over-identification restrictions for GMM are valid) the risk of error is 28.58%. At the same time, standard tests for cross-section dependence in panels (Breusch-Pagan χ^2 , Pearson LM and CD Normal, Friedman χ^2 , Frees Q) do not reject the hypothesis of independence: the risk of first order error is by far superior to the critical threshold of 5%.

Conclusion

Consequently, the model which explains the impact of competition on the dynamics of gross domestic product is valid from an econometric perspective. When steady-state is reached, the coefficient of impact is

$$\beta = 2.916072 + 5.527289 + 2.900866 = 11.344227$$

and the previous equation is:

$$\text{PIB} = (0.909460 - 0.198455 + 0.170355) \cdot \text{PIB} + 11.344227 \cdot \text{CONC}$$

$$\text{or } (1 - 0.881360) \cdot \text{PIB} - 11.344227 \cdot \text{CONC} = 0$$

$$\text{PIB} - 95.618856 \cdot \text{CONC} = 0$$

Calculation suggests *a positive relation between* the gross domestic product and intensity of competition worldwide between 2007 and 2017. We do not interpret the dimension of the influence, as variables are calculated in different units of measure: growth percentages compared to 2010 – for the gross domestic product and points on a scale from 1 to 7, for the intensity of competition. Even if the dimension of time series is not very large, the consistency is assured by the cross-section dimension of panel. This allows us to state that *the previous relation demonstrates a positive impact of the level of competition on economic growth.*

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Annexes

Annex 1: Countries in panel

<i>Symbol</i>	<i>Country</i>	<i>Symbol</i>	<i>Country</i>	<i>Symbol</i>	<i>Country</i>
AGO	Angola	CPV	Cape Verde	IRL	Ireland
ALB	Albania	CRI	Costa Rica	IRN	Iran, Islamic Rep.
ARE	United Arab Emirates	CYP	Cyprus	ISL	Iceland
ARG	Argentina	CZE	Czech Republic	ISR	Israel
ARM	Armenia	DEU	Germany	ITA	Italy
AUS	Australia	DNK	Denmark	JAM	Jamaica
AUT	Austria	DOM	Dominican Republic	JOR	Jordan
AZE	Azerbaijan	DZA	Algeria	JPN	Japan
BDI	Burundi	ECU	Ecuador	KAZ	Kazakhstan
BEL	Belgium	EGY	Egypt	KEN	Kenya
BEN	Benin	ESP	Spain	KGZ	Kyrgyz Republic
BFA	Burkina Faso	EST	Estonia	KHM	Cambodia
BGD	Bangladesh	ETH	Ethiopia	KOR	Korea, Rep.
BGR	Bulgaria	FIN	Finland	KWT	Kuwait
BHR	Bahrain	FRA	France	LAO	Lao PDR
BIH	Bosnia and Herzegovina	GAB	Gabon	LBN	Lebanon
BOL	Bolivia	GBR	United Kingdom	LBR	Liberia
BRA	Brazil	GEO	Georgia	LBY	Libya
BRB	Barbados	GHA	Ghana	LKA	Sri Lanka
BRN	Brunei Darussalam	GIN	Guinea	LSO	Lesotho
BTN	Bhutan	GIN	Guinea	LTU	Lithuania
BWA	Botswana	GMB	Gambia, The	LUX	Luxembourg
CAN	Canada	GRC	Greece	LVA	Latvia
CHE	Switzerland	GTM	Guatemala	MAR	Morocco
CHL	Chile	HKG	Hong Kong SAR	MDA	Moldova
CHN	China	HND	Honduras	MDG	Madagascar
CIV	Côte d'Ivoire	HRV	Croatia	MEX	Mexico
CMR	Cameroon	HTI	Haiti	MKD	Macedonia, FYR
COL	Colombia	HUN	Hungary	MLI	Mali
		IDN	Indonesia	MLT	Malta
		IND	India	MNE	Montenegro

<i>Symbol</i>	<i>Country</i>	<i>Symbol</i>	<i>Country</i>	<i>Symbol</i>	<i>Country</i>
MNG	Mongolia	PRT	Portugal	TCD	Chad
MOZ	Mozambique	PRY	Paraguay	THA	Thailand
MRT	Mauritania	QAT	Qatar	TJK	Tajikistan
MUS	Mauritius	ROU	Romania	TTO	Trinidad and Tobago
MWI	Malawi	RUS	Russian Federation	TUN	Tunisia
MYS	Malaysia	RWA	Rwanda	TUR	Turkey
NAM	Namibia	SAU	Saudi Arabia	TZA	Tanzania
NGA	Nigeria	SEN	Senegal	UGA	Uganda
NIC	Nicaragua	SGP	Singapore	UKR	Ukraine
NLD	Netherlands	SLE	Sierra Leone	URY	Uruguay
NOR	Norway	SLV	El Salvador	USA	United States
NPL	Nepal	SRB	Serbia	VEN	Venezuela
NZL	New Zealand	SUR	Suriname	VNM	Viet Nam
OMN	Oman	SVK	Slovak Republic	YEM	Yemen
PAK	Pakistan	SVN	Slovenia	ZAF	South Africa
PAN	Panama	SWE	Sweden	ZMB	Zambia
PER	Peru	SWZ	Swaziland	ZWE	Zimbabwe
PHL	Philippines	SYC	Seychelles		
POL	Poland	SYR	Syria		

Annex 2. Panel Unit Roots Tests

2.1. Panel Unit Roots Tests for Gross Domestic Product

Series: Dynamics of Gross Domestic Product(GDP, 2010=100%) – AGO, ALB, ARE, ARG, ARM, AUS, AUT, AZE, BDI, BEL, BEN, BFA, BGD, BGR, BHR, BIH, BOL, BRA, BRB, BRN, BTN, BWA, CAN, CHE, CHL, CHN, CIV, CMR, COL, CPV, CRI, CYP, CZE, DEU, DNK, DOM, DZA, ECU, EGY, ESP, EST, ETH, FIN, FRA, GAB, GBR, GEO, GHA, GIN, GMB, GRC, GTM, HKG, HND, HRV, HTI, HUN, IDN, IND, IRL, IRN, ISL, ISR, ITA, JAM, JOR, JPN, KAZ, KEN, KGZ, KHM, KOR, KWT, LAO, LBN, LBR, LBY, LKA, LSO, LTU, LUX, LVA, MAR, MDA, MDG, MEX, MKD, MLI, MLT, MNE, MNG, MOZ, MRT, MUS, MWI, MYS, NAM, NGA, NIC, NLD, NOR, NPL, NZL, OMN, PAK, PAN, PER, PHL, POL, PRT, PRY, QAT, ROU, RUS, RWA, SAU, SEN, SGP, SLE, SLV, SRB, SUR, SVK, SVN, SWE, SWZ, SYC, SYR, TCD, THA, TJK, TTO, TUN, TUR, TZA, UGA, UKR, URY, USA, VEN, VNM, YEM, ZAF, ZMB, ZWE

Sample: 2007 – 2017

Exogenous variables: Individual effects, individual linear trends

Automatic lag length selection based on SIC: 0 to 1

Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin, Chu (t-stat)	-31.8294	0.0000	142	1246
Breitung t-stat	10.7234	1.0000	142	1104
Null: Unit root (assumes common unit root process)				
Im, Pesaran, Shin (W-stat)	-4.22663	0.0000	142	1246

ADF - Fisher (χ^2 -stat)	506.213	0.0000	142	1246
PP - Fisher (χ^2 -stat)	365.894	0.0007	142	1314

Source: EViews estimations based on International Monetary Fund, section "International Financial Statistics (IFS)", table "Gross Domestic Product, Real, Index" available at <http://data.imf.org/regular.aspx?key=61545864> (accessed May 6, 2018). EViews calculation.

2.2. Panel Unit Roots Tests for Competition (145 countries, 2007 – 2017)

Series: Competition - AGO, ALB, ARE, ARG, ARM, AUS, AUT, AZE, BDI, BEL, BEN, BFA, BGD, BGR, BHR, BIH, BOL, BRA, BRB, BRN, BTN, BWA, CAN, CHE, CHL, CHN, CIV, CMR, COL, CPV, CRI, CYP, CZE, DEU, DNK, DOM, DZA, ECU, EGY, ESP, EST, ETH, FIN, FRA, GAB, GBR, GEO, GHA, GIN, GMB, GRC, GTM, HKG, HND, HRV, HTI, HUN, IDN, IND, IRL, IRN, ISL, ISR, ITA, JAM, JOR, JPN, KAZ, KEN, KGZ, KHM, KOR, KWT, LAO, LBN, LBR, LBY, LKA, LSO, LTU, LUX, LVA, MAR, MDA, MDG, MEX, MKD, MLI, MLT, MNE, MNG, MOZ, MRT, MUS, MWI, MYS, NAM, NGA, NIC, NLD, NOR, NPL, NZL, OMN, PAK, PAN, PER, PHL, POL, PRT, PRY, QAT, ROU, RUS, RWA, SAU, SEN, SGP, SLE, SLV, SRB, SUR, SVK, SVN, SWE, SWZ, SYC, SYR, TCD, THA, TJK, TTO, TUN, TUR, TZA, UGA, UKR, URY, USA, VEN, VNM, YEM, ZAF, ZMB, ZWE

Sample: 2007 – 2017

Exogenous variables: Individual effects, individual linear trends

Automatic lag length selection based on SIC: 0 to 1

Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.	Cross-sections	Obs.
Null: Unit root (assumes common unit root process)				
Levin, Lin, Chu (t-stat)	-18.9427	0.0000	140	1263
Breitung t-stat	0.54410	0.7068	140	1123
Null: Unit root (assumes individual unit root process)				
Im, Pesaran, Shin (W-stat)	-1.16550	0.1219	140	1263
ADF - Fisher (χ^2 -stat)	330.839	0.0198	140	1263
PP - Fisher (χ^2 -stat)	375.542	0.0001	140	1308

Source: Data extracted from World Economic Forum, 2017. *The Global Competitiveness Report 2017–2018*. Available at: http://reports.weforum.org/pdf/gci-2017-2018-scorecard/WEF_GCI_2017_2018_Scorecard_GCI.B.06.01.pdf

Annex 3. Dynamic panel data model for the relationship between the gross domestic product (GDP) and the intensity of competition (140 countries, 2007-2017)

Dependent Variable: GDP
 Method: Panel Generalized Method of Moments
 Transformation: First Differences
 Sample (adjusted): 2011 2017
 Periods included: 7
 Cross-sections included: 140
 Total panel (unbalanced) observations: 802
 White period instrument weighting matrix
 White period standard errors & covariance (d.f. corrected)
 Instrument specification: @DYN(PIB,-2), Constant

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP(-1)	0.909460	0.029194	31.15240	0.0000
GDP(-2)	-0.198455	0.024642	-8.053651	0.0000
GDP(-3)	0.170355	0.017412	9.783995	0.0000
CONC	2.916072	1.047862	2.782877	0.0055
CONC(-1)	5.527289	0.953646	5.795957	0.0000
CONC(-2)	2.900866	1.117850	2.595041	0.0096

Effects specification: Cross-section fixed (first differences)

Mean dependent var	3.666584	S.D. dependent var	3.629470
S.E. of regression	3.456344	Sum squared resid	9509.268
J-statistic	40.29924	Instrument rank	42
Prob(J-statistic)	0.285792		

Source: EViews

✓ *Competition*: World Economic Forum 2017. *Global Competitiveness Report 2017–2018*. Available at http://reports.weforum.org/pdf/gci-2017-2018-scorecard/WEF_GCI_2017_2018_Scorecard_GCI.B.06.01.pdf (accessed in May 6, 2018)

✓ *GDP*: International Monetary Fund Datasets, section "International Financial Statistics (IFS) – Gross Domestic Product and Components selected indicators", table "Gross Domestic Product, Real, Index" available at <http://data.imf.org/regular.aspx?key=61545864> (accessed in May 6, 2018).