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A One-Way or Two-Way Relationship?**

Aleksandra Kordalska, Magdalena Olczyk

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Aleksandra Kordalska, Magdalena Olczyk  
Aleksandra.Kordalska@zie.pg.gda.pl; Magdalena.Olczyk@zie.pg.gda.pl  
Gdansk University of Technology, Faculty of Management and Economics,  
80-233 Gdansk, Traugutta Street 79

## Global Competitiveness and Economic Growth: A One-Way or Two-Way Relationship?

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**Abstract:** The Global Competitiveness Index is treated as a standard to measure the competitiveness of countries. Leaders look at it to make policy and resource allocation decisions because global competitiveness is expected to be related to economic growth. However, studies which analyze the empirical relationship between these two economic categories are very rare. It is still an open question in the literature whether economic growth can be used to predict future global competitiveness or the other way round. This paper empirically tests the relationship between the GCI and the economic growth rate by using a panel Granger causality analysis based on annual data for 114 countries divided into five groups by income criteria and covering the period 2006-2014. We confirm a strong unidirectional causality among the countries analyzed, i.e. GDP growth causes global competitiveness. Additionally, we find that the GCI is not successful in predicting economic growth for the majority of the 114 countries, with the exception of few large economies such as China, India, the United States and Russia.

### Introduction

National competitiveness is one of the most central preoccupations for both advanced and developing countries (Porter, 1990) and "many policy makers express serious concerns about it" (Lall, 2001, p.1501). Much has already been written about competitiveness, and today many economic phenomena are described as competitive or non-competitive issues. Nevertheless, both the definition and the analysis of the competitiveness of an economy still pose many problems. First of all, one may be surprised not only by the multitude of definitions of national competitiveness but also by the diversity of approaches to determining what competitiveness actually is at the macro level. Even such an expert as M. Porter in his book "The competitiveness advantage of nations" does not define it explicitly, despite using the term very often (Olczyk, 2008). Berger identifies four main but very different theoretical constructs for national competitiveness, and they show large divergences. National competitiveness can be understood as the "ability of a nation to sell its goods to another nation", as the "ability of a nation to earn", as the "ability to adjust to changes in the external environment" and as the "national ability to attract scarce mobile resources" (Berger, 2008, pp. 378-392). Each approach implies the use of different indicators to assess country competitiveness.

According to Berger, another fifth concept of national competitiveness exists based on Porter's diamond model and its extended versions. Porter proposed a national diamond model, which identifies four classes of country attributes that determine national competitive advantage: factor conditions; demand conditions; related and supporting industries; and company strategy, structure and rivalry. He also indicates two other factors – government policy and chance (exogenous shocks) – that support the system of national competitiveness but do not create it (Porter, 1990). A key feature of Porter's proposal is that it integrates many different theories into the one concept, i.e. "factor conditions" relate to classical/neoclassical economics, "demand conditions" are connected to product cycle theory and Rostow growth theory, "related and supporting companies" derives from polarization theory and Marshall's industrial districts, and "firm strategy, structure and rivalry" refer to Schumpeter's works. Although the diamond model has been widely applied to studying the competitiveness of different countries, it has met with some criticism. According to Smit (2010, pp.105-130), the weak aspects of Porter's model have been pointed out both by scholars of management (Dunning, 1992; Dunning, 1993; Rugman, 1990; Rugman, 1991; Rugman and Verbeke, 1993) and economics (Waverman, 1995; Boltho, 1996; Davies and Ellis, 2000). Management experts accuse Porter of not considering multinational activities in his model, so Dunning (1993) extended Porter's original model

by adding the following variables: foreign direct investment, government policies and pro-competitive policies. In turn, economists indicate a lack of *ex ante* prediction ability as a weak point of the model.

Nevertheless, the national diamond model was a breakthrough in the study of country competitiveness due to Porter and his followers' complex approach to macro-competitiveness analysis. It opened a discussion about the determinants and indicators of national competitiveness and became a basis for the creation of two leading indices of country competitiveness: that published in the World Economic Forum Report and that in the IMD's World Competitiveness Yearbook. In particular, the methodology used by the World Economic Forum (WEF) is very closely related to Porter's diamond model. It defines country competitiveness as the "*set of institutions, policies, and factors that determine the level of productivity of a country*" (Schwab, 2015, p.4). Porter also states that competitiveness has a set of microeconomic determinants (like, e.g., firm strategies, rivalry), macroeconomic conditions (like, e.g., demand) and factors determining government power. Thus, the methodology proposed by the WEF is based on the assumption that competitiveness is such a multidimensional phenomena that the most appropriate approach to assessing country competitiveness as a single indicator involves a compilation of many individual competitiveness indicators.

The WEF constructs a Growth Competitiveness Index (GCI) which includes a weighted average of 112 different components. These components are grouped into 12 pillars of competitiveness and each of them measures a different aspect of it. They are: (1) institutions, (2) infrastructure, (3) macroeconomic environment, (4) health and primary education, (5) higher education and training, (6) goods market efficiency, (7) labour market efficiency, (8) financial market development, (9) technological readiness, (10) market size, (11) business sophistication, and (12) innovation (Global Competitiveness Report 2015-2014, pp. 4-8). These 12 pillars are organized into three groups: basic requirements (pillars 1-4), efficiency enhancers (pillars 5-10) and innovation and sophistication factors (pillars 11-12). The WEF puts a different weight on each of the three groups and divides countries according to their stage of development, because developing countries are competitive in the field of basic requirements, the competitiveness of emerging countries is based on the efficiency enhancers, and at least most developed countries compete thanks to their innovations.

Although the GCI is one of the most accepted and recognized indicators of national competitiveness in the literature, it is not exempt from criticism. Lall (2001, pp.1501-1525) indicates many methodological, quantitative and analytical problems, and dubs the index "misleading" due to its arbitrary weighting of variables and use of subjective indicators. Other researchers also question the high correlation among its pillars (Carvalho et al., 2012, pp. 421-434), the lack of a good theoretical basis for the selection of its variables (Berger & Bristow, 2009, pp. 378-392), and even methodological errors and data manipulation which may lead to undesirable results (Freudenberg, 2003, pp. 1-29). Van Stel indicates two of the most serious problems with the GCI (Van Stel et al., 2005, pp. 311-321): the index is not even stable over short time periods for developed economies (the USA was ranked 6th in 2007 and 1st in 2008); and it is not successful in predicting short- and long-term economic growth because it combines so many other variables, such as entrepreneurial activity (Xia et al., p. 47). However, the authors of the latest Global Competitiveness Report state that "the concept of competitiveness thus involves static and dynamic competitiveness and ... can explain an economy's growth potential" (Schwab, 2015, p.4). Because studies which evaluate the validity of the GCI for economic growth prediction are very rare, the aim of this paper consists in empirically evaluating the effect of global competitiveness on economic growth. In addition, we have decided to go further and check the predictive validity of the inverse relationship, i.e. whether economic growth predicts global competitiveness.

The paper is organized as follows. The next section contains a theoretical discussion on the possible impact of global competitiveness on economic growth and *vice versa*. Section 3 opens up the methodological part of the paper, i.e. it introduces the data and the panel Granger causality test methodology. Section 4 presents the results of the analysis and the last section gives our conclusions.

### **Economic growth driven by the Global Competitiveness Index or *vice versa* - theoretical aspects**

As mentioned, the WEF-constructed Growth Competitiveness Index (GCI) includes a weighted average of 112 different components grouped into 12 pillars of competitiveness, and the pillars are classified into three components: "factors", which determine a better environment for high productivity (Bai, 2009, pp. 257-275), "efficiency", which is connected with the labour, goods and services markets and their influence on production efficiency (Qin et al., 2009, pp. 291-315), and "innovations", which are necessary for growth sustainability (Koong et al., 2011, pp. 181-196). In reality, the majority of these pillars are taken from six main economic theories: classical, neoclassical and Keynesian economic theory, development economics, new trade theory,

and the most important new economic growth theory – endogenous growth theory (see Table1). Since the GCI measures "the level of productivity of an economy, which determines its long-term growth potential" (Schwab, 2015, Appendix A), endogenous growth theory becomes more significant.

**Table 1.** Keys driving factors of competitiveness in main economic theories

<b>Theory</b>	<b>Keys driving factors of competitiveness</b>
Classical	<ul style="list-style-type: none"> <li>• investment in capital (i.e. improved technology) enhances the division of labour (specialization) and, hence, raises productivity.</li> <li>• trade (moving from autarky to free trade) provides an engine for growth (static gains from trade).</li> </ul>
Neoclassical	<ul style="list-style-type: none"> <li>• trade (moving from autarky to free trade) provides an engine for growth (static gains from trade).</li> </ul>
Keynesian economic theory	<ul style="list-style-type: none"> <li>• capital intensity.</li> <li>• investment .</li> <li>• government spending, such as investment in the public domain and subsidies/tax cuts for enterprises.</li> </ul>
Development economics	<ul style="list-style-type: none"> <li>• moving from agriculture to higher value added sectors.</li> <li>• openness to trade.</li> <li>• foreign direct investment (FDI).</li> <li>• (foreign) development funds.</li> </ul>
New economic growth theory	<ul style="list-style-type: none"> <li>• R&amp;D expenditure.</li> <li>• innovativeness (patents).</li> <li>• education level .</li> <li>• spending on investment in human capital (schooling, training).</li> <li>• effective dissemination of knowledge (knowledge centres).</li> </ul>
New trade theory	<p>Factors influencing "first mover" advantage, e.g.</p> <ul style="list-style-type: none"> <li>• skilled labour</li> <li>• specialized infrastructure</li> <li>• networks of suppliers</li> <li>• localized technologies</li> </ul>

Source: own elaboration based on (Garden, Martin, 2005, pp.10-16)

Endogenous growth is long-run economic growth at a rate determined by forces that are internal to the economic system, and particularly those forces governing the opportunities and incentives to create technological knowledge. This theory attempts to explain the sources of productivity growth and emphasizes the crucial roles of human capital (Lucas 1998), innovations (Romer, 1990; Aghion & Howitt, 1992), infrastructure (Barro, 1990), institutions (Romer, 1986), competition and openness (Grosman & Helpman, 1991). In Table 2, the determinants of selected endogenous growth models are assigned to some of the pillars of the GCI.

**Table 2.** The inspiration for the pillars of global competitiveness from models of endogenous growth

<b>Pillars of competitiveness</b>	<b>Pillar 1</b>	<b>Pillar 2</b>	<b>Pillars</b>
Endogenous growth model inspirations	Romer (1986): institutions Barro (1990): infrastructure Lucas (1988): health and primary education	Lucas (1988): health and primary education Pagano (1993): sophistication of financial markets Grosman and Helpman (1991): opening to technology and size of the market	Romer (1990) and Aghion et Howitt (1992): sophistication of firms and innovations

Source: (Ben Amar, Hamdi, 2012, p. 126).

Because the determinants of growth in endogenous growth theory are often simultaneously key drivers in the GCI pillars, we decide to check the following hypothesis: the GDP growth rate can predict the Global Competitiveness Index.

We also decide to verify the opposite hypothesis: that the GCI can be a good predictor of GDP growth. The authors of older versions of the Global Competitiveness Report themselves claimed that the GCI can "determine the aggregate growth rates of an economy" (Lopez-Claros et al. 2007, p. 3). In the latest WEF Report on Global Competitiveness we can also find the argument that "a more competitive economy is one that likely grows faster over time" (Schwab, 2015, p.4).

## Data and Methodology

The empirical analysis presented in this paper is based on the Global Competitiveness Index Historical Dataset for 114 countries over the years 2005-2014. The historical data in the dataset are not updated but correspond to the data that was originally published in nine past editions of the WEF Global Competitiveness Report<sup>1</sup>. The list of countries analysed is limited from 144 to 114 due to either a lack of a Global Competitiveness Index or of GDP PPP values for some countries in part of the period analysed.

We use two variables: the Global Competitiveness Index (GCI) and the GDP PPP annual growth rate. GDP PPP is gross domestic product converted to international dollars using purchasing power parity rates<sup>2</sup>. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products (World Bank, 2015). An international dollar has the same purchasing power over GDP as the U.S. dollar has in the United States. The data are in current international dollars. For most economies, the PPP figures are either extrapolated from the 2011 International Comparison Program (ICP) benchmark estimates or else imputed using a statistical model based on the 2011 ICP report.<sup>3</sup>

The GCI is a composite competitiveness index combining "hard data" on various national characteristics and "soft data" compiled from the WEF's annual Executive Opinion Survey. To ease the calculation of indexes, the WEF converts all hard data items onto a 1-7 scale using a min-max transformation.<sup>4</sup> The theoretical maximum of GCI is 7. Computation of it is based on successive aggregations of scores from the indicator level. At the most disaggregated level, an arithmetic mean within a category is used to aggregate the individual indicators, while for the higher aggregation levels fixed weights for each category are applied (Schwab 2015, Appendix B). At the highest aggregation level – i.e. at the three sub-indices level – the weights applied are not fixed and depend on each country's stage of development.

To analyze the relationship between global competitiveness and the economic growth rate, we decide to divide all 114 economies into homogenous groups according to their gross national income (GNI) per capita<sup>5</sup>, calculated using the World Bank Atlas method<sup>6</sup>. The purpose of the Atlas conversion is to reduce the impact of exchange rate fluctuations in the cross-country comparison of national incomes. Each of the economies analysed belongs to one of five groups: low-income, lower-middle-income, upper-middle-income, high-income non-OECD countries, and high-income OECD countries.

In this paper, the relationship described above is assessed by means of a Granger causality test. In accordance with Granger (1969), causality means that a series  $x$  can be said to cause a series  $y$  if and only if the expectation of  $y$  given the history of  $x$  differs from the unconditional expectation of  $y$ :

$$E(y | y_{y-k}, x_{t-k}) \neq E(y | y_{t-k}). \quad (1)$$

<sup>1</sup> (editions: 2006-2007, 2007-2008, 2008-2009, 2009-2010, 2010-2011, 2011-2012, 2012-2013, 2013-2014, 2014-2015)

<sup>2</sup> The Purchasing Power Parity (PPP) between two countries is the rate at which the currency of one country needs to be converted into that of the second country to ensure that a given amount of the first country's currency will purchase the same volume of goods and services in the second country as it does in the first.

<sup>3</sup> The International Comparisons Program (ICP) is a global statistical initiative that produces internationally comparable Purchasing Power Parity (PPP) estimates. See [http://siteresources.worldbank.org/ICPEXT/Resources/ICP\\_2011.html](http://siteresources.worldbank.org/ICPEXT/Resources/ICP_2011.html).

<sup>4</sup>  $\min - \max \text{ formula} = 6 * [(country \text{ value} - sample \text{ minimum}) / (sample \text{ maximum} - sample \text{ minimum})] + 1$

<sup>5</sup> As of 1 July 2014, low-income economies are defined as those with a GNI per capita, calculated using the World Bank Atlas method, of \$1,045 or less in 2013; middle-income economies are those with a GNI per capita of more than \$1,045 but less than \$12,746; high-income economies are those with a GNI per capita of \$12,746 or more. Lower-middle-income and upper-middle-income economies are separated at a GNI per capita of \$4,125. See <http://data.worldbank.org/news/2015-country-classifications>.

<sup>6</sup> The Atlas conversion factor for any year is the average of a country's exchange rate for that year and its exchange rates for the two preceding years, adjusted for the difference between the rate of inflation in the country and international inflation. <https://datahelpdesk.worldbank.org/knowledgebase/articles/378832-what-is-the-world-bank-atlas-method>.

The question is whether lagged values of series  $x$  bring additional information to predict series  $y$  or if series  $y$  can be better predicted only using its past values.

For  $T$  periods and  $N$  individuals, the time-stationary VAR model adapted to a panel data context is as follows:

$$y_{i,t} = \sum_{k=1}^p \gamma^{(k)} y_{i,t-k} + \sum_{k=0}^p \beta_i^{(k)} x_{i,t-k} + v_{i,t}, \quad i=1,\dots,N, \quad t=1,\dots,T, \quad (2)$$

where  $v_{it}$  is the sum of individual effects  $\alpha_i$  and random disturbances  $\varepsilon_{it}$ .

The concept of Granger causality for panel data can be considered in two ways. The first approach, proposed by Holtz-Eakin et al. (1985, p.12), uses Chamberlain's investigation (1984, pp. 1247-1318) and allows all of the parameters in regression two to be time-varying. Following this, Hsiao (1989, pp.565-587) and in a similar way Weinhold (1996, pp.163-175), Weinhold (1999) and Nair-Reichert & Weinhold (2001, pp.193-171) use a Mixed Fixed and Random Model to evaluate Granger causality. A different approach is used by Hurlin & Venet (2001, pp.3-19), who assume that the parameters of the regression are fixed and propose a wide procedure for testing causality. In this paper, the Hurlin and Venet approach is applied.

When using panel data, we expect heterogeneity between individuals to be for two reasons. The first reason is a natural cross-sectional difference between panel units. This type of heterogeneity is taken into account by separating individual fixed effects  $\alpha_i$  from random disturbances  $v_{it}$ .

Applying this to equation 2, we treat  $v_{it}$  as the sum of individual effects  $\alpha_i$  and random disturbances  $\varepsilon_{it}$  and impose the following assumptions on  $\alpha_i$  and  $\varepsilon_{it}$ :

$$\begin{aligned} \alpha_i &\sim IID(0, \sigma_\alpha^2), \quad \varepsilon_{it} \sim IID(0, \sigma_\varepsilon^2) \\ E(\alpha_i \varepsilon_{it}) &= 0 \\ E(\alpha_i \alpha_j) &= E(\varepsilon_{it} \varepsilon_{js}) = 0, \quad \text{for } i \neq j \text{ and } t \neq s \\ E(\alpha_i x_{it}) &= E(\varepsilon_{it} x_{it}) = 0. \end{aligned} \quad (3)$$

The second reason for heterogeneity among panel units follows from there being two subgroups within the whole group – a subgroup where causality between  $x$  and  $y$  exists ( $\beta_i^{(k)} \neq 0$ ) and a subgroup where the causal relationship is not observed ( $\beta_i^{(k)} = 0$ ). The assumptions concerning the model coefficients are as follows:

- the autoregressive parameters  $\gamma^{(k)}$  and coefficient slopes  $\beta_i^{(k)}$  are constant for all lags;
- the autoregressive coefficients  $\gamma^{(k)}$  are identical for all individuals but the regression coefficient slopes  $\beta_i^{(k)}$  may vary between individuals.

The strategy for testing Granger causality proposed by Hurlin & Venet (2001) is presented in Table 3.

**Table 3.** Hypotheses and test statistics in Granger's causality test for panel data models

Hypotheses	Test statistics
STEP I	
$H_0 : \beta_i^{(k)} = 0 \forall i = 1, \dots, N \forall k = 1, \dots, p$ $H_1 : \exists(i, k) \beta_i^{(k)} \neq 0$	$F_{HNC} = \frac{(RSS_2 - RSS_1) / Np}{RSS_1 / (NT - N(1+p) - p)}$
STEP II	
$H_0 : \forall k = 1, \dots, p / \beta_i^k = \beta_i \forall i = 1, \dots, N$ $H_1 : \exists k \in [1, p], \exists(i, j) \in [1, N] / \beta_i^k \neq \beta_j^k$	$F_{HC} = \frac{(RSS_3 - RSS_1) / (N-1)p}{RSS_1 / (NT - N(1+p) - p)}$
STEP III	
$H_0 : \exists i \in [1, N] / \forall k \in [1, p] \beta_i^k = 0$ $H_1 : \forall i = 1, \dots, N \exists k \in [1, p] / \beta_i^k \neq 0$	$F_{HENC} = \frac{(RSS_{2,i} - RSS_1) / p}{RSS_1 / (NT - N(1+2p) + p)}$

Source: Own elaboration based on Hurlin and Venet (2001).

The procedure consists of 3 steps. First, the Homogeneous Non-Causality (HNC) hypothesis is tested. When the null cannot be rejected, it means that no individual Granger causality is observed. Otherwise, the second step of the procedure is needed. This step consists in checking whether the group analysed is homogeneous or not. The last step allows the question of there being a subgroup of individuals for which causality is observed and a subgroup for which the causal relationship does not exist to be answered.

## Results

The procedure for evaluating Granger causality is based on a time-stationary VAR model. For the purpose of evaluating unit-root presence we use two panel unit root tests: the Harris-Tzavalis test (Harris & Tzavalis, 1999, pp. 201-226) (HT) and the Im-Pesaran-Shin test (Im et al., 2003, pp. 53-74) (IPS), which are chosen in the light of the sample size. Additionally, in the HT test a small-sample adjustment to  $T$  is made. Both tests are applied for each of the five income groups: low-income countries (LI), lower-middle-income countries (LMI), upper-middle-income countries (UMI), high-income non-OECD countries (HnOECD) and high-income OECD countries (HOECD). The results of the tests are presented in Table 4.

**Table 4.** Results for panel unit root tests

	GDP growth				
	LI	LMI	UMI	HnOECD	HOECD
HT	-0.016 *	-0.179 ***	0.004 ***	0.314 ***	0.007 ***
IPS	-4.543 ***	-5.492 ***	-5.884 ***	-3.111 ***	-4.626 ***
	Global Competitiveness Index				
	LI	LMI	UMI	HnOECD	HOECD
HT	0.174 *	0.218 *	0.268	0.605	0.605 **
IPS	-2.437 ***	-2.148 **	-2.020 **	-1.304 *	-2.121 **

\* significant at 0.1%, \*\* significant at 0.05%, \*\*\* significant at 0.01%

Source: Own preparation

For GDP growth, both the Harris-Tzavalis and the IPS test allow the null hypothesis that the GDP growth time series contains a unit root to be rejected. For the Global Competitiveness Index, the IPS test is

significant for all the groups as well, but the HT test for UMI and HnOECD countries does not reject the null.

Finally, we can treat both variables as time-stationary and start the procedure for Granger causality evaluation, which is based on two regressions, estimated for each income group separately:

$$\Delta GDP_{i,t} = \sum_{k=1}^p \gamma^{(k)} \Delta GDP_{i,t-k} + \sum_{k=0}^p \beta_i^{(k)} GCI_{i,t-k} + v_{i,t}, \quad (4)$$

$$GCI_{i,t} = \sum_{k=1}^p \gamma^{(k)} GCI_{i,t-k} + \sum_{k=0}^p \beta_i^{(k)} \Delta GDP_{i,t-k} + v_{i,t} \quad (5)$$

Due to the shortness of the time series, the number of lags in regressions 4 and 5 are limited to k=2. A LSDV estimator is used to estimate the above models<sup>7</sup>.

Following Table 3, first we explore whether in the homogeneous sample we can observe bidirectional causality, unidirectional causality or we cannot reject the null. Taking each income group individually, we can strongly reject the homogeneous non-causality hypothesis (Table 5). A causal relationship from the Global Competitiveness Index to GDP growth exists and it also works the other way round for all the lags tested apart from the relation GCI→ΔGDP assessed for high-income non-OECD countries and the first lag.

**Table 5.** Results for the Homogenous Non-Causality hypothesis

Global Competitiveness Index → GDP growth						
lag	LI	LMI	UMI	HnOECD	HOECD	
1	18.289 ***	2.265 ***	69.553 ***	0.929	9.659 ***	
2	2.309 ***	3.394 ***	1.423 *	26.243 ***	14.982 ***	
GDP growth → Global Competitiveness Index						
lag	LI	LMI	UMI	HnOECD	HOECD	
1	9.697 ***	5.617 ***	7.255 ***	3.563 ***	10.917 ***	
2	4.970 ***	6.104 ***	4.236 ***	2.675 ***	12.880 ***	

\* significant at 0.1%, \*\* significant at 0.05%, \*\*\* significant at 0.01%

Source: Own preparation

The next step is to examine whether the relationship between the competitiveness measure and GDP changes is strictly homogeneous or not in the countries which belong to each income group. The results are reported in Table 6. We reject the Homogeneous Causality hypothesis, which is in line with our expectations. The pattern of rejection is similar to the first step. As previously, for the relation from GCI to GDP growth with one lag for HnOECD countries we cannot reject the HC hypothesis. In addition, it cannot be rejected for the second lag and the relation in the opposite direction. Except for these cases, in general we observe a differentiation in respect of causality according to the group that the countries analysed belong to.

**Table 6.** Results for the Homogeneous Causality hypothesis

Global Competitiveness Index → GDP growth						
lag	LI	LMI	UMI	HnOECD	HOECD	
1	17.731 ***	2.347 ***	69.755 ***	0.992	9.256 ***	
2	2.302 ***	3.500 ***	1.372 *	25.026 ***	14.864 ***	
GDP growth → Global Competitiveness Index						
lag	LI	LMI	UMI	HnOECD	HOECD	
1	10.39 ***	3.8031 ***	4.04 ***	1.814 **	2.972 ***	
2	5.325 ***	5.178 ***	2.665 ***	1.453	3.869 ***	

\* significant at 0.1%, \*\* significant at 0.05%, \*\*\* significant at 0.01%

Source: Own preparation

<sup>7</sup> As Hurlin & Venet (2001) note, the results of F statistics obtained with consistent estimators like the Anderson and Hsiao estimator or the GMM estimator are lower than those with a FE estimator, but in fact the differences are relatively small. In our case, it means that we will have an upward bias and we should not reject the null in some cases.



Given the rejection of the HC hypothesis, the HENC hypothesis should be tested. We are interested in the subgroup of countries among each income group for which the causal relationship does not exist, neither from GDP growth to GCI nor from GCI to GDP growth, both for which we can observe a one-way relationship and for which the relationship is bidirectional. The results are reported in Tables 7,8,9,10 and 11 for LI countries, LMI countries, UMI countries, HnOECD countries and HOECD countries respectively.

**Table 7.** Results for the Heterogeneous Non-Causality hypothesis – low-income countries

LI	Global Competitiveness Index → GDP growth		GDP growth → Global Competitiveness Index	
	lag 1	lag2	lag 1	lag2
Bangladesh	213.60 ***	5.214 ***	4.327 **	1.648
Burkina Faso	0.194	0.114	3.717 *	0.425
Burundi	0.001	0.211	21.121 ***	7.320 ***
Cambodia	4.372 **	0.844	10.483 ***	7.762 ***
Chad	0.018	6.181 ***	0.713	0.314
Ethiopia	7.359 ***	0.954	3.785 *	2.425 *
Gambia	0.031	0.024	4.000 **	1.575
Kenya	0.199	1.537	7.476 ***	2.410
Madagascar	0.028	0.479	0.301	0.335
Mali	0.046	0.102	3.783 *	1.423
Mozambique	4.213 **	0.101	4.978 **	0.889
Nepal	2.220	0.438	6.723 **	5.420 ***
Tanzania	2.088	2.736 *	1.258	0.532
Uganda	8.723 ***	2.885 *	4.002 **	1.474
Zimbabwe	10.588 ***	0.529	45.642 **	14.259 ***

\* significant at 0.1%, \*\* significant at 0.05%, \*\*\* significant at 0.01%

Source: Own preparation

**Table 8.** Results for the Heterogeneous Non-Causality hypothesis – lower-middle-income countries

LMI	Global Competitiveness Index → GDP growth		GDP growth → Global Competitiveness Index	
	lag 1	lag2	lag 1	lag2
Armenia	0.000	0.019	88.325 ***	28.449 ***
Bolivia	0.005	0.071	12.027 ***	3.347 **
Cameroon	0.002	0.004	0.199	0.612
Egypt	0.113	1.567	9.653 ***	5.466 ***
El Salvador	0.000	0.016	2.170	1.885
Georgia	0.000	0.037	0.003	3.670 **
Guatemala	0.001	0.013	0.438	0.789
Guyana	0.000	0.006	0.597	0.925
Honduras	0.000	0.061	2.726	3.608 **
India	46.656 ***	47.885 ***	0.077	0.283
Indonesia	2.102	12.603 ***	3.561 *	2.375 *
Kyrgyz Republic	0.000	0.002	2.979 *	4.831 **
Lesotho	0.000	0.001	0.358	8.016 ***
Mauritania	0.000	0.001	3.450 *	3.611 **
Mongolia	0.000	0.011	5.503 **	7.190 ***
Morocco	0.016	0.149	1.092	1.062
Nicaragua	0.011	0.088	6.847 ***	2.713 *
Nigeria	0.365	2.853 *	8.538 ***	3.847 **
Pakistan	0.253	1.698	1.450	1.368
Paraguay	0.007	0.075	2.963 *	3.177 **
Philippines	0.538	17.629 ***	11.206 ***	9.366 ***
Sri Lanka	0.046	0.557	1.785	3.459 **
Timor-Leste	0.005	0.159	1.427	1.155
Ukraine	0.134	4.771 **	1.500	1.204
Vietnam	0.308	5.460 ***	2.418	4.383 **
Zambia	0.000	0.005	1.225	3.372 **

\* significant at 0.1%, \*\* significant at 0.05%, \*\*\* significant at 0.01%

Source: Own preparation

**Table 9.** Results for the Heterogeneous Non-Causality hypothesis – upper-middle-income countries

UMI	Global Competitiveness Index → GDP growth		GDP growth → Global Competitiveness Index	
	lag 1	lag2	lag 1	lag2
Albania	0.000	0.000	12.494 ***	4.486 **
Algeria	0.014	0.003	17.972 ***	7.761 ***
Argentina	0.523	0.400	4.183 **	1.718
Azerbaijan	0.011	0.014	9.721 ***	5.439 ***
Botswana	0.002	0.003	23.249 ***	6.838 ***
Brazil	1.245	1.289	9.021 ***	1.271
Bulgaria	0.005	0.025	7.614 ***	3.475 **
China	1579.0 ***	15.956 ***	2.628	0.810
Colombia	0.255	0.952	2.971 *	1.548
Costa Rica	0.007	0.000	2.133	1.236
Dominican Republic	0.028	0.032	1.266	0.511
Hungary	0.020	0.049	6.440 **	1.435
Jamaica	0.003	0.001	4.222 **	1.241
Jordan	0.004	0.002	2.464	1.986
Kazakhstan	0.006	0.054	9.833 ***	4.882 ***
Macedonia, FYR	0.000	0.000	10.279 ***	1.803
Malaysia	0.357	0.331	3.002 *	2.234
Mauritius	0.001	0.000	5.027 **	3.778 **
Mexico	1.456	1.276	2.349	1.795
Namibia	0.002	0.001	7.462 ***	2.119
Panama	0.000	0.004	4.102 **	3.536 **
Peru	0.023	0.065	6.551 **	2.470 *
Romania	0.069	0.114	2.620	0.397
South Africa	1.894	0.042	1.290	0.575
Thailand	1.173	0.465	1.837	0.811
Turkey	1.131	1.903	2.288	6.540 ***
Venezuela	2.266	0.667	0.327	1.587

\* significant at 0.1%, \*\* significant at 0.05%, \*\*\* significant at 0.01%

Source: Own preparation

**Table 10.** Results for the Heterogeneous Non-Causality hypothesis – Non-OECD high-income countries

HnOECD	Global Competitiveness Index → GDP growth		GDP growth → Global Competitiveness Index	
	lag 1	lag2	lag 1	lag2
Bahrain	0.023	0.102	1.228	0.996
Barbados	0.001	0.005	3.047 *	0.493
Croatia	0.105	0.707	3.963 *	2.508 *
Cyprus	0.084	0.990	7.870 ***	6.528 ***
Hong Kong SAR	0.056	2.057	1.025	1.749
Kuwait	1.568	0.498	0.682	0.572
Latvia	0.021	0.138	3.619 *	2.309
Lithuania	0.060	0.464	1.153	0.510
Malta	0.097	1.171	2.066	0.783
Qatar	0.545	1.599	6.191 **	1.570
Russian Federation	6.828 **	235.4 ***	0.110	2.706 *
Singapore	2.074	5.325 ***	2.787 *	2.236
Trinidad and Tobago	0.000	0.040	1.116	0.410
United Arab Emirates	0.453	8.486 ***	8.929 ***	1.343
Uruguay	0.001	0.071	0.137	0.742

\* significant at 0.1%, \*\* significant at 0.05%, \*\*\* significant at 0.01%

Source: Own preparation

**Table 11.** Results for the Heterogeneous Non-Causality hypothesis – OECD high-income countries

HOECD	Global Competitiveness Index → GDP growth		GDP growth → Global Competitiveness Index	
	lag 1	lag2	lag 1	lag2
Australia	0.338	0.157	0.708	1.288
Austria	0.118	0.221	4.464 **	2.256
Belgium	0.090	0.203	1.573	3.694 **
Canada	0.009	3.081 **	0.236	2.363 *
Chile	0.122	0.511	1.064	1.483
Czech Republic	0.022	0.026	1.112	5.491 ***
Denmark	0.011	0.044	6.691 **	13.086 ***
Estonia	0.006	0.010	0.605	2.020
Finland	0.073	0.134	3.468 *	2.807 *
France	1.392	4.005 **	0.601	2.699 *
Germany	4.257 **	14.569 ***	1.062	0.824
Greece	0.555	0.435	4.976 **	4.510 **
Iceland	0.000	0.001	3.666 *	13.840 ***
Ireland	0.040	0.226	5.601 **	4.409 **
Israel	0.289	0.053	8.795 ***	3.576 **
Italy	0.993	4.814 **	0.660	1.830
Japan	2.494	17.291 ***	0.369	0.309
Korea, Rep.	0.166	1.878	38.681 ***	3.968 **
Luxembourg	0.001	0.002	10.832 ***	5.700 ***
Netherlands	0.075	0.651	2.847 *	4.000 **
New Zealand	0.003	0.020	8.265 ***	8.531 ***
Norway	0.041	0.173	2.490	3.678 **
Poland	0.181	0.178	8.775 ***	3.485 **
Portugal	0.040	0.025	0.644	1.376
Slovak Republic	0.019	0.058	2.495	4.699 **
Slovenia	0.011	0.017	13.529 ***	10.416 ***
Spain	6.470 **	4.312 **	7.103 ***	5.616 ***
Sweden	0.220	0.483	2.094	1.784
Switzerland	0.058	0.150	1.851	2.555 *
United Kingdom	2.589 *	8.208 ***	3.979 **	3.186 **
United States	218.56 ***	251.97 ***	10.453 ***	12.218 ***

\* significant at 0.1%, \*\* significant at 0.05%, \*\*\* significant at 0.01%

Source: Own preparation

The results suggest that regardless of the income group, the relationship from GDP growth to the Global Competitiveness Index is more often observed than the opposite one. It is interesting that only for large economies like India, China, Russia, Germany, the United Kingdom and the United States there is a strong significant influence of the GCI on the growth rate of GDP. For the majority of these countries the relationship is unidirectional only, but a two-way relationship between competitiveness and economic growth is observed for the United Kingdom and the United States.

In this research we use a LSDV estimator, which, in light of dynamic regression (2), has an upward bias in comparison with the Anderson-Hsiao estimator or the GMM estimator, but the values of the F statistics obtained for the countries mentioned above are large enough to reject the null.

## Conclusions

This paper has tested whether the GCI is a reliable predictor of economic growth or whether the growth rate can be believed to predict the global competitiveness of a country. Our empirical study, first done at the country group level, indicates a quite strong bidirectional causality between the Global Competitiveness Index and the economic growth rate for all the lags tested. The exception is the group of high income non-

OECD countries, where a relation from the GCI to GDP growth is significant for one lag and the opposite relation for the second lag only.

We have also examined the kind of causality. The results were in line with our expectations. All the groups analysed turned out to be heterogeneous.

The last step of our investigation was to assess the direction of the relationship between the GCI and the growth rate of GDP at the level of individual countries within each of the five groups of countries. The results of our estimations confirm that economic growth affects global competitiveness in the case of 70% of the countries in our sample. Most often this relationship exists among low income countries (in 12 out of 15 economies i.e. for 80% of the countries analysed). In turn, it is relatively rare among high-income non-OECD countries (in 53% of the countries).

Finally, we have confirmed that the GCI can predict the dynamic of a national economy, but only in some particular cases. We can support the WEF's claim that the GCI can "determine the aggregate growth rates of an economy" for the group of low-income countries. For almost 8 of the 15 countries with a lower income level we can justify the contribution of their global competitiveness level to their economic growth during the last decade. This evolution is probably due to a large number of economic reforms in these countries and good political stability, which affect capital accumulation and finally economic growth. Among the countries with a higher level of income, the causal relationship from the Global Competitiveness Index to GDP growth only exists for seven countries and they are all big economies, such as China, India, the United States and Russia.

Our study has a preliminary character, but its results imply that the WEF should refine GCI so that it can be a better predictor of economic growth.

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