Competitiveness and Economic Growth: A model with application to 105 countries (2006 to 2017)

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Abstract
This study aims to establish a link between economic growth and competitiveness based on data from the World Economic Forum (WEF). WEF outlines the competitiveness of countries in 12 pillars, which are grouped into three sub-indices – basic requirements, efficiency enhancers, and innovation and sophistication factors. In particular, this paper presupposes a model in which efficiency enhancers and factors of innovation and sophistication depend on the evolution of basic requirements in earlier periods. An empirical application of the model is performed for 105 countries using the Pooled Ordinary Least Squares (POLS) and Fixed Effects (FE) methods. In sum, the results show that the level of economic activity of the countries is positively related to the competitiveness indicators, besides corroborating the conclusion of the model that the current and lagged rate of the basic factors are the main determinants of the activity level of the countries.
Keywords: Economic growth; Global Competitiveness Index, panel data
JEL Classification: O47, F43

Resumo
Este estudo visa estabelecer uma ligação entre o crescimento econômico e competitividade a partir dos dados do Fórum Econômico Mundial (WEF). O WEF delineia a competitividade dos países em 12 pilares, os quais são agrupados em três subíndices – requerimentos básicos, intensificadores de eficiência e fatores de inovação e sofisticação. Em particular, o presente artigo pressupõe um modelo teórico no qual os intensificadores de eficiência e os fatores de inovação e sofisticação dependem da evolução dos requerimentos básicos em períodos anteriores. Uma aplicação empírica do modelo é realizada para 105 países utilizando os métodos *Pooled Ordinary Least Squares* (POLS) e Efeitos Fixos (EF). Em suma, os resultados apontam que o nível de atividade econômica dos países se relaciona positivamente com os indicadores de competitividade, além disso, corroboram a conclusão do modelo teórico de que a taxa corrente e defasada dos fatores básicos são os principais determinantes do nível de atividade dos países.
Palavras-chave: crescimento econômico; índice de Competitividade Global, dados em painel

Área 6: Globalização e competitividade regional

1. INTRODUCTION

The term competitiveness is related to productivity and quality gains resulting from an interaction of factors, internal and external to the company, that make economic production more efficient, such as infrastructure, education, health, innovation and macroeconomic policy. Thus, competitiveness can be seen as the sum of productivity and quality gains related to important factors for building companies competitive advantages and, consequently, contributing to the countries own development. For the World Economic Forum (WEF, 2017, p. 11), competitiveness "is the set of institutions, policies and factors that determine a country's level of productivity". Productivity is the element that sustains the economic prosperity of nations. Porter (1990, 2003) argues that a country's competitiveness depends on its industry's ability to innovate, keep up to date, and achieve continuous productivity and quality gains. Thus, the wealth of nations and the quality of life of populations depend on the ability of companies to innovate and increase productivity gains permanently. For Krugman (1996a, 1996b), competitiveness is defined as the ability to produce goods and services that meet the test of international markets, while maintaining high and sustainable income levels or, more generally, the ability to generate, being exposed to external competition, relatively high levels of income and employment.

Esser *et al* (1994) argue that the concept of competitiveness involves four levels of variables that affect the competitive capacity of companies and countries, calling it systemic competitiveness, namely: micro level, which considers the ability of companies to increase revenues; meso level, which deals with industrial and regional competitiveness related to infrastructure and the ability to network and make improvements to innovation systems; macro level, related to national macroeconomic factors that affect companies' competitiveness, such as interest and exchange rates, trade and payment balance and public debt; and target level, related to the cultural factors of the country, such as the ability of society to reach consensus to achieve the jointly defined objectives. In addition, the authors consider it important for countries to be competitive so that they can acquire more markets and consequently higher income levels.

Given the preponderant role of competitiveness in the economic performance of countries, it was necessary to understand the factors that determine the level of competitiveness of nations. In the meantime, since 2004, the World Economic Forum (WEF) has developed a methodology for measuring the level of competitiveness of countries. The assessment is based on a nation's level of competitiveness, using the Global Competitiveness Index (GCI), which is published annually and contains a ranking among countries, as a parameter. The purpose of the report is to identify the factors that determine a nation's economic growth and development by trying to explain why some countries can grow more than others.

With a focus on long-term economic performance, the Global Competitiveness Index combines a set of variables that are relevant to determining a country's prosperity. These variables are grouped into twelve pillars and divided into three non-independent sub-indices. They are: basic requirements (institutions; infrastructure; macroeconomic stability; health and primary education); efficiency enhancers (higher education and training; goods market efficiency; labor market efficiency; financial market sophistication; technological readiness; market size); and innovation and sophistication factors (business sophistication; innovation)[1].

[1] The 3 (three) sub-indices have different weights in the calculation of the global competitiveness index. The measurement varies depending on the stage of development of each country's economy, which is measured by

According to WEF (2017), this division is important because it allows specifying in which areas a particular country needs to improve.

In this context, the objective of this paper is to verify the relationship between competitiveness and economic growth from the Global Competitiveness Index. Therefore, a model is used in which it is assumed that efficiency enhancers and factors of innovation and sophistication depend on the evolution of basic requirements in previous periods. An application of the model is developed using the Pooled Ordinary Least Squares (POLS) and Fixed Effects (FE) methods. Evidence suggests that GCI competitiveness indicators are positively correlated with countries' economic performance. Moreover, they point out that the growth rate of the level of economic activity is a function of the current and lagged growth rate of two basic requirements.

In addition to this introduction, the paper is further subdivided into four sections. The second section presents the concept of competitiveness of the World Economic Forum from the 12 pillars, as well as relates each pillar to the countries' economic growth. The third section develops the model. The fourth presents the database. The fifth exposes and discusses an application of the model. And the sixth section brings the final remarks.

2. ECONOMIC GROWTH DRIVEN BY THE GLOBAL COMPETITIVENESS INDEX: THEORETICAL ASPECTS

According to WEF (2017), a country's competitiveness is a set of 12 pillars, structured in three groups. The first group is related to the basic requirements of (i) institutions, (ii) infrastructure, (ii) macroeconomic stability, (iv) health and (v) primary education. The second group represents the sources of efficiency – (vi) higher education, (vii) commodity market efficiency, (viii) labor market efficiency, (ix) financial market development, (x) technological readiness, size and sophistication of the financial market. The third group includes factors of (xi) innovation and (xii) business sophistication. Pillars are important for all economies; however, due to the different stages of development of countries, they affect them in different ways. Basic requirements are crucial for countries that are still in the factor-oriented stage, and efficiency enhancers are important for countries that have progressed in the efficiency-oriented stage. The factors of innovation and sophistication affect countries at the innovation stage. All countries between two of the three stages can be considered in transition. For each of the 12 pillars of a country's competitiveness, there is empirical evidence of its impact on economic growth.

The quality of a country's institutions (i), which can be determined by the legal framework in which individuals, businesses and governments interact to generate wealth, has been proven to be a factor in economic growth in several studies (eg, Acemoglu *et al* (2002); North 1989; Rodrik *et al* (2002). According to Miller *et al* (2014), public institutions can impose significant economic costs on companies and slow down the process of economic development (eg, excessive bureaucracy, over-regulation, corruption, dishonesty in dealing with public procurement, lack of transparency, inability to provide appropriate business services, inadequate management of public finances, and political dependence on the judiciary.) In addition to public institutions, good governance of private institutions and maintaining the trust of investors and consumers are also important elements of the process of generating wealth (ZINGALES, 1998).

GDP per capita. The weighting of each index is performed by looking at the country classification at stage 1 (one), stage 2 (two) or stage 3 (three), or at some stage of transition.

The quality and breadth of infrastructure networks (ii) that integrate the domestic market and connect it at low cost to markets in other countries, allow companies to market their products and services securely and timely, enable a fast and cheap flow of information, determine the location of economic activities, facilitate the movement of workers, prevent interruptions and shortages of energy supply, among others. It's positive impact on economic growth has been identified, for example, by Canning and Pedroni (1999) and Calderon and Serven (2004).

Although Fischer 1993 found only weak effects of macroeconomic stability (iii) on productivity and growth, there is evidence of its impact on short-term economic activity. For example, the positive impacts of low and moderate inflation levels are studied by Goodfriend (2007) and Temple (2000), the impacts of government debt levels are examined by Reinhart and Rogoff (2010) and the tax structure and the way the government spends money are analyzed by Johansson *et al* (2008), among others.

Healthy workers are vital to a country's productivity. Thus, investment in the provision of health services (iv) is a factor of economic development and growth (SACHS, 2001). The amount and quality of basic education (v) received by the population increases worker efficiency and contributes to the creation or execution of innovations. Secondary and tertiary enrollment rates, as well as the quality of higher education (vi), are also key factors for economies wishing to move up the value chain (KRUEGER AND LINDAHL, 2001).

Commodity market efficiency (vii) is related to producing the right mix of products and services, given a country's specific supply and demand conditions, as well as the effectiveness of trade with these products (WEF, 2017). The best environment for commodity exchange requires a high level of competition in the market and a minimum of government intervention that hinders commercial activities (BRANSTETTER ET AL, 2010). Opening up to international competition via trade and investment allows a country to improve productivity, expand its most productive local industries, and access more advanced knowledge and technologies from abroad (DELGADO ET AL, 2012). A positive relationship between openness and prosperity was found by Alesina *et al* (2005); Baldwin (2003); Dollar and Kraay (2003) among others, as well as the positive influence of trade on knowledge transfer and innovation in a country (BRANSTETTER, 2006). Market efficiency also depends on demand conditions, such as customer orientation and buyer sophistication (PORTER, 1998). More demanding customers force companies to be more innovative and customer-oriented and thus impose the discipline necessary for market efficiency.

To achieve labor market efficiency (viii), workers must be allocated to their most effective use in the economy and given incentives to invest their best efforts in their jobs. Thus, the labor market creates support for economic growth if it is flexible enough to move workers from one economic activity to another quickly and at low cost, and to allow wage fluctuations without much social disruption (KAPLAN, 2009).

Efficient access to capital (ix) is important for companies to make the long-term investments needed to increase productivity levels (LEVINE, 2005). Financial market development is reflected in the allocation of financial resources to business or investment projects with the highest expected rates of return rather than politically connected ones. To fulfill these functions, the financial market needs appropriate regulation to protect investors and other actors in the economy.

For an economy to thrive, it is important to be agile in adopting technologies to increase the productivity of its industries (BARRO AND SALA-IMARTIN, 2003). Thus, contemporary technological readiness (x_a) is reflected in the access and use of information and communication technology (ICT).

Market size (x_b) affects productivity through opportunities to achieve economies of scale. In the age of globalization, international markets have become a substitute for domestic markets, especially for small countries. Thus, exports and participation in regional integration (which allows cheaper and simpler access to other markets) can be a substitute for domestic demand in determining the size of the market for companies in a country. The effects of international markets on the economic growth of countries are shown by Parteka and Wolszczak-Derlacz (2013).

The positive impact of technological innovation (xi) (including innovation support institutions and policies) on productivity has been empirically proven by Grossman and Helpman (1991) and Furman et al (2002). According to Romer (1990), technological innovation is particularly important for economies that can no longer improve their productivity simply by integrating and adapting exogenous technologies.

Business sophistication (xii) is concerned with the quantity and quality of local suppliers, service providers and institutions and the extent of their interactions. The companies' advanced operations and strategies (brands, marketing, distribution, advanced production processes and unique and sophisticated product production) spread throughout the economy and lead to sophisticated and modern business processes in the country's business sectors, which contributes to higher productivity (WEF, 2013). Bloom and Van Reenen (2007) confirm the importance of business operations and productivity strategies.

3. THE MODEL

Starting from the relationship between competitiveness and economic growth, the first equation of the model assumes that the level of production Y (economic growth proxy) is a function of the level of Competitiveness, C, of the country in period t.

$$Y_t = C_t^{\rho} \tag{1}$$

Where ρ is the elasticity of the output rate relative to the competitiveness growth rate.

However, according to the Global Competitiveness Report, a country's competitiveness can be expressed in twelve pillars, divided into three sub-indices: basic requirements (B) efficiency enhancers (E) innovation and sophistication factors (I). Therefore, it is possible to represent the degree of competitiveness of a country in a given period of time t from equation 2:

$$C_t = I_t^{\alpha} E_t^{\emptyset} B_t^{\beta} \tag{2}$$

According to WEF (2017), the twelve pillars of competitiveness are not independent, but sequentially interdependent, forming three stages/steps that countries must go through to become competitive and consequently achieve higher growth. The country starts at the first stage driven by its endowment of factors – mainly unskilled labor and natural resources. However, as the country develops the basic requirements indicators, it becomes competitive,

allowing it to reach the developmental stages towards efficiency and innovation, respectively. Thus, there is a relationship of dependence of one stage on the other. For a country to enter stage 2, there is a need for deep development of the stage 1 pillars. For a country to enter stage 3, there is a need for improvements to the stage 1 and 2 pillars. Stage 1, being the most basic, is the one that contains the most relevant pillars, which will provide the evolution of the other pillars contained in stages 2 and 3.

Therefore, based on WEF (2017), it appears that the performance of a country in efficiency enhancers and factors of innovation and sophistication in a given period t, is a function of the growth rate of lagged basic requirements, $g_{B_{t-\tau}}$ and $g_{B_{t-j}}$.

$$E_t = Ne^{t\theta g_{B_{t-j}}} \tag{3}$$

$$I_t = Me^{t\gamma g_{B_{t-\tau}}} \tag{4}$$

Log-linearizing and deriving from t equations 3 and 4, we have the growth rate of the efficiency enhancers and the innovation and sophistication factors, respectively.

$$\frac{\dot{E}}{E} = g_E = \theta\frac{\dot{B}}{B} = \theta g_{B_{t-j}} \tag{5}$$

$$\frac{\dot{I}}{I} = g_I = \frac{\dot{B}}{B} = \gamma g_{B_{t-\tau}} \tag{6}$$

Substituting equation (2) into equation (1), one can rewrite the product as a function of the basic requirements, efficiency enhancers, and innovation and sophistication factors (7):

$$Y_t = \left(B_t^{\beta} E_t^{\emptyset} I_t^{\alpha}\right)^{\rho} \tag{7}$$

Log linearizing (7) and deriving from time, we have the product growth rate, as a function of the growth rates of the basic requirements, the efficiency enhancers and the innovation and sophistication factors (8):

$$g_{yt} = (\beta\rho)g_{Bt} + (\emptyset\rho)g_{Et} + (\alpha\rho)g_{It} \tag{8}$$

Substituting (5) and (6) for (8), the product growth rate is a function of the current and lagged growth rate of the basic requirements (9):

$$g_{yt} = (\beta\rho)g_{Bt} + (\emptyset\rho\theta)g_{Bt-j} + (\alpha\rho\gamma)g_{Bt-\tau} \tag{9}$$

4. DATA BASE

For the application of equation 9, data were considered for 105 countries in the period from 2006 to 2017. As a proxy for economic performance, we used the Gross Domestic Product at constant 2010 prices, present in the World Bank database. For information on basic requirements, efficiency enhancers, and innovation and sophistication factors, we used the scores of the respective indices presented in the Global Competitiveness Reports of the World Economic Forum.

From table 1, it is observed the impact that the increase of the score in the basic requirements sub-index would have in the two other sub-indices. Overall, it is noted that a positive 0.36 change in the average of the basic requirements sub-index score over a 2-year average yields an average increase of 0.15 point in the efficiency stimulant sub-index over a medium range 3.86 years, and a 0.18 point increase in the sub-index of innovation and sophistication factors over an average range of 4 years. In addition, the data show that 81 countries have improved in either or both sub-indices (efficiency drivers and innovation and sophistication factors) following the prior development of the basic requirements sub-index.

Table 1 – Subindexes Evolution – WEF (2006-2017)

ST	ECONOMY	B		E		I	
		TV	SV	TV	SV	TV	SV
STAGE 1	Benin	2007/2011	0,3	2011/2015	-0,1	2011/2015	0,1
	Burundi	2006/2007	0,3	2007/2017	0,3	2007/2017	0,5
	Cambodia	2009/2011	0,4	2011/2012	0,1	2011/2012	0,2
	Cameroon	2007/2010	0,3	2010/2012	0,3	2010/2014	0,4
	Chad	2010/2012	0,4	2012/2014	-0,2	2012/2014	-0,3
	Ethiopia	2010/2011	0,5	2011/2015	0,1	2011/2016	0,6
	Gambia	2007/2008	0,4	2008/2017	0,2	2008/2012	0,2
	Ghana	2009/2012	0,5	2012/2017	0,1	2012/2017	0,4
	Haiti	2012/2013	0,3	2013/2014	0,2	2013/2014	0,1
	India	2014/2016	0,4	2016/2017	0,1	2016/2017	0,1
	Kenya	2007/2008	0,3	2008/2014	0,2	2008/2017	0,2
	Kyrgyz Republic	2009/2013	0,3	2013/2014	0,2	2013/2014	0,3
	Lesotho	2012/2013	0,5	2013/2017	-0,2	2013/2015	0,6
	Malawi	2009/2011	0,3	2011/2015	-0,2	2011/2016	-0,4
	Mali	2006/2007	0,4	2007/2012	0,2	2007/2014	0,2
	Mauritania	2008/2012	0,3	2012/2017	-0,4	2012/2016	-0,6
	Mozambique	2007/2009	0,3	2009/2012	-0,1	2009/2015	0,3
	Nepal	2010/2013	0,5	2013/2017	0,4	2013/2017	0,2
	Rwanda	2010/2012	0,3	2012/2016	0,1	2012/2017	0,2
	Sierra Leone	2012/2014	0,3	2014/2017	-0,1	2014/2017	0,1
	Tajikistan	2009/2011	0,5	2011/2016	0,3	2011/2016	0,5
	Uganda	2008/2009	0,3	2009/2012	0,2	2009/2016	0,3
	Zambia	2007/2010	0,3	2010/2014	0,3	2010/2014	0,5
	Zimbabwe	2009/2010	0,3	2010/2017	0,2	2010/2013	0,1
TRAN 1-2	Algeria	2012/2014	0,4	2014/2017	0,4	2014/2016	0,2
	Azerbaijan	2007/2012	0,4	2012/2017	0,3	2012/2017	0,5
	Botswana	2007/2008	0,4	2008/2014	0,1	2008/2012	0,2
	Brunei Darussalam	2008/2012	0,3	2012/2013	0,1	2012/2013	0,2
	Kazakhstan	2009/2011	0,3	2011/2015	0,4	2011/2014	0,5
	Mongolia	2009/2010	0,5	2010/2015	0,4	2010/2015	0,3

	Nicaragua	2009/2010	0,3	2010/2017	0,2	2010/2013	0,4
	Nigeria	2010/2012	0,4	2012/2017	-0,1	2012/2015	-0,3
	Philippines	2009/2011	0,3	2011/2014	0,3	2011/2014	0,5
	Ukraine	2010/2011	0,3	2011/2012	0,1	2011/2015	0,3
	Vietnam	2009/2010	0,4	2010/2015	-0,2	2010/2012	-0,4
STAGE 2	Albania	2007/2010	0,6	2010/2017	0,2	2010/2017	0,5
	Armenia	2008/2012	0,4	2012/2016	0,1	2012/2017	0,3
	Bosnia	2009/2010	0,4	2010/2013	0,2	2010/2013	0,5
	Brazil	2007/2010	0,5	2010/2012	0,1	2010/2015	-0,4
	Bulgaria	2009/2010	0,3	2010/2016	0,3	2010/2016	0,4
	Cape Verde	2013/2014	0,3	2014/2015	0,1	2014/2015	0,1
	China	2007/2010	0,5	2010/2017	0,3	2010/2017	0,2
	Colombia	2009/2010	0,3	2010/2016	0,3	2010/2015	0,1
	Ecuador	2010/2011	0,3	2011/2013	0,4	2011/2013	0,5
	Georgia	2011/2012	0,3	2012/2016	0,3	2012/2016	0,2
	Indonesia	2007/2010	0,5	2010/2017	0,3	2010/2017	0,2
	Jamaica	2012/2014	0,3	2014/2017	0,2	2014/2017	0,2
	Montenegro	2009/2010	0,5	2010/2012	-0,1	2010/2015	-0,3
	Morocco	2007/2011	0,4	2011/2017	0	2011/2017	0,2
	Namibia	2006/2008	0,3	2008/2010	0,2	2008/2015	0,3
	Paraguay	2007/2010	0,3	2010/2012	0,2	2010/2017	0,4
	Peru	2007/2010	0,3	2010/2011	0,1	2010/2013	0,1
	Russian	2009/2012	0,4	2012/2016	0,3	2012/2017	0,6
	Serbia	2006/2007	0,3	2007/2017	0,4	2007/2013	-0,3
	Sri Lanka	2009/2010	0,3	2010/2017	-0,2	2010/2017	-0,2
	Swaziland	2012/2013	0,3	2013/2015	-0,1	2013/2017	-0,4
TRAN 2-3	Chile	2009/2011	0,3	2011/2016	0,3	2011/2016	-0,2
	Costa Rica	2007/2008	0,4	2008/2017	0,3	2008/2016	-0,2
	Hungary	2008/2012	0,4	2012/2017	0,1	2012/2016	-0,3
	Latvia	2009/2012	0,3	2012/2014	0,2	2012/2014	0,1
	Lithuania	2012/2014	0,3	2014/2015	0,1	2014/2015	0
	Malaysia	2009/2011	0,4	2011/2015	0,1	2011/2015	0,4
	Mauritius	2009/2013	0,4	2013/2017	0,1	2013/2017	0,1
	Oman	2007/2009	0,3	2009/2013	0,3	2009/2013	0,3
	Panama	2009/2010	0,3	2010/2012	0,3	2010/2013	0,3
	Poland	2009/2010	0,4	2010/2012	0,1	2010/2013	-0,1
	Romania	2009/2010	0,3	2010/2015	0,2	2010/2014	0,3
	Saudi Arabia	2010/2011	0,4	2011/2014	-0,2	2011/2016	-0,5
	Trinidad and Tobago	2008/2009	0,3	2009/2017	0,3	2009/2014	0,1
	Turkey	2009/2011	0,3	2011/2012	0,2	2011/2013	0,3
	Uruguay	2008/2010	0,3	2010/2016	0,2	2010/2016	0

STAGE 3	Bahrain	2006/2010	0,3	2010/2011	0,1	2010/2016	0,3
	Cyprus	2006/2008	0,5	2008/2010	0,1	2008/2009	0,2
	Czech Republic	2013/2015	0,5	2015/2017	0,1	2015/2017	0,1
	Denmark	2013/2014	0,4	2014/2017	0,2	2014/2015	0,1
	Estonia	2009/2010	0,3	2010/2017	0,4	2010/2016	0,3
	Hong Kong	2009/2011	0,3	2011/2013	0,1	2011/2017	0,4
	Iceland	2007/2008	0,3	2008/2012	-0,4	2008/2014	-0,4
	Ireland	2012/2015	0,4	2015/2017	0	2015/2017	-0,1
	Israel	2009/2011	0,3	2011/2017	0,2	2011/2017	0,2
	Italy	2009/2010	0,4	2010/2017	0,2	2010/2017	0,4
	Korea, Republic	2010/2012	0,3	2012/2014	-0,2	2012/2014	-0,2
	Luxembourg	2007/2012	0,3	2012/2014	0,1	2012/2016	0,2
	Malta	2014/2016	0,3	2016/2017	0,1	2016/2017	0,2
	Netherlands	2009/2014	0,3	2014/2017	0,2	2014/2017	0,2
	New Zealand	2007/2013	0,3	2013/2016	0,2	2013/2017	0,3
	Norway	2010/2011	0,3	2011/2015	0,1	2011/2015	0,4
	Qatar	2007/2010	0,3	2010/2015	0,4	2010/2015	0,7
	Singapore	2009/2011	0,3	2011/2014	0,1	2011/2012	0,1
	Switzerland	2009/2015	0,3	2015/2016	0,1	2015/2017	0,1
	United Arab Emirates	2007/2008	0,3	2008/2014	0,6	2008/2016	0,8
	United Kingdom	2009/2010	0,3	2010/2016	0,3	2010/2012	0,3
	United States	2014/2016	0,3	2016/2017	0,2	2016/2017	0,2

† Key: ST: Stages; B: Basic Requirements; E: Efficiency Enhancers; I: Factors of Innovation and Sophistication; TV: Temporal Variation; SV: Score Variation.
Source: WEF (2017)

Stage 1 countries had an average increase of 0.1 point in 4 years in the second sub-index and an average increase of 0.2 point in the third sub-index in 4.25 years, with emphasis on four countries – Cameroon, Nepal, Tajikistan and Zambia –, which had the most significant evolution.

For countries in the transition from stage 1 to stage 2, they had an average improvement of 0.18 points over 4.1 years in the efficiency stimulators sub-index, and an average evolution of 0.22 points over 3.2 years in the sub-index of innovation and sophistication factors. From this group of countries, the most evolving in the period were: Algeria, Azerbaijan, Kazakhstan, Mongolia and the Philippines.

Stage 2 countries had an average improvement of 0.17 point over 4.2 years in the second sub-index and a high average of 0.15 point over 5 years in the third sub-index. Noteworthy are Ecuador and Russia.

Countries transitioning from stage 2 to stage 3 had an average increase of 0.17 points over 4 years in the efficiency drivers sub-index and an average evolution of 0.04 points over 4 years

in the innovation and sophistication factors sub-index. The best performing nations were Oman, Panama and Turkey.

Stage 3 countries had an average improvement of 0.14 points in 3.3 years on efficiency enhancers, and a high average of 0.22 points in 3.6 years on innovation and sophistication factors. Highlighting the development of Estonia, Qatar, the United Arab Emirates and the United States.

Considering the stages of development, it can be said that the transition countries from stage 1 to stage 2 had the highest average evolution in the sub-indices of efficiency enhancers and factors of innovation and sophistication, after a previous increase in the basic requirements sub-index. This confirms the arguments of the World Economic Forum that nations in this rating range already have improvements in the pillars of institutions, infrastructure, the macroeconomic environment, and health and primary education (pillars of the first basic requirements sub-index), enabling the subsequent pillars, that are responsible for the performance of the second and third sub-indices, to be developed. Therefore, there is a dependence on innovation, business sophistication, the goods, labor and financial markets, technological capacity, higher education, training and market size in relation to institutions, infrastructure, the macro environment, health and primary education. From the improvement of these last four pillars, there will be greater evolution of the pillars contained in the subsequent stages (sub-indices).

5. APPLICATION AND DISCUSSIONS

To estimate the parameters of equation 9, we used Pooled Ordinary Least Squares and Fixed Effects methods for panel data. The use of the methods is justified by the fact that the first one works with the unfiltered variables, allowing a purer analysis of the relations, and second because it controls the bias of omitted variables, making the analysis more robust.[2]

The second column of table 2 presents the estimated coefficients by POLS for the ratios of equation 9 – Mod 1. Considering a two-year lag for the growth rate of the basic factors[3], the estimates indicate that the activity level is positively related to current and time-lagged basic requirements, corroborating the implications of the model. That is, a positive 1% change in the growth rate of basic requirements in the current period, g_{Bt}, and the same two-phase lag, g_{Bt-2}, increases the growth rate of the domestic product, g_{yt}, by 0.274% and 0.162%, respectively.

Table 2- Results for country growth rate – g_yt – as dependent variable

	POLS			EF		
Explanatory Variables \Model	Mod1	Mod2	Mod3	Mod4	Mod5	Mod6
	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient

[2] For more information, see Greene (2012), Maddala and Lahiri (2006), Davidson and MacKinnon (1993), and Judge *et al* (1985).

[3] Given the evidence that on average basic factors have an effect on innovation potential and efficiency over 2.5 years, it was decided to work across the application with the basic factor growth rate, g_b, lagged by 2 years. In addition, to corroborate the evidence of dependence on the Efficiency Stimulators (E) and Innovation and Sophistication Factors (I) in relation to the basic factors lagged in 2 periods, (B) a correlation test was applied (Appendix 1). The evidence is highly correlated.

g_{Bt}	0.274*** (0.000)	0.124*** (0.000)	0.263*** (0.000)	0.230*** (0.000)	0.100*** (0.001)	0.226*** (0.000)
g_{Bt_2}	0.162*** (0.000)	-	0.163*** (0.000)	0.127*** (0.000)	-	0.127*** (0.000)
g_{Et}	-	0.164*** (0.000)	0.039 (0.492)	-	0.09*** (0.018)	-0.005 (0.916)
g_{It}	-	-0.013 (0.691)	0.027 (0.482)	-	-0.014 (0.667)	0.033 (0.343)
Constant	0.015*** (000)	0.018*** (0.000)	0.015*** (0.000)	0.016*** (000)	0.019*** (0.000)	0.015*** (0.000)
Number of observations	945	1155	945	945	1155	945

Source: Own elaboration

† p-value in parentheses with *** p <0.01, ** p <0.05, * p <0.1

As a comparison, two more exercises using the POLS method were implemented – Mod2 and Mod3. In Mod2, we estimate the effect of the growth rate of the basic requirements, g_{Bit}, efficiency enhancers, g_{Et}, and innovation and sophistication factors, g_{It}, on the GDP rate, g_{yt}. The objective is to test the current relationship between economic performance level and WEF sub-indices (2018). In the third exercise, Mod3, the growth rate of the two-phase lagged requirements, g_{Bt-2}, is added to Mod2. The purpose of this application is to verify how the significance and magnitude of the coefficients related to the current variables – g_{Bt}, g_{Et} and g_{It} – change by adding the conclusion of the model – the basic requirements are the main determinants of the efficiency enhancers and the power innovation factors and sophistication of countries in subsequent periods.

In the third column of Table 2, the estimated coefficients for Mod2 indicate that the growth rate of the basic requirements, g_{Bt}, and the efficiency enhancers, g_{Et}, are significant at 99% confidence and present signal as proposed by the Forum. Economic growth, that is a positive 1% change in the growth rate of basic requirements and efficiency enhancers, raises the product growth rate by 0.124% and 0.163%, respectively. On the other hand, the growth rate of innovation and sophistication factors, g_{It}, is negative and not significant. The non-significance may be due to the joint dependence of this sub-index with the efficiency enhancers on time-lagged basic requirements, which makes g_{Et} and g_{It} highly correlated[4] – Appendix 1.

For Mod3 – fourth column of table 2 –, it is noted that both the growth rate of the current basic requirements, g_{Bt}, and lagged in two periods, g_{Bt-2}, are significant at 99% confidence and positive, that is , a positive change of 1% in g_{Bt} and g_{Bt-2}, raises the product growth rate by 0.263% and 0.163%, in due order. Otherwise, g_{Et} and g_{It} are not significant to explain variations in product growth rate, g_{yt}. The non-significance of the efficiency enhancer sub-indices and the innovation and sophistication factors have similar characteristics to the previous one, that is, since these indices are highly correlated with the time-lagged basic requirements, g_{Bt-2}, this may have captured the full effect, making g_{Et} and g_{It} nonsignificant and reinforcing the outcome of the model that, at the limit, changes in the growth rate of countries are essentially explained by changes in the current and lagged rate of basic factors (institutions; infrastructure; macroeconomic stability; health and primary education).

[4] In the process of parameter estimation, when there are highly correlated explanatory variables, usually one attracts every effect, rendering the others meaningless.

In order to make the predicted ratios of POLS estimates robust, the previous exercises are redone using the Fixed Effects method, with columns 5, 6 and 7 representing the modeling structures of columns 2, 3 and 4, respectively. The estimation of fixed effects equation 9 – Mod4 – confirms the results presented in column 2, that is, the positive values of the g_{Bt} and g_{Bt-2} coefficients indicate that the current and lagged rate of the basic requirements positively affects the activity level. Concerning columns 6 (Mod5) and 7 (Mod6), the evidence corroborates the estimates presented in columns 3 and 4, indicating that the basic requirements tend to attract the full effect on the activity level, making the coefficients of g_{Et} and g_{It}. In general, both POLS and EF estimates corroborate the implications of the model, suggesting that in the limit the GDP growth rate is a function of the current and lagged rate of the basic requirements.

6. CONCLUSION

This article sought to broaden the discussion between competitiveness and economic growth by focusing on the Global Competitiveness Report (GCR) developed by the World Economic Forum (WEF). A model was developed, in which the solution is that the growth rate of a country's level of economic activity over a given period of time is a function of the current and lagged growth rate of basic requirements.

Using data for 105 countries from 2006 to 2017, six econometric exercises were performed to test the implications of the model. Based on the estimation coefficients, the evidence suggests that GDP growth rate and economic competitiveness growth are positively related, corroborating the studies by Canning and Pedroni (1999), Calderon and Serven (2004), Acemoglu *et al* (2002)); North 1989; Rodrik *et al* (2002), Barro and Sala-iMartin (2003), Grossman and Helpman (1991) and Furman *et al* (2002), Romer (1990), Van Reenen (2007) among others. Moreover, the results indicate that the growth rate of the economic activity level is a function of the current growth rate and lagged in two periods of the factors, thus corroborating the conclusions of the model.

Thus, for a country to achieve a satisfactory and sustainable level of economic performance, it is recommended that there be high investments in the basic requirements pillars, in order to allow the full performance of the other pillars referring to the most advanced stages of stimulators – efficiency, innovation and sophistication – in subsequent periods.

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Appendix 1- Correlations between EE, FIS and RB lagged by two periods

Variables	EE_t	FIS_t	RB_{t-2}
EE_t	1		
FIS_t	0.914	1	
RB_{t-2}	0.908	0.847	1

Source: Own elaboration from WEF data (2017)