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New evidence of competitiveness based on the global competitiveness index

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Abstract

The search for answers as to the determinants that most influence countries`competitiveness has been a constant concern of economists especially in the last years. As competitiveness impacts economic growth, which in turn allows providing high levels of prosperity to citizens, it turns the topic hotter and more current. Competitive economies provide greater productivity gains that impact workers`earnings through their wages. Considering the 12 pillars of the GCI Index for the first 50 countries in the 2018 Report, we intend to empirically verify which pillars are most important for the economic growth of nations. Using the fixed effects of panel data and GMM in the first differences, we conclude that the quality of institutions, innovation, and infrastructures tend to impact economic growth. The labor market is contributing to the decline in GDP, perhaps because there are strict worker protection laws in most countries, which prevent the labor market from functioning efficiently. Surprisingly, the variables market size and business sophistication present negative coefficients, perhaps because the way chosen to measure these variables is not the most appropriate, or the scores assigned are not the correct ones. In the fixed-effects model, the variables health and primary education, skills, market efficiency, and technological readiness have a positive and statistically significant impact, which in itself demonstrates the contribution of these variables to economic growth.

1. Introduction

The concept of a country's competitiveness is not yet fully defined, as well as making this measurement through criteria that allow it to accommodate the different realities of world economies and obtain results comparable between economies and over time, is still not completed. Aware of this reality, the World Economic Forum seeks, through the elaboration of the Global Competitiveness Index and with the respective detailed report, to provide a basis for comparison between countries, and over time, of their evolving evolution in terms of competitiveness.

The competitiveness ranking of the World Economic Forum has been published since 2005, but the study of competitiveness by this organization already reports back to 1979. Since 2007, the competitiveness ranking has been based on 12 dimensions called pillars of competitiveness and more than 100 indicators. Previous empirical studies have been based on the Global Competitiveness Index (GCI), but none, as far as we are aware, used the pillars of competitiveness jointly to study their effect on the economic growth of the respective countries. Mandatorily, not all 12 dimensions will have the same impact on economic growth. In this study and for the sample and period considered, we purpose to study which or which dimensions are more relevant and which, for example, could receive special attention.

It is very difficult for nations' policymakers to simultaneously act on all the important variables identified in the literature and that make up the GCI, and through the results of this study they can formulate informed action choices, this being our greatest motivation and objective in the elaboration of this paper.

The twelve pillars are divided into four groups, namely, Enabling Environment (Institutions; Infrastructure; ICT Adoption; Macroeconomic Stability), Human Capital (Health; Education and Skills), Markets (Product Market; Labour Market; Financial System; Market Size), and Innovation Ecosystem (Business Dynamism; Innovation Capability), although the study of each of these pillars over economic growth has been residual or inexistent (Dadgar et al., 2018).

Although not free from criticism, this tool has proven to be extremely useful in terms of studying competitiveness, both for policymakers, economists, managers, students, and others interested in this important subject. One of the great advantages of this index is its annual publication of free access in full terms, as well as covering 140 economies that together represent about 99% of the world GDP. Still, and despite the well-reported positive and significant correlation between the final value of the index and economic growth, the relevance and contribution of each of these twelve pillars for economic growth worldwide have not yet been assessed. However, the literature that focuses on economic growth based on the competitiveness of countries is extensive. Authors such as Annoni and Dijkstra (2013) and Schwab and Sala-i-Martin (2014, 2015), among many others, argue that the more competitive a country is, the greater the probability of obtaining economic growth. Nevertheless, constantly changing economic, social, political aspects, and many other factors, cause differences in the global competitiveness of economies, conditioning economic growth. This forces economies to analyze their competitive level more complexly since the country's heterogeneity will play a role in the relationship between competitiveness and growth (Kiseľáková et al., 2019). This as well justifies the need to study the impact of each of these pillars over economic growth worldwide, filling this gap in the literature on economic growth and the GCI.

After these introductory remarks, the next section presents a brief literature review. Section three presents data and methodology, section four the estimation results, and section five presents the main conclusions.

2. Brief literature review

One of the first authors to address in the literature the importance of competitiveness was Krugman (1996), who points out that a country that does not supplant others in terms of productivity or technology, will face competitive problems and will not be able to compete in international markets. Previously, Porter (1990) states that a country's competitiveness depends on its capacity to innovate, which will allow it to achieve competitive success as compared to international competition.

Given the importance of countries' competitiveness in international markets, the subject continued to be debated in the literature, and more recently, Annoni and Dijkstra (2013) and Schwab and Sala-i-Martin (2015) point out that the more competitive an economy is, the greater its long-term capacity to attract investment, create wealth, jobs and social well-being. These authors conclude that more competitive economies provide prosperity in the future and solidly maintain that prosperity.

Additionally, Sachs and Larrain (1993) point out that the competitiveness of an economy depends on the existence of efficient markets, as well as production factors and other characteristics that develop potentializing advantages, allowing sustainable economic growth. Some of these characteristics have been addressed in the literature, such as productivity, innovation, R&D, entrepreneurship, education, and the macroeconomic environment, among others.

Regarding productivity Hanafi et al. (2017), in an extensive literature review, conclude that productivity is the main determinant of competitiveness, which in turn is responsible for achieving high standards of living and promoting social inclusion, reducing inequalities.

Concerning innovation, Ciocanel and Pavelescu (2015), Kuhlman et al. (2017), among others, consider that it contributes to the increase of competitiveness, being even an important pillar in the economic growth of countries. Still on the importance of innovation in economic growth, Marčeta and Bojnec (2021), for the EU countries between 2008 and 2017, found strong positive correlations between the GCI indicators that measure innovation and GDP per capita. Positive correlations between GDP per capita and the GCI score were also found.

Among other factors that make it possible to contribute to increasing the competitiveness of a country, Rusu and Dornean (2019) argue that the quality of entrepreneurship is one of the factors that most impact this competitiveness, but the impact of R&D innovation should not be overlooked, as well as the macroeconomic environment.

Regarding education, Radulesco et al. (2018) believe that the level of higher education is mainly the most important factor that reinforces the competitiveness of an economy. Reinforcing the importance of the macroeconomic environment in the competitiveness of countries, Stightz (2000) argues that high public debts cause weak competitive advantages in international markets and slow economic growth. More recently, Kristic et al. (2020) analyzing the competitiveness of 32 countries in Europe found empirically that education in general and higher education in a particular way, are one of the main sources for a country to obtain competitiveness and move to a higher level of economic development. Still, for these authors, competitiveness significantly determines the sustainable level of prosperity achieved by an economy.

As well, Ionesco (2012) believes that the bureaucracy of public institutions can constitute a barrier to the competitiveness of countries, affecting their development and stability. However, concerning the institutions, Buitrago and Camargo (2021) state that in recent years due to the growing globalization and international competition, the countries where the institutions are stronger, besides being more competitive, tend to increase their economic performance.

To measure the competitiveness of countries, several international organizations publish different rankings based on micro and macroeconomic indicators, as well as surveys obtained from important national players. The growing international competitiveness, the dynamic development of information and communication technology, knowledge, as well as the scarcity of resources, lead countries to pay growing attention to the evaluation of competitiveness, which for Onuferavá et al. (2020) justifies the use of indices such as the Global Competitiveness Index of the World Economic Forum. For these authors, these indices also serve as country performance indicators, which can help policymakers to solve the most significant problems and implement more sustainable economic development strategies.

For Schwab and Sala-i-Martin (2014) the Global Competitive Index was designed to assess the ability of countries to provide high levels of prosperity to their citizens. They also consider that it is a comprehensive indicator for measuring competitiveness as it involves several dimensions of national realities.

Also, in the same sense, Siddiqui and Azhar (2020) considering that competitiveness increases the likelihood of a nation exporting, believe that the GCI is an indicator that adequately measures the level of national competitiveness.

3. Data and methodology

Thus, based on the twelve pillars of competitiveness in the Global Competitiveness Index, for the years 2007 to 2017, and considering solely the first 50 countries in the ranking (in the 2017-2018 edition), understand whether all the pillars influence economic growth and which ones contribute most to this growth becomes essential. Moreover, the present study turns possible the replication of the study for any year, period, and a panel of countries, whereas providing a brief general picture of the overall importance and contribution of any of these pillars to the 50 most competitive countries.

Thus, according to The Global Competitiveness Report 2017–2018, the top 50 countries in the ranking and which were considered in this study are shown in Table 1.

Table 1. Countries considered in the study

1. Switzerland	11. Norway	21. Australia	31. Czech Rep.	41. Lithuania
2. United States	12. Denmark	22. France	32. Thailand	42. Portugal
3. Singapore	13. New Zealand	23. Malaysia	33. Chile	43. Italy
4. The Netherlands	14. Canada	24. Ireland	34. Spain	44. Bahrain
5. Germany	15. Taiwan	25. Qatar	35. Azerbaijan	45. Mauritius
6. Hong Kong	16. Israel	26. Korea, Rep.	36. Indonesia	46. Brunei Darius.
7. Sweden	17. U. A Emirates	27. China	37. Malta	47. Costa Rica
8. United Kingdom	18. Austria	28. Iceland	38. Russian Fed.	48. Slovenia
9. Japan	19. Luxemburg	29. Estonia	39. Poland	49. Bulgaria
10. Finland	20. Belgium	30. Saudi Arabia	40. India	50. Panamá

Source: Authors' elaboration.

The twelve pillars of competitiveness that serve to calculate the GCI are the independent variables of our model (Table 2) and to assess the importance that these twelve variables have in economic growth, we use the per capita Gross Domestic Product (PPP) as a dependent variable. To better interpret the coefficients, we use a log-log model specification, which also has the advantage of allowing us to compute elasticities.

Our panel ordinary least square (OLS) regression is a follow:

$$Ln\,GDPpc_{(i,t)} = a\ +\ \sum_{K=1}^{K}\beta_k\,X_{kit} +\ \varepsilon_{i,t} \qquad\qquad (1)$$

Where t = 1,…, T respects periods and i = 1,…, N to countries of the panel, k is the number of explanatory variables and X represents the set of explanatory variables (more information provided in Table 2).

Table 3 contains the main descriptive statistics, and in the last column, we show the countries and years where the maximum and minimum values of the variables were verified.

Three methods can be used to estimate the specification using panel data – OLS, Fixed Effects (FE), and Random Effects (RE). The FEM model is the most appropriate specification to adopt when performing the three statistical tests (Table 5).

Table 2. Variables, objectives, and data sources

Variable	Name	Objectives of the variables	Source
GDPpc	Gross Domestic Product per capita (PPP)	Achieving the growth of an economy.	World Bank
Inst	Institutions	Measure the quality of institutions.	World Economic Forum
Infra	Infrastructure	Measure the development and quality of infrastructure.	World Economic Forum
Macr	Macroeconomic environment	Measure the stability of the macroeconomic environment.	World Economic Forum
Health	Health and primary education	Measure the provision of health services and the quality of primary education.	World Economic Forum
Skills	Higher education and training	Quality of higher education and professional training.	World Economic Forum
Goods	Goods market efficiency	Measure the efficiency of goods markets, as well as the guarantee of their trade ability.	World Economic Forum
Labor	Labor market efficiency	Measure labor market efficiency and flexibility.	World Economic Forum
Finance	Financial market development	Measure the strength and functionality of the financial market.	World Economic Forum
Tec	Technological readiness	Measure the speed with which existing technologies are adopted.	World Economic Forum
Market	Market size	Measure the potential to exploit economies of scale.	World Economic Forum
Bus	Business sophistication	Get the quality of individual firms' operations and strategies and the quality of a country´s overall business networks.	World Economic Forum
Innov	Innovation	Measure, among other factors, investment in R&D, the quality of research institutions, and the protection of intellectual property.	World Economic Forum

Source: Authors' elaboration.

A very common problem in panel data is endogeneity, which is often not verified and corrected. As we can see in Table 4, the results of the Hausman Test, point out that several variables can be considered endogenous (p-value less than 0.05). In this case, the null hypothesis that there is no correlation with the error term is rejected, so the estimation approach using instrumental variables should be used to obtain consistent estimators, for example, by dynamizing the model (Gujarati, 2009).

According to Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998), the inclusion of the lagged dependent variable streamlines the model but causes problems of endogeneity, which cannot be solved by traditional methods (for example 2SLS (Two-stage Least Squares), 3SLS (Three-stage Least Squares) or SUR (Seemingly Unrelated Regression)). So, according to these authors, in this case, the best estimation method should be the GMM method in the first differences.

Table 3. Descriptive statistics

Variable	Average	Standard deviation	Maximum	Minimum	Observations
GDPpc	39511	22421	141635	3525	Max. 2012 Qatar Min. 2007 India
Inst	4.851	0.7776	6.20	3.10	Max.2017 Finland Min.2012 Russia
Infra	5.167	0.8346	6.80	2.70	Max 2010 Hong Kong Min 2007 Costa Rica
Macr	5.295	0.7497	6.80	2.60	Max 2016 Norway Min 2010 Iceland
Health	6.155	0.3799	6.90	4.70	Max 2017 Finland Min 2007 Azerbaijan
Skills	5.094	0.5925	6.30	3.70	Max 2017 Singapore Min 2007 Azerbaijan
Goods	4.858	04498	6.20	3.60	Max 2017 Iceland Min 2011 Russia
Labor	4.704	0.5056	6.00	3.30	Max 2011 Switzerland Min 2014 Italy
Finance	4.715	0.6660	6.20	2.80	Max 2008 Hong Kong Min 2015 Slovenia
Tec	5.055	0.8705	6.50	2.70	Max 2017 Luxemburg Min 2014 India
Market	4.576	1.0771	7.00	2.16	Max 2015 China Min 2007 Malta
Bus	4.817	0.5686	5.93	3.30	Max 2007 Germany Min 2011 Russia
Innov	4.303	0.8112	5.84	2.90	Max 2008 USA Min 2009 Bulgaria

Source: Authors' elaboration.

Table 4. Hausman test specification results

Inst – pvalue = 0.61417	Skills – pvalue = 0.00025	Tec – pvalue = 1.42852e-006
Infra – pvalue = 0.05981	Product – pvalue = 0.00301	Market – pvalue = 0.60123
Macr – pvalue = 0.06452	Labor – pvalue = 0.41225	Bus – pvalue = 2.47206e-005
Health – pvalue = 1.39715e-005	Finance – pvalue = 0.00246	Innov – pvalue = 0.90610

Source: Authors' calculations.

The estimation using the GMM method in the first differences (as recommended by Arellano and Bond, 1991 and Blundell and Bond, 1998), for the variables that seek to justify the growth rate of GDP per capita, allows considering the persistence of the dependent variable in time, in addition to solving potential problems caused by endogeneity.

4. Estimation results

Table 5 reproduces the estimated results through the panel data fixed effects methodology and the GMM methodology in the first differences.

The first major conclusion we can draw is that since the coefficient of the dependent variable lagged in a period is 0.87, it reveals the high persistence of the effect of the economic growth of the previous year, that is, only about 13% of the economic growth is adjusted the following year.

In the fixed-effects model, there is a greater number of variables with statistical significance than in the GMM model, but the GMM model does not present endogeneity, which in this way does not compromise the reliability of the estimated coefficients, as well as its statistical inference.

Table 5. Results from the estimations
Dependent variable: Ln GDPpc

	Fixed effects		GMM first differences	
	Model 1 Coefficients	Model 2 Coefficients	Model 3 Coefficients	Model 4 Coefficients
Intercept	6.94874***	6.81267***	1.30128***	1.41961***
Ln GDPpc (-1)			0.87552***	0.86039***
Ln Inst	-0.12668		0.13991*	0.16266**
Ln Infra	0.17665**	0.16041**	0.17528*	0.21507***
Ln Macr	0.53471***	0.51974***	0.05811	
Ln Health	1.08136***	1.10756***	0.07460	
Ln Skills	0.37306**	0.36155**	0.10484	
Ln Goods	0.27026**	0.24154**	0.08964	
Ln Labor	-0.23726**	-0.25908**	-0.23460**	-0.19387***
Ln Finance	-0.06416		-0.00440	
Ln Tec	0.40360***	0.41646***	-0.10094	
Ln Market	-0.04180		-0.29585***	-0.24795***
Ln Bus	-0.64154***	-0.72700***-	-0.30246***	-0.18911***
Ln Inovat	0.25622**	0.28258**	0.29251***	0.29314***
R-Squared	0.98212	0.98201		
F-test (p-value)	2.96551e-250	1.68271e-256		
Breus-Pagan test (p-value)	0	0		
Hausman test (p-value)	4.74168e-009	8.92379e-009		
Observations	541	541		

Note: ***. **. and * denote statistical significance at the 1%. 5% and 10% level of significance respectively.

Source: Authors' estimations.

We can also see that in the models considered, the quality of a country's infrastructure plays an important role in economic growth. For example, in the case of the GMM model, an increase of 1% in the score of infrastructures can have an impact on the economic growth of between 0.16% and 0.21%.

In models without endogeneity, the variable Institutions assumes statistical significance, which demonstrates its vital role in economic growth. Strong, transparent, and reliable institutions give stability to investors, investments, and entrepreneurs. Michael Porter in 1990, stressed the importance of institutions in the competitiveness and economic growth of countries. With a similar opinion, Acemoglu et al. (2001) demonstrate that strong institutions are an important determinant of countries' wealth and long-term economic growth. Countries that in the past have had strong political and economic institutions have developed more rapidly. Similarly, Alam et al. (2017) refer that the role of good governance fosters economic growth, for example by complementing the private sector in various initiatives, as well as improving the market.

Positive signs were expected for all coefficients since it would be expected that progressions in dimensions would have a positive impact on economic growth, but some coefficients are surprisingly negative. In the GMM model, these coefficientsare related to the variables Labor market efficiency, Market size, and Business sophistication. Two of the possible explanations for this may be that the way of measuringthese variables is not the most correct or the score attributed to these countries in these years is not the most correct. This provides reasoning to the conclusions attained by Zubović and Bradić-Martinović (2014) that the large number of variables composing theGCI index, applied as well to sub-indexes or pillars, does not allow observing particularities of individual countries in the most correct way. Another possible explanation may be that the score given is correct given the state of the countries and thatthis is negatively influencing economic growth, with countries needing to carry out reforms, for example, to make labor legislation more flexible.

In the fixed-effects model, the most important variable is the health and basic education, and under the ceteris paribus condition, an increase of 1% in the value of this variable causes an increase of 1.08% in GDP per capita. In this way, investments in health and basic education are expected to cause important increases in economic growth, since workers with fewer health problems are less absent from work, work more motivated and concentrated. Similar conclusions were also reached by Onuferavá et al. (2020) when referring that physical and mental health are values that are at the top of the hierarchy of needs and therefore have a high impact on wealth creation. About basic education, we all know its importance in the future of each person.

Still, in the fixed effects model, the variables Higher education and training, Goods market efficiency, and Macroeconomic environment (Shegquan et al., 2019) present positive coefficients and are statistically significant. Thus, we can consider that these variables play an important role in the economic growth of countries. Saidi and Mongi (2018) also concluded that education assumes an important role in economic growth.

As we mentioned, the macroeconomic environment takes great importance. The greater a country's macroeconomic stability, the greater its likelihood of achieving higher economic growth (Stightz, 2000). Regarding the variables, higher education and training this reveal to have a positive impact on economic growth, as already detected by Radulescu et al. (2018).

Still, concerning the fixed effects model, the Technological readiness variable is statistically significant at a significance level of 1%, in addition to presenting a high coefficient. This means that the speed with which the available technology is being adopted is enabling economic growth. Onuferevá et al. (2020), believe that the rapid

development of technologies and their incorporation in production cycles allows increasing competition, which in turn impacts productivity and forces economies to have to pay more attention to these competitive factors.

Finally, about the variable that measures innovation and like Kuhlman et al. (2017), we conclude that it has an important impact on economic growth in all models considered. When developing a model to measure innovation, these authors concluded that increasing innovation increases competitiveness. As competitiveness is an important pillar of economic growth, innovation spills over into the entire economy and multiplies that growth. Higher uncertainty and lower confidence dampen investment (Giordano et al., 2019).

5. Conclusions

One of the ultimate goals of economic policies is to achieve economic growth, thereby improving the standard of living of its citizens. Using the twelve pillars of competitiveness of the World Economic Forum (which are based on the underlying items), we can conclude that even the top 50 countries in terms of competitiveness should pay special attention to certain dimensions of the GCI, which contribute more quickly to economic growth.

Based on the results obtained, several recommendations can be made to decision-makers to carry out actions more directed to the dimensions that contribute to faster and more impactful results. Initiatives in some dimensions can take years to effect, but in other dimensions, the results can be obtained in the short term.

Of all the dimensions considered, the one that in the short term can have positive effects on economic growth is the current labor market legislation and which in many countries is causing an economic decrease. More flexible labor legislation will allow companies to hire or fire workers according to their real needs, which will boost economic growth and a higher level of employment in the future. For workers in individual terms, it can cause feelings of insecurity, but the so-called existing social stabilizers tend to mitigate these effects, and these stabilizers can also be reinforced.

It is also important that investments made in health and primary education take time to have the desired effect on the economy. But concerning the acquisition of certain skills, the effects on economic growth may already occur in the short term, particularly concerning training. Training actions geared to the specific needs of each job increase productivity and show faster results in the economy, while still investing in higher education that causes other types of skills.

In many countries, the best technologies and management practices originate from foreign direct investment, and this only flows into the country if these investors feel confident with the country's institutions. In addition to companies trying to incorporate the most innovative technologies in their production processes more quickly, production according to the real wishes of consumers benefits its marketability and increases productivity. In this way, innovation and technological readiness should be one of the concerns of any government.

Although with effects that should not be felt in the short term, policymakers should pay attention to the creation of infrastructure, macroeconomic stability, and the quality of institutions. Investors can hardly create companies in countries with insufficient infrastructure, unstable, and weak institutions.

At a time when the economic effects of the pandemic are being felt around the world, these must be the best of policymakers to return to sustainable economic growth in their countries.

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