



Economic growth and the dynamic efficiency theory

Crecimiento económico y la teoría de la eficiencia dinámica

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Abstract

This research analyzes economic growth from the theory of dynamic efficiency, using a global indicator of competitiveness and one of global economic freedom, starting from the hypothesis that greater economic freedom translates into greater competitiveness and economic growth. The dynamic efficiency supported by authors of the Austrian economy aims to explain how the increase in profitability and productivity in the production of goods and services depends mainly on business creativity. From the methodological point of view, the study is descriptive, correlational and prospective, using panel data from the 20 largest economies in the American continent. The study analyzes the main macroeconomic indicators, the quality of institutions, health, primary education, infrastructure and the degree of business innovation, correlated with variables that measure the level of freedom to do business, fiscal pressure, size of government, security Legal, competitiveness is measured through the factors that determine the productivity of an economy. Among the main results, it was found that the index of economic freedom and the GDP per capita show a bidirectional causal relationship in the Granger sense, thus revealing an endogeneity relationship between both variables. The degree of cointegration, causality and explanation of competitiveness and economic freedom with economic growth was demonstrated.

Resumen

Esta investigación analiza el crecimiento económico desde la teoría de la eficiencia dinámica, utilizando un indicador global de competitividad y uno de libertad económica global, partiendo de la hipótesis de que mayor libertad económica se traduce en mayor competitividad y crecimiento económico. La eficiencia dinámica sustentada en autores de la economía austriaca pretende explicar cómo el incremento en la rentabilidad y productividad en la producción de bienes y servicios, depende principalmente de la creatividad empresarial. Desde el punto de vista metodológico, el estudio es descriptivo, correlacional y prospectivo, se empleó datos de panel de las 20 economías más grandes del continente americano; también analiza los principales indicadores macroeconómicos, la calidad de las instituciones, salud, educación primaria, infraestructura y el grado de innovación empresarial, correlacionado con variables que miden el nivel de libertad para hacer negocios, presión fiscal, tamaño del gobierno, seguridad jurídica; se mide la competitividad por medio de los factores que determinan la productividad de una economía. Entre los principales resultados se encontró que el índice de libertad económica y el PIB per cápita, muestran una relación causal bidireccional en el sentido de Granger, develando con ello una relación de endogeneidad entre ambas variables. Se demostró el grado de cointegración, causalidad y explicación de la competitividad y la libertad económica con el crecimiento económico.

Keywords | palabras clave

Competitiveness, economic freedom, business function, and economic growth, dynamic efficiency, innovation, productivity.
Competitividad, libertad económica, función empresarial, crecimiento económico, eficiencia dinámica, innovación, productividad.

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1. Introduction

This study proposes a methodology that allows explaining economic growth from the theory of dynamic efficiency, using a global indicator of competitiveness and one of global economic freedom. The competitiveness indicator measures the quality of institutions, infrastructure, macroeconomic environment, health, and primary education, all of which are basic requirements; thus, a series of indicators that enhance economic efficiency are considered, such as higher education and training for work, the effectiveness of the market for goods and work, development of financial markets, technological availability, and the size of the market; finally, business discovery and business sophistication are assumed as fundamental elements of innovation. The economic freedom indicator measures the level of freedom to do business and trade, the level of fiscal pressure and size of the government, the level of independence of monetary policy, and the governing body that implements it, that is, monetary freedom, also, legal security for investment or investment freedom, legal guarantees of property rights, low levels of discretion in the operation of State institutions or freedom from corruption, labor flexibility or labor freedom in the consummation and dissolution of contracts of work or labor relations between employer and worker. It is hypothesized that greater economic freedom translates into greater competitiveness and economic growth. Now, from the approach of the Austrian school of economics, both variables are the product of the business function and are generated by processes of dynamic efficiency within the free market.

For this reason, the work will be subdivided into: 1) a brief summary of the characteristics of the research and the theoretical foundations that support the study; 2) the methodology assumed to integrate the theory with the empirical referents; 3) the results of a mathematical model of approximation of economic growth from the competitiveness and economic freedom of the respective countries under study, and 4) the conclusions of the case.

1.1. The free market, the business function and dynamic efficiency

Competitiveness, economic freedom, and growth are very old concepts, especially from the rebellion against mercantilism in the seventeenth century, where liberals such as Thomas Le Gendre coined the phrase *laissez-faire*¹ (letting be) (Rothbard, 2012). Later, at the end of the 18th century, the great thinker and statesman Anne Robert Jaques Turgot would come. This economic doctrine stated that trade can only flourish and subsist when merchants are free to procure the goods they need in the places where they are sold at the lowest price (Rothbard, 2012) and Mises (1983 [1944]).

For this reason, Schumpeter (1983) characterized the market as the place where intertemporal competitive processes take place, where economic risk is always present in setting the prices of goods and services, in addition to other things beyond purchase-sale contracts. According to Schumpeter (1983), market processes provide a

1 According to Ferguson (1979 [1938]) and Schumpeter (1994 [1954]) the phrase is rightly or wrongly attributed to Vincent de Gournay (1712-1759). The sentence would be: “Laissez faire laissez passer le monde va de lui-même”. According to Schumpeter (1994 [1954]), Gournay had two great contributions to the economy and specifically to economic freedom: 1) he was together with Mirabeau one of the main popularizers of the work of Richard Cantillon (1680-1734), since they considered that it was a systematic and didactic work that turned it into a great antecedent to the work of Quesnay; and 2) “... his contribution to the economic training of Anne Robert Jacques Turgot (1721-1781)” (Schumpeter, 1994 [1954], p. 289).

relevant case for clearly distinguishing between what the author calls “circular current” and “development” (*Entwicklung*).

Regarding development, Schumpeter (1983) characterizes it as follows: 1) alterations of the economic system from the economic sphere; 2) that arise from the growth of economic activity, population, or wealth; 3) it does not refer to adaptation processes of the economic system, as it is related to exo-economic factors; 4) as a process that rests on the preceding development; 5) are associated with spontaneous and discontinuous alterations of the circular current; 6) by the implementation of new combinations of the elements that serve as materials for production, production methods, packaging systems, labeling systems, marketing systems or markets to which it will be used to satisfy the needs; and 7) be the result of non-pure competition.

Within the circular current and development is where companies and the business function act. Thus, for Knight (1964 [1921]): “We live only by knowledge about the future; while the problems of life, or behavior at least, arise from the fact that we only know a very small portion of the future” (p. 199). Man and his conscience, says Frank Knight, faces the environment and constantly adapts to it. Man reacts to the “image” of a future that may be, among other things, the future situation of business; and by common sense, the image is both present and operative; the image is spontaneous and looks forward. For Frank Knight, the role of consciousness is to give the organism knowledge of the future and based on René Descartes: “We perceive the world before we can react to it, and we react not to what we perceive, but always to what we infer” (Knight, 1964 [1921], p. 201).

But development requires a place where the combinations take place and the actor who carries them out. In this way, Schumpeter expresses the following: “We call “company” the realization of new combinations, and “business men” the individuals in charge of directing said realization” (Schumpeter, 1983, p. 84).

Leibenstein (1969), the business function would be all those actions that seek to reduce the inefficiencies of the organizational cycle of the company. These inefficiencies come from the incomplete specification of contracts and knowledge gaps from both the organizational cycle and the market. For Huerta de Soto (2010): “The business function is the typically human capacity to realize the profit opportunities that arise in the environment, acting accordingly to take advantage of them” (p. 110). For his part, Kirzner (1979), entrepreneurship does not always work in equilibrium conditions in the neoclassical style. Entrepreneurship can sometimes face profit and loss situations, non-balancing situations.

These ideas have as a common base the proposals of Mises (1983 [1944]) and Hayek (1978):

Those eager to profit are always looking for an opportunity. As soon as they discover that the relation of the prices of the factors of production to the anticipated prices of the products seems to offer such an opportunity, they intervene. If their valuation of all the elements involved was correct, they make a profit. (Mises, 1983 [1944], pp. 31-32)

But for Mises (1983 [1944]) the nature of profits is found in the fact that the real world is not stationary, but changing and in this sense the author states:

But today’s world is a world in constant flux. The numbers, tastes, and needs of the population, the supply of factors of production, and technological methods are in constant flux. In such a state of affairs, a continuous adjustment of production to changing conditions is necessary. This is where the entrepreneur comes in. (Mises, 1983 [1944], p. 31)

Now, the free market and, with it, competition are approached from the perspective of dynamic efficiency theory; which aims to explain how the increase in profitability and productivity in the production of goods and services depends mainly on business creativity and speculation² in commercial activities, avoiding the waste of resources given according to static efficiency (Huerta, 2010).

For this reason, the business function always generates new information (Huerta, 2010). This occurs due to the social imbalances generated by the market which, in turn, mean new business opportunities and profits. This information is transmitted mainly through the price system in the various markets of the economic system.

Economic equilibrium is not the same as general equilibrium theory. The origins of the first date back to late scholasticism (Schumpeter, 1994 [1954]). From Saint Thomas, balance, let's say individual, starts from the respect for the idea of the common good or just good. Equilibrium, following Aristotle (1992) is a proportion following the rules of commutative justice. The first broad vision of the economic process came from the hand of Saint Anthony Pierozzi (1389-1459) and Gabriel Biel (1425-1495). Already in late scholasticism the just price was identified not only with the normal competitive price but with any competitive price. With Pietro Verri (1728-1797) the vision of balance was based on calculations of pleasure and pain in the style of Jeremy Bentham. Pierre le Pesant sieur de Boisguillebert (1646-1714), the equilibrium is of interdependent economic magnitudes, but from the point of view of consumption (Schumpeter, 1994 [1954], p. 259). The first mathematical exposition of equilibrium is due to Achille Isnard. Although Charles Devenant, Josiah Child, and John Pollexfen build relationships between economic magnitudes, it is with the Tableau Cantillon-Quesnay that the first method was reached to expose the nature of economic equilibrium seen as social aggregates. The process outlined above was continued by Smith (1982 [1776]), when studying the price components (costs and income: wages, income, and profit), he established a primitive interdependence of the magnitudes that make up the economic system. Special mention must be made of Ferdinando Galiani who exposed the economic equilibrium from a long-term perspective (Schumpeter, 1994 [1954]). Among the classics, we must highlight Jean-Baptiste Say (1767-1832) (2001 [1841]), whose ideas of economic balance brought together the contributions of Richard Cantillon (2002 [1959]) and Jacques Turgot (Aramburo-González, 1998) with Leon Walras. With Nicolás Barbón (1640-1698), the economic equilibrium extends to international trade, and with John Stuart Mill (1806-1873) (1985 [1848]) the static analysis and the idea of steady-state insistently used by David Ricardo (1772-1823) (1973) and Sir Thomas Robert Malthus (1766-1834) (1977).

In this sense, the theory of dynamic efficiency differs from the concept of economic equilibrium and particularly from the Walrasian and its variants. For Huerta de Soto

2 From the Latin noun *speculatio* and from the Latin verb *specuari*, which means to register, look at, carefully observe something to recognize and examine it and *speculātor*, observer, spy, explorer. Commercial speculation is about buying (or selling certain products at a certain price to resell them (or buy them again) at a price at higher or lower prices that occur in other circumstances of time and place in order to obtain a profit. That is, the speculative business consists of knowing the way in which the market works, through bidders and claimants in order to take advantage of the arbitration. The necessary conditions for it to occur are: 1) that the goods object of the business is negotiated in different markets, to locate their differential price variations; 2) the market is not in a position to offset such variations on its own. In the case of the Economy, speculation is the effort made to take advantage of the market knowledge of the product of interest to the speculator, on the path that its price will take (Salvat, 1972).

(2010), dynamic efficiency is based on creativity, discovery, and organizational coordination. It consists of adapting ends and means within chronic imbalances in any part of the economic system related to the organization and its most important economic variables. Necessarily, a point of indifference (Pareto limit of efficiency) will not be reached in a function of production possibilities, which would imply underutilization of resources, since what matters is that the company can hunt for profit opportunities and with its expansion its function of possibilities. In this idea of hunting opportunities, Kirzner (1979) proposes the idea that entrepreneurs carry out entrepreneurial acts in search of profit in a context where failure is a (non-statistical) possibility and where there is learning of the behavior of the variables that affect the business. This profit-making becomes a mechanism for transmitting information and coordinating the activities of an entire economic sector.

Now, from the point of view of the context, the company finds that it cannot fully know the set of ends and means by which it will make decisions. This incompleteness in encompassing all the possibilities of the context is due to the fact that the variety of businesses is indeterminate (Rothbard, 1979). Therefore, making decisions assuming a certain generic utility function would tend to underestimate or overestimate the reality of business. For Rothbard (1979), one element that can help improve dynamic efficiency is to have an adequate ethical framework in which at least the right to property is guaranteed and the possibility of executing voluntary agreements is guaranteed. In the words of Demmert and Klein (2003) it would be: “A regime of freedom —low taxes, secure private property, minimal restrictions on voluntary agreements— could promote all kinds of discovery and improve the alignment between individual opportunity and social betterment” (p. 299).

Finally, Joseph A. Schumpeter proposes, apart from the role of the businessman exposed above, the idea of creative destruction and in that sense:

The fundamental impulse that sets and keeps the engine of capitalism in motion comes from the new consumer goods, the new methods of production and transportation, the new markets, the new forms of industrial organization that capitalist companies create. (Schumpeter, 2008 [1942], p. 83)

However, this creative destruction and, consequently, “sunk costs” for many organizations do not occur in a perfectly competitive market or in situations of automatic and instantaneous equilibrium. That destruction is found in the so-called development (*Entwicklung*) and that process of destruction that presupposes a process of creation is surprising. With regard to Leibenstein (1966), economic relations between agents can lead to contracts that do not consider all possible situations between suppliers and demanders. That is, the generation of gaps, areas of uncertainty, or indeterminacy in specific situations can lead to wrong decisions in companies. Bad decisions can be aggravated in a context that allows the existence of “loophole minning” (Kane, 1981) or problems of adverse selection (Akerlof, 1970). The end result of an adverse context and poor decisions is organizational inefficiency.

One of the things that must be considered from the above is that the idea of automatic, instantaneous, simultaneous, and perennial³ equilibrium of neoclassical econo-

3 When talking about the theory of general equilibrium, one initially starts from the works of Cournot (1863) and then Walras (1987 [1874]). Walras’s versions are long-term models and he was interested in knowing when the equilibrium was final and stable. Equilibrium for Walras involved a process known as “*Tâtonnement*”, where an auctioneer announced a price and agents responded with their supply and demand amounts that they were willing to compromise. When a price match occurred, it

mists is a concept far removed from the reality of economics because: 1) one starts from a version of ontological and methodological individualism that assumes that economic agents have all the knowledge to make their economic decisions (Hayek, 1989); 2) one starts from the “heroic” assumption (Bunge, 1999) that the economy is a closed system both in its relations with the government and with the rest of the world; 3) rationality is understood both as the inevitable maximization of utility and total profit, which, according to Morgenstern (1972), implies that people and companies control all the variables on which the maximum depends; 4) the market is perfectly competitive and that the price expresses that equilibrium, although in the long run, the price is equal to the average unit cost, which makes it difficult to explain the profit (Samuelson et al., 1983); 5) agents and their desires are mutually exclusive, they are random variables; 6) the existence of the “invisible hand” as a self-regulation mechanism of the system.

However, when the interaction of the business function and competitiveness are taken to the macroeconomic level and specifically of economic growth from the Austrian perspective, the contribution of Garrison (2005) should be considered in the sense of considering two crucial problems: the problem of if the market works and the approach in which it should be approached from work or from the capital. In this sense, the first problem considers the question of whether decentralized decisions lead to macroeconomic coordination or lack of coordination. The analytical orientation, for its part, has to do with the preference to approach coordination in the study of the labor or capital market. Both John M. Keynes and Milton Friedman focus on the study of the labor market, but while the first assumes that the market does not properly work, the second believes that it does. For his part, Friedrich von Hayek considers that markets, by working without government interference and studying the economic problem from the capital factor, produce better economic decisions.

Accordingly, indicators have been developed that, on the one hand, emphasize the results of the economic process, such as gross domestic product per capita with labor productivity, and on the other, evaluate the determining factors. With regard to the latter, four large blocks have been considered: infrastructures and accessibility, human resources, technological innovation, and the productive environment. (BBVA Foundation Notebooks, 2008). In light of this, DeLong (2003) and the European Commission (1999) in their sixth periodic report on the economic and social situation support the idea that competitiveness is important to achieve economic growth, of income per capita with the concourse of the accumulation and efficient use of physical, human, intellectual and technological capital obtained through the mechanism of the free market, where companies, industries, regions, nations, supranational regions compete with relatively high levels of income and employment.

The determining factors of per capita income growth from economic competitiveness would be: 1) the inventory of productive fixed capital in relation to qualified employment; 2) transport infrastructure, communications and production facilities; 3) the existence of a Research and Development department in the companies; 4)

was either produced or traded in the markets involved. Subsequently, the models of Kenneth Arrow, Gerard Debreu, and Lionel W. McKenzie emerged in the 1950s. In later years, both the New Keynesians and the new classical macroeconomic economists (without forgetting that they have, for example, the theory of real cycles), accept that macroeconomic models should be of general equilibrium both in the world of perfect competition with flexible wages and prices, but what is known as dynamic stochastic general equilibrium models (Dynamic Stochastic General Equilibrium or DSGE) are used to study the short-term effects of alternative policies in contexts of imperfect competition, both in the market work as well as products (Woodford, 2008).

Exo-economic aspects such as geographical location, nature of labor relations, public policies oriented towards production and productivity, among other aspects (BBVA Fundación Notebooks, 2008).

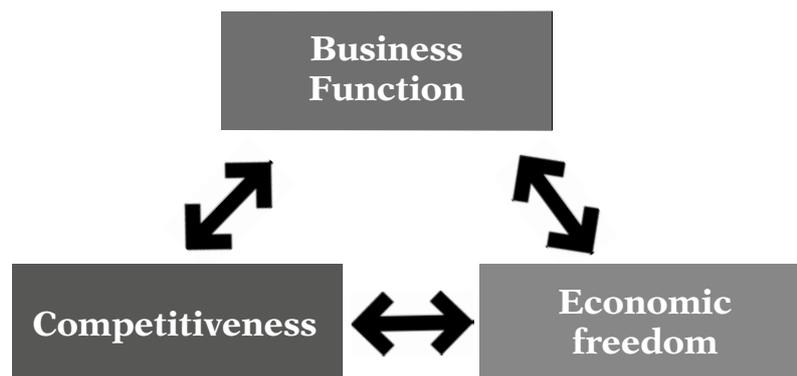
For this reason, economic competitiveness can be seen from two perspectives: 1) the external one, based on the capacities and potential of the sustainability of production, supported by low comparative average unit costs to strongly participate in the rest of the world (Fundación BBVA Notebooks, 2008); and 2) the aggregate, which suggests an aggregate supply and demand perspective of competitiveness, which focuses on productivity per worker.

Likewise, Traverso et al. (2017) point out that competitiveness (measured by the Global Competitive Report produced by the World Economic Forum) is a variable highly associated with per capita economic growth. In other words, the most competitive economies are the ones that grow the most in per capita terms. However, economic freedom should also be considered as an indicator that explains both competitiveness and economic growth. The aforementioned statement is based on the postulates of Rothbard (2001) who points out:

Free competition is the application of freedom to the field of production: freedom to buy, sell and transform one's own goods without violent interference from any external power. This is due to the fact that in a free competition regime, consumer satisfaction tends to be maximized, within the existing natural conditions. Those who make their forecasts better have the possibility of emerging as outstanding business people, and if one sees an untapped opportunity, one is at liberty to take advantage of his better speculative capacity. (p. 70)

Due to the aforementioned, economic growth is based on the triad composed of the business function, competitiveness, and economic freedom from the principles of the Austrian school of economics as shown in Figure 1. Consequently, this work will use as an explanatory variable of the economic growth the index of economic freedom, and the global index of competitiveness.

Figure 1. Triangle of economic growth



Source: Own elaboration (2019).

However, there are positions that account for the relationship between economic growth, productivity, and competitiveness of the economy. Schumpeter (1983) establishes a difference between his concept of “Economic development” and the growth of the economy:

Nor will the mere growth of the economy, reflected by that of population and wealth, be called a process of development here. For it does not represent qualitatively different pheno-

mena, but only adaptation processes, of the same kind as changes in natural data. (Schumpeter, 1983, p. 74)

And he adds the following to explain the previous quote: “We do this because these changes are small annually and do not mean, therefore, difficulties for the application of the static method. However, its existence is often a condition of development, in our sense” (Schumpeter, 1983, p. 74).

One author who related the entrepreneurial function to the increase in per capita income was Leibenstein (1968). He affirmed that this growth was only possible with the field of the technological patterns of the companies through the creation of new products, new raw materials, new organizational forms, and new knowledge. In this way, Harvey Leibenstein visualizes the entrepreneur as the input, the key element, and the first inspiration in the growth process. For Kirzner (1985), once the business people are taken into account in economic growth, the emphasis is on the discovery of new structures of ends and means. This vision allows accounting for the changes in the set of inputs and the relationships between these and the results of the organizational processes (including the productive ones). To understand the process of economic growth, the problem of resource allocation must be approached from the point of view of discovery processes.

For his part, Baumol (1990) starts from the simple idea that while the total number of businesspeople is more or less fixed, their contribution to growth could vary to a greater extent. The businessperson may or may not contribute per capita income depending on the relative income that a society offers. In other words, the businessperson's contribution will depend on the stability of the rules of the game that a society/government offers since this influences the structure of the reward system. This reward structure, in turn, affects the pattern of resource allocation. In summary, for Baumol (1990), there is a strong link between the degree to which an economy socially rewards productive entrepreneurial activity and the prosperity of that economic system. Most studies confirm the positive relationship between entrepreneurial activity and economic growth (Córdova et al., 2020). There are also other elements that contribute to economic growth, such as the degree of economic openness of a country with the rest of the world (Molero et al., 2020).

In this way, the relationships between the variables of the triad previously exposed could depend on 1) the degree of complexity of the work carried out and the quality of the training of skilled labor on a world scale; 2) intervention with advantages in foreign trade; 3) disparities in per capita income; 4) sociodemographic disproportions; 5) the speed of economic growth; 6) the accessibility and availability of productive factors; 7) the prevailing social climate and its effects on the development of the political system, and 8) factors associated with risks and hedging costs among other factors (Cadavid & Franco, 2006).

2. Materials and method

From a methodological point of view, the study is descriptive, correlational, and prospective. Panel data was used for the 20 largest economies in the American continent, grouped into four clusters: 1. Ecuador, Nicaragua, Argentina, Bolivia, and Venezuela; 2. Colombia, Peru, Brazil, El Salvador, Paraguay, Honduras, Guatemala, and the Dominican Republic; 3. Chile, Mexico, Uruguay, Costa Rica, and Panama; 4. The United States and Canada. For the statistical tests, the Eviews 10.0 and SPSS 24.0 programs were used, the variables under study were standardized with standard scores (number of standard deviations that are above or below the mean of the rank-

ing and global competitiveness index published by the World Economic Forum).⁴ The description refers to the process of outlining the relationship between the competitiveness index and the global index of freedom with economic growth (Marczyk et al., 2005). Correlational research attempts to determine whether there is some degree of statistical association between the two indices presented above with economic growth. Finally, it is prospective, because if the correlation is verified, then it is possible to advance approximations about the future behavior of the variable, considering certain conditions and restrictions (Marczyk et al., 2005).

Therefore, this study is framed within the focus of the global competitiveness indices (hereinafter GCI) of the World Economic Forum (hereinafter WEF). Competitiveness is measured by means of the factors that determine the productivity of an economy and specifically those of income levels and long-term growth. Then, the GCI assesses productivity through the so-called 12 “pillars”, paying attention to the participation of human capital, productive creativity, the ability to recover from unfavorable circumstances, and flexibility in organizational systems seen as factors that guide the economic-financial success. These are security, property rights, social capital, checks and balances, public sector performance, and corporate governance; the quality and extent of transportation infrastructure and infrastructure for public services; adoption of information and communication technologies (ICT), the level of inflation and the sustainability of fiscal policy; studies health-adjusted life expectancy, that is, the average number of years a newborn is expected to live in good health; the general skill level of the workforce and the quantity and quality of education.

Similarly, it studies the degree to which a nation-state provides equal opportunities for free access to its markets; looks at the ways in which human resources are reorganized and leveraged; examines the depth and diversity of monetary financial markets; the tolerance limits of the economy to financial and economic risks. Next, it studies the dimension in demographic and purchasing power terms of the markets that companies⁵ could enter. Finally, it analyzes the scenario for the production of scientific knowledge convertible into research applied to processes, goods, and services to achieve greater competitiveness in terms of quality and quantity (Center for Studies on the Pacific Basin, 2018).

3. Results

This study began with the performance of the Granger causality test, where the probability of the F statistic whose decision rule is to reject H_0 : There is no causality between the variables, the decision rule being: If $\text{Prob} < 0.05$, H_0 is rejected in this sense, it was found that the competitiveness index causes, in Granger terms (precedes), GDP per capita; plus GDP per capita does not cause, in Granger terms (precedes), the competitiveness index as shown in Table 1. For their part, the index of economic freedom and GDP per capita shows a bidirectional causal relationship in the sense of Granger, thus revealing an endogeneity relationship between both variables. It is also worth noting the bidirectional non-causality in Granger terms between the economic freedom index and the competitiveness index.

4 Published annually since 1979, it covers 140 countries; the index and ranking of economic freedom created in 1995, includes 180 nations, and since then published annually by the Heritage Foundation and the Wall Street Journal.

5 Their values are obtained with the sum of consumption, investment, and exports. This evaluates the attitude of the private sector to generate and adopt new technologies and insert them into its productive and organizational process.

Table 1. Granger's causality test

Pairwise Granger Causality Tests				
Date: 11/10/19 Time: 11:40				
Sample: 2006 2017				
Lags: 2				
Null Hypothesis:	Obs	F-Statistic	Prob	Result
ECONOMIC_FREEDOM_INDEX does not Granger Cause COMPETITIVENESS_INDEX	200	237.105	0,0961	H0 is accepted
COMPETITIVENESS_INDEX does not Granger Cause ECONOMIC_FREEDOM_INDEX		204.678	0,1319	H0 is accepted
GDP_PER_CAPITA does not Granger Cause COMPETITIVENESS_INDEX	200	282.044	0,062	H0 is accepted
COMPETITIVENESS_INDEX does not Granger Cause GDP_PER_CAPITA		365.471	0,0277	H0 is rejected
GDP_PER_CAPITA does not Granger Cause ECONOMIC_FREEDOM_INDEX	200	461.399	0,011	H0 is rejected
ECONOMIC_FREEDOM_INDEX does not Granger Cause GDP_PER_CAPITA		483.245	0,0089	H0 is rejected

Source: Eviews 10.0 (2019).

The analysis of the triangle of economic growth proposed in the theoretical foundation of the work, which in the case of the 20 largest economies of the American continent subject to study, shows that the index of economic freedom is an endogenous variable for estimating GDP per capita, therefore, the lags of said variable cause an impact on the future values of GDP per capita, while the competitiveness index is an exogenous variable in the estimation of GDP per capita.

Similarly, the Pedroni residual cointegration test was performed for panel data, taking a single lag, showing that 7 of the 11 test statistic show a probability (Prob<0.05), which shows that the variables subject to study, that is, the competitiveness index, the economic freedom index and the GDP per capita are cointegrated, that is, they have a long-term relationship. Therefore, the null hypothesis is no cointegration. The decision rule is to reject H0 if Prob <0.05 in this case 7 of the 11 tests reject H0, that is, the variables are cointegrated because Prob. <0.05 as shown in Table 2.

The factor analysis model states that the covariances in a set of observable variables X_1, X_2, \dots, X_n in terms of a small number of common factors that are latent not observed, are presented in their developed form as a system of linear equations in 1 (OECD & JRC, 2008; Timm, 2002; Peña, 2002).

$$X_1 - u_1 = \lambda_{11}f_1 + \lambda_{12}f_2 + \dots + \lambda_{1k}f_k + e_1$$

$$X_2 - u_2 = \lambda_{21}f_1 + \lambda_{22}f_2 + \dots + \lambda_{2k}f_k + e_2$$

$$\vdots$$

$$X_i - u_i = \lambda_{i1}f_1 + \lambda_{i2}f_2 + \dots + \lambda_{ik}f_k + e_i$$

$$\vdots$$

$$X_n - u_n = \lambda_{n1}f_1 + \lambda_{n2}f_2 + \dots + \lambda_{nk}f_k + e_n$$

Where: X_i represents the observed variables obtained from data and that when standardizing will have mean $E(X_i) = 0$ y $\sigma^2 = 1$ for all $i = 1, 2, \dots, p$; las $\lambda_{11}, \lambda_{12}, \dots, \lambda_k$ are regression coefficients, which in this technique are called factor weights; the f_1, f_2, \dots, f_k are the so-called unobserved latent common factors that are investigated, each average observation $E(X_i) = 0$ y $\sigma^2 = 1$; finally, e_i is the residuals or the observed population disturbances of the unique or specific factors (García et al., 2017).

Table 2. Pedroni's residuals cointegration test

Pedroni Residual Cointegration Test					
Series: INDICE_DE_COMPETITIVIDAD INDICE_DE_LIBERTAD_ECONO					
MICA PIB_PER_CAPITA					
Date: 11/10/19 Time: 12:05					
Sample: 2006 2017					
Included observations: 240					
Cross-sections included: 20					
Null Hypothesis: No cointegration					
Trend assumption: No deterministic tren					
User-specified lag length: 1					
Newey-West automatic bandwidth selection and Bartlett kernel					
Alternative hypothesis: common AR coefs, (within-dimension)					
		Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic		2.344.857	0,0095	0,202451	0,4198
Panel rho-Statistic		-0,381267	0,3515	0,030367	0,5121
Panel PP-Statistic		-3.424.514	0,0003	-3.087.803	0,001
Panel ADF-Statistic		-3.197.237	0,0007	-2.954.698	0,0016
Alternative hypothesis: individual AR coefs, (between-dimension)					
		Statistic	Prob.		
Group rho-Statistic		1.491.335	0,9321		
Group PP-Statistic		-4.141.125	0		
Group ADF-Statistic		-4.749.343	0		
Cross section specific results					
Phillips-Peron results (non-parametric)					
Cross ID	AR(1)	Variance	HAC	Bandwidth	Obs
ARGENTINA	0,328	0,987572	1,175089	2	11
BOLIVIA	0,46	1,555689	1,775483	2	11
BRASIL	0,362	1,288832	1,288832	0	11
CANADA	-0,413	1,102382	0,862499	2	11
CHILE	0,358	0,711223	0,438157	4	11
COLOMBIA	0,081	0,179908	0,190315	1	11
COSTA RICA	-0,301	0,634419	0,562050	1	11
ECUADOR	0,184	1,096583	1,379429	2	11
EEUU	0,169	2,629120	2,702221	1	11
EL SALVADOR	0,24	0,943645	0,771107	3	11
GUATEMALA	-0,294	1,020709	0,607087	10	11
HONDURAS	-0,041	1,887664	1,014380	10	11

Cross section specific results Phillips-Peron results (non-parametric)					
Cross ID	AR(1)	Variance	HAC	Bandwidth	Obs
MÉXICO	0,112	0,354694	0,188321	6	11
NICARAGUA	-0,032	1,646624	1,582661	1	11
PANAMÁ	-0,392	0,540932	0,495727	1	11
PARAGUAY	-0,096	0,511455	0,482381	2	11
PERÚ	0,097	0,246061	0,246061	0	11
REPÚBLICA DOMINICANA	-0,356	0,234491	0,067484	10	11
URUGUAY	0,623	1,594121	2,061241	1	11
VENEZUELA	-0,279	1,399358	1,030636	2	11

Source: Eviews 10.0 (2019).

In this research, panel data were used, where all the variables under study were standardized with standard scores (number of standard deviations that are above or below the mean of the ranking and index of global competitiveness published by the World Economic Forum). For its part, GDP per capita was estimated using data provided by Penn World Table 3⁶. The results obtained were the following:

Table 3. Reliability analysis

Case Processing Summary				Reliability statistics	
		N	%	Cronbach Alfa	N of Element
Cases	Valid	240	100,0	0,931	5
	Excluded ^a	0	0,0		
	Total	240	100,0		

a. List elimination is based on all variables in the procedure.

Source: SPSS Ver. 24.0

The reliability analysis was carried out by estimating the Alpha Cronbach coefficient of the variables previously standardized with the Z functions. In this sense, reliability represents the stability or persistence of the evolution of a variable with respect to different subjects or research objects (Kerlinger & Lee, 2002). In this case, the variables are the Z scores of the index and ranking of competitiveness and economic freedom and GDP per capita and the research objects are the economies under study.

The Alpha Cronbach coefficient of 0.931 indicates that the data subject to study is 93.1% reliable, that is, there is a high degree of association or linear correlation between the sums of the variances of the scores $Z = \frac{X_i - \bar{X}}{\sigma}$ of each of the 20 economies subject to studies, with respect to the sum of the variances of each variable with respect to the 240 analyzed cases.

6 It is a set of national accounts data developed and maintained by academics from the University of California, and the Groningen Growth Development Center of the Faculty of Economics and Business at the University of Groningen, it is a database with information on relative levels of income, products, inputs, and productivity, covering 182 countries between 1950 and 2017 based on purchasing power parity.

Table 4. Cluster analysis

Final cluster centers				
GDP per capita Z score	Clúster			
Cluster of membership according to the level of GDP per capita	1 (Low)	2 (Moderate)	3 (High)	4 (Very high)
	-0,78	-0,30	0,22	2,71
	\$5.399	\$11.047	\$17.241	\$46.698
	Clúster			
	1 (Low)	2 (Moderate)	3 (High)	4 (Very high)
Cases	68	85	63	24

Source: SPSS Ver. 24.0

Now, in this research, the k-means agglomeration technique was used, which according to Everitt and Hothorn (2011), aims to divide the n subjects or study objects in a multivariate data set into k groups or clusters, (G1, G2, ..., Gk), where denotes the set of subjects or study objects in group i, and ka is given a possible variable of which the researcher specifies the range, minimizing some numerical criteria, where the low values of which are considered indicative give a “good” solution. The most used is the implementation of k-means clustering, which wants to find the partition of the n subjects into k groups that reduces the within-group sum of squares (WGSS) over all variables; explicitly, this criterion is:

$$WGSS = \sum_{j=1}^q \sum_{l=1}^k \sum_{i \in G_i} (X_{ij} - \bar{X}_j^{(l)})^2 \tag{1}$$

Where $\bar{X}_{ij}^{(l)}$ is the mean of the elements in the group in the variable.

Establishing for this case four clusters as shown in Table 4: Group 1 with 68 cases whose economies on average have a GDP per capita of \$ 5399 dollars; group 2 \$ 11,047 with 85 cases; group 3 with \$ 17,241 and 63 cases; and group 4, with an average GDP per capita of \$ 46,698, with only 24 summarized cases in which the economies of Canada and the United States of America stand out for America. Likewise, below is an index of evaluation of competitiveness, economic freedom, and economic growth, elaborated by the researchers according to the categorization of the variables subject to study on a scale of 1 to 5 for the 12 years studied for each economy, whose maximum accumulated sum has a score of 300 points and a minimum of 60 points.

Cluster 4: United States and Canada.

Cluster 3: Chile, Mexico, Uruguay, Costa Rica and Panama.

Cluster 2: Colombia, Peru, Brazil, El Salvador, Paraguay, Honduras and Guatemala.

Cluster 1: Ecuador, Nicaragua, Argentina, Bolivia and Venezuela.

Graph 1. Index of evaluation of competitiveness, freedom and economic growth

Source: Own elaboration.

3.1. Factorial analysis

In the determinant of the matrix of correlation coefficients, Bartlett's sphericity contrast test of the Z scores of the studied variables approaches zero $\Delta_D = 0,000173763$, which is an important indicator to support the use of factor analysis, because it denotes a high degree of linear association between the variables considered (see Table 5).

Table 5. Correlation Matrix

Correlation Matrix ^a							
		Competitiveness Index Z score	Competitive Ranking Z Score	Economic Freedom Index Z Score	Economic Freedom Ranking Z Score	GDP per capita Z score	Cluster
Correlation	Competitiveness Index Z score	1,000	0,963	0,661	0,704	0,886	0,750
	Competitive Ranking Z Score	0,963	1,000	0,671	0,744	0,794	0,719
	Economic Freedom Index Z Score	0,661	0,671	1,000	0,902	0,468	0,323
	Economic Freedom Ranking Z Score	0,704	0,744	0,902	1,000	0,509	0,395
	GDP per capita Z score	0,886	0,794	0,468	0,509	1,000	0,861
	Cluster	0,750	0,719	0,323	0,395	0,861	1,000

a. Determinant = ,000
Source: SPSS Ver. 24.0

Table 6. KMO sample sufficiency test

KMO and Bartlett test		
Kaiser-Meyer-Olkin measure of sampling adequacy		0,690
Bartlett's sphericity test	Approx. Chi-squared	2044,687
	Gl	15
	Sig.	0,000

Source: SPSS Ver. 24.0

The general sampling adequacy measure (Kaiser-Mayer-Olkin) shown in Table 6 is a global measure indicative of whether factor analysis is carried out, how strong and adequate would be the possible solution to be found? The larger this value, the stronger the solution; the optimum is for it to be: $MSg \geq 0,5$. And considered acceptable according to Garza et al. (2013). In the case of this study, the value of the coefficient is 0.69, which is acceptable, thus validating the relevance of the factor analysis.

Table 7. Anti-image matrix for sampling adequacy measures

Anti-image matrix							
		Competitiveness Index Z score	Competitive Ranking Z Score	Economic Freedom Index Z Score	Economic Freedom Ranking Z Score	GDP per capita Z score	Cluster
Anti-image correlation	Competitiveness Index Z score	,665 ^a	-0,894	-0,250	0,187	-0,761	0,369
	Competitive Ranking Z Score	-0,894	,676 ^a	0,216	-0,339	0,577	-0,428
	Economic Freedom Index Z Score	-0,250	0,216	,724 ^a	-0,806	0,092	0,078
	Economic Freedom Ranking Z Score	0,187	-0,339	-0,806	,739 ^a	-0,067	0,056
	GDP per capita Z score	-0,761	0,577	0,092	-0,067	,653 ^a	-0,691
	Cluster of membership according to the level of GDP per capita	0,369	-0,428	0,078	0,056	-0,691	,721 ^a

a. Measures according to sampling (MSA)
Source: SPSS Ver. 24.0

The anti-image matrix for sampling adequacy measures, shown in Table 7, indicates on its main diagonal that all the variables considered are relevant for factor analysis since the correlation coefficients present values above 0.5. Likewise, the matrix of communalities, which shows the percentage of the total variance explained by the fac-

tor(s), as evidenced in Table 8, indicates that they explain 92.3% of the Z-score variable of GDP per capita; 94.4% of the variable Z score of the competitiveness index; 93.6% of the variable Z score of the index of economic freedom.

Table 8. Matrix of communalities

Communalities		
	Initial	Extraction
Competitiveness Index Z score	1,000	0,944
Competitive Ranking Z Score	1,000	0,907
Economic Freedom Index Z Score	1,000	0,936
Economic Freedom Ranking Z Score	1,000	0,940
GDP per capita Z score	1,000	0,923
Cluster of membership according to the level of GDP per capita	1,000	0,896
Extraction method: main component analysis.		

Source: SPSS Ver. 24.0

Table 9. Total variance of the variables subject to study explained by the factors

Total variance explained									
Component	Initial auto-values			squared			squared		
	Total	% of variance	% accumulated	Total	% of variance	% accumulated	Total	% of variance	% accumulated
1	4,483	74,725	74,725	4,483	74,725	74,725	3,044	50,737	50,737
2	1,062	17,705	92,430	1,062	17,705	92,430	2,502	41,693	92,430
3	0,215	3,582	96,012						
4	0,141	2,353	98,364						
5	0,084	1,396	99,761						
6	0,014	0,239	100,000						
Extraction method: main component analysis.									

Source: SPSS Ver. 24.0

Table 9 shows how the two considered factors explain 92.43% of the total variance of the variables subject to study. The first factor explains 74.73% and the second factor 17.71%.

Table 10. Component score coefficient and rotated component matrix

Component score coefficient matrix			Rotated component matrix ^a		
	Componente			Componente	
	1	2		1	2
Competitiveness Index Z score	0,227	0,066	Competitiveness Index Z score	0,802	
Competitive Ranking Z Score	0,178	0,119	Competitive Ranking Z Score	0,741	
Economic Freedom Index Z Score	-0,229	0,532	Economic Freedom Index Z Score		0,946
Economic Freedom Ranking Z Score	-0,182	0,494	Economic Freedom Ranking Z Score		0,929
GDP per capita Z score	0,386	-0,151	GDP per capita Z score	0,921	
Cluster	0,456	-0,265	Cluster	0,940	
Extraction method: main component analysis. Rotation method: Varimax with Kaiser normalization			Extraction method: main component analysis. Rotation method: Varimax with Kaiser normalization		

Source: SPSS Ver. 24.0

$$F_2 = 0,07PZIC + 0,12PZRC + 0,53PZILE + 0,49PZRLE - 0,15PZPIBPC - 0,27CNPIB \quad (2)$$

$$F_2 = 0,07PZIC + 0,12PZRC + 0,53PZILE + 0,49PZRLE - 0,15PZPIBPC - 0,27CNPIB \quad (3)$$

The component coefficient matrix shows the unbiased estimators of the F_1 and F_2 factors based on the Z scores of each variable under study, as shown in Table 10 and equations 1 and 2. Likewise, in Table 10, the matrix of the rotated components is observed, which indicates which variables are explained to a greater extent by each factor, in this case, the variables related to competitiveness and economic growth are explained by factor 1; while the variables related to economic freedom are explained by factor 2. We proceeded with the estimation of a multiple regression model using GDP per capita as a dependent variable per level, obtaining the following results in the following tables:

Table 11. Correlation coefficient and determination between the real variable and the forecast

Summary of the model ^b				
Model	R	R square	Adjusted R squared	Forecast standard error
1	,951 ^a	0,905	0,904	3656,53356

a. Predictors: (Constant), Reg factor score 2, for analysis 3, REGR factor score 1 for analysis 3

b. Dependent variable: GDP_PER_CAPITA

Source: SPSS Ver. 24.0

Pearson's linear correlation coefficient expresses that the percentage of linear association between the real and predicted variable is 95.1%; R^2 shows that the percent-

age of the variance of the dependent variable explained by the regression is 90.5% and R^2 (adjusted) indicates that 90.4% of the variance of the dependent variable is explained by the independent variables of joint way.

Table 12. Correlation coefficient and determination between the real variable and the forecast

ANOVA ^a						
Model		Sum of squares	gl	Quadratic mean	F	Sig.
1	Regression	30.270.356.045,53	2,00	15.135.178.022,77	1.132,01	,000 ^b
	Residue	3.168.746.332,43	237,00	13.370.237,69		
	total	33.439.102.377,96	239,00			

a. Dependent variable: GDP_PER_CAPITA

b. Predictors: (Constant), Reg factor score 2, for analysis 3, REGR factor score 1 for analysis 3

Source: SPSS Ver. 24.0

In the analysis of variance shown in Table 12, it is evident that the model is significant since the sig. (Bilateral) < 0,05 Fisher's F statistic $F_{(calculated)} = 1.132 > F_{(theoretical)} = 26,13$. At 5% significance; Therefore, H_0 is rejected, the explanatory variables jointly and linearly influence the explained variable.

Table 13. Unbiased coefficient of the regression model

Coefficients ^a								
Model		Non-standardized coefficients		Standardized coefficients	t	Sig.	Estadísticas de colinealidad	
		B	Standard error	Beta			Tolerancia	VIF
1	(Constante)	14.642,87	236,03		62,04	0,00		
	REGR factor score 1 for analysis 3	10.741,15	236,52	0,91	45,41	0,00	1,00	1,00
	REGR factor score 2 for analysis 3	3.358,86	236,52	0,28	14,20	0,00	1,00	1,00

a. Dependent variable: GDP_PER_CAPITA

Source: SPSS Ver. 24.0

It can be observed in Table 13, that the unbiased estimators are significant as well as the intercept, since the sig. (Bilateral) < 0.05; similarly, the Variance Inflation Factor (VIF) of each estimator as the constant or regression intercept $VIF < 15$, with which there are no collinearity problems between the independent or explanatory variables.

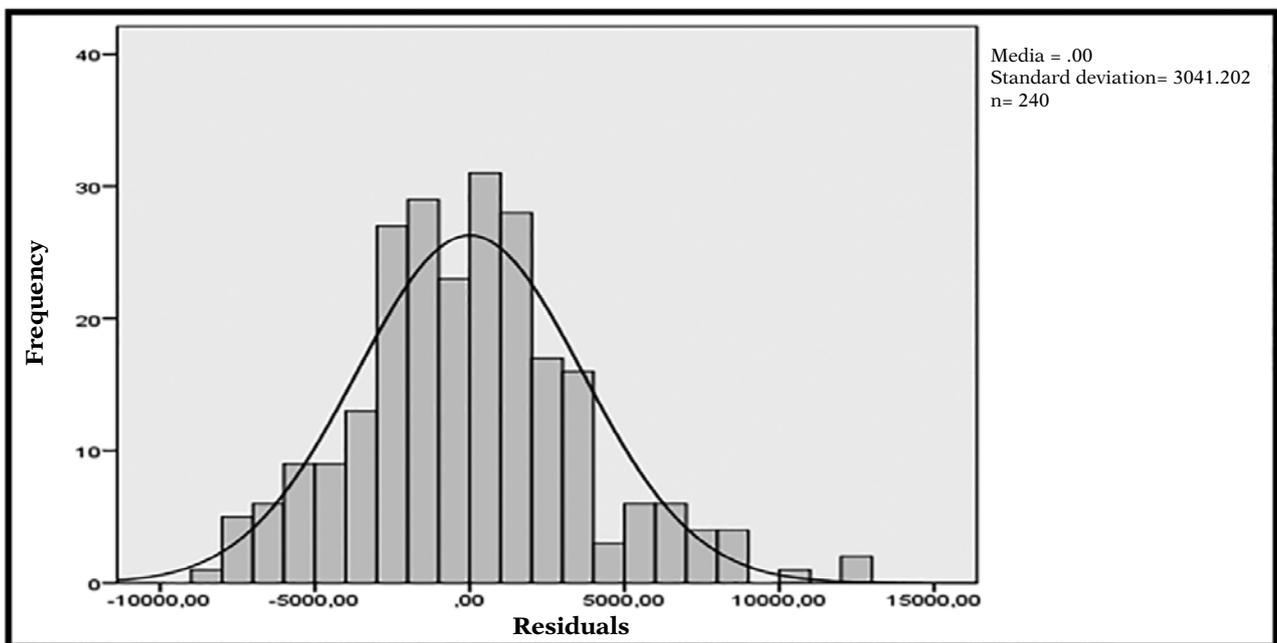
Table 14. Normality test of the regression model residuals

Normality test						
	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistical	gl	Sig.	Statistical	gl	Sig.
RESIDUES	0,051	240	,200*	0,980	240	0,002

*. This is a lower limit of true significance
 a. Lilliefors significance correction
 Source: SPSS Ver. 24.0

Finally, the normality test of the residuals shown in Table 14 and Figure 2, indicates a sig. (Bilateral) > 0.05 for the Kolmogorov-Smirnov test sig. (Bilateral) = 0.200 for samples larger than 50 subjects or objects, which shows the existence of a normal distribution in the model residuals.

Figure 2. Histogram of the residuals of the regression model



Source: SPSS Ver. 24.0

Table 15. Homogeneity test of the residuals of the inter-cluster regression model

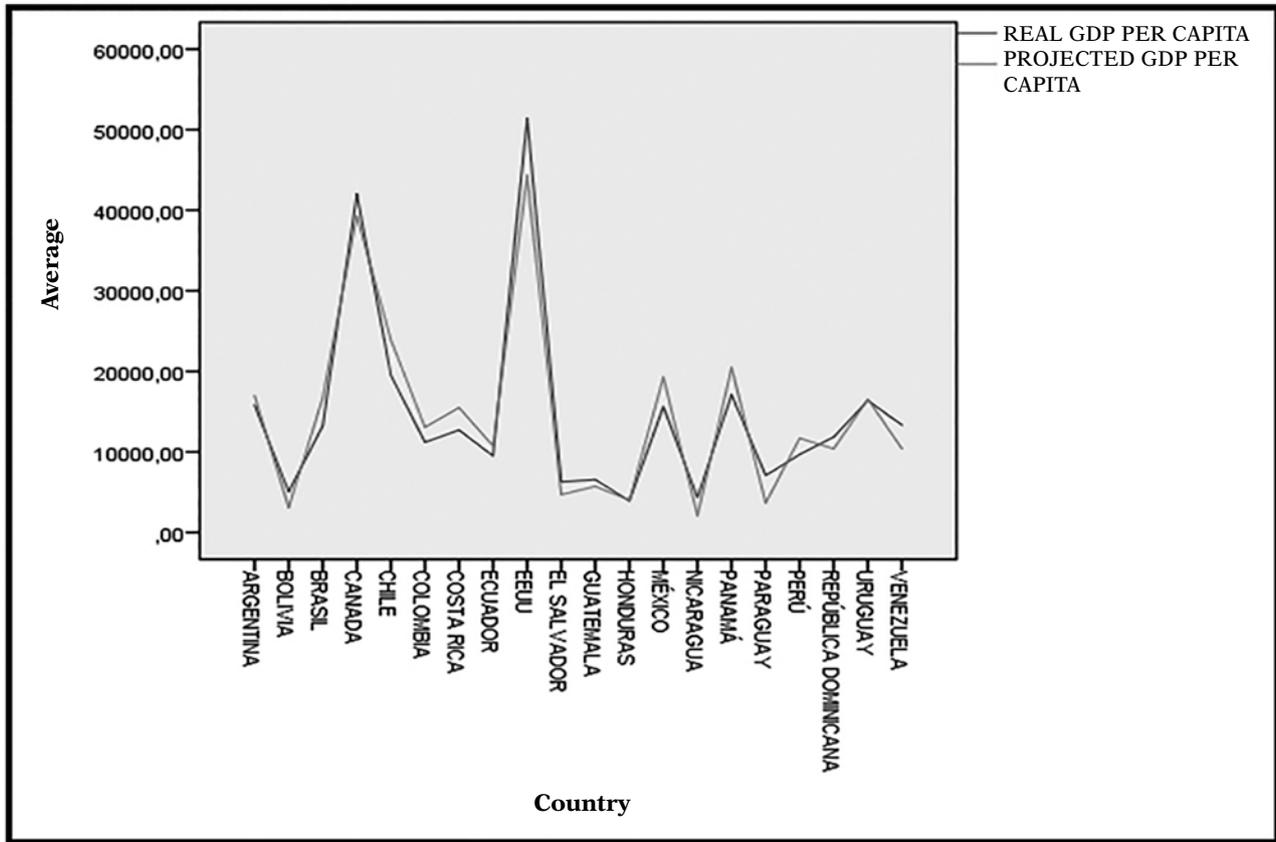
Homogeneity test			
RESIDUALS			
Levene statistic	gl1	gl2	Sig.
1,117	3	236	0,343

Source: SPSS Ver. 24.0

Table 15 shows the results of the Levene statistic, where Ho is contrasted for homogeneity of population variances and whose decision rule establishes if Sig. (Bilateral) > 0.05 Ho is rejected. The result shows that the null hypothesis is not rejected. Therefore, there is homogeneity in the variances of the residuals between clusters. In Figure 3, the

efficiency of the model is shown once again by graphing the average real GDP of each country vs. the projected one, where one is practically collinear with the other.

Figure 3. Graph of the average real GDP of each country vs. the projected GDP



Source: SPSS Ver. 24.0

4. Conclusions and discussion

The most relevant conclusive element of this study is, without a doubt, the statistical and econometric demonstration of the thesis put forward by the Austrian School of Economics according to which the freest and most competitive economies are those that show the greatest advances and positioning, at an international level, in terms of economic growth. Likewise, the bidirectional causality relationship between the index of economic freedom and the GDP per capita was verified for each of the economies studied in the panel; such as the significant degree of long-term cointegration between competitiveness, economic freedom, and GDP per capita.

It is also important to highlight how competitiveness and economic growth are statistically explained with data available, at the current moment, by one factor, while economic freedom is explained by another factor. However, both factors explain by more than 90% the variance of economic growth measured through GDP per capita. This allowed the study to build a regression model that, rather than a forecast of GDP per capita, more reliably demonstrated the hypothesis raised in the research, according to which greater competitiveness and economic freedom translates into higher levels of economic growth.

Likewise, it is important to emphasize how in the case of the economies of the American continent, the competitiveness factor has a greater incidence explaining

growth than economic freedom, this is evidenced in the significant differences in the average GDP per capita of the cluster 4 made up of the United States and Canada with respect to the rest of the economies of the continent. The contrast materializes when economies such as those of Ecuador, Nicaragua, Argentina, Bolivia, and Venezuela have ended up curtailing the incentives for competitiveness and economic freedom, showing lower levels of economic growth including contraction of GDP per capita. The reason is located in: 1) the application of inflationary monetary and fiscal policies; 2) interference in the price system through the establishment of controls; 3) a higher fiscal pressure that mainly covers accumulated fiscal deficits, and 4) the disproportionate increase in state regulations.

The above reasons are supported by the theories according to which for the capitalist system to function efficiently (correcting market failures, achieve a more equitable distribution of national disposable income) and offer social welfare through the free market, it must tolerate a greater government intervention through its fiscal, monetary, credit and budgetary policy. For this, the public sector should not fear the execution of unbalanced budgets financed with debt, because all this will translate into an increase in domestic demand and aggregate supply. Consequently, the government, as a result of the economic expansion, will collect more direct and indirect taxes. However, the reality is that fiscal policy becomes increasingly expansive, and external debt reaches superlative degrees, while the economy grows at rates well below population growth, which generates a generalized impoverishment as a result of the drop in GDP per capita.

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