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Economic Growth and Natural Resources in Latin America: an application of the Stiglitz model

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Abstract

The development and the improvement of the use natural resources can greatly stimulate the economic development of a country. The aim of this article is to examine the effect of economic income on economic growth in nineteen Latin American countries. Based on Stiglitz´s model (1974), who proposes a segmented by high income, high middle and low income. In order to abide the mentioned objective, we use an econometric panel data, taking economic and independent growth as the dependent variable for natural resources. The results show that economic growth is statistically significant in aggregate form, the same that varies when it incorporates certain variables of control and the stages of development reached by the countries of the region. Wherever, in high-income countries, natural resources have a negative and significant effect on output, while in middle-income countries, the effect is negative and statistically insignificant. Finally, we find in low-middle income countries, the ratio is the same than in the countries with middle and high income.

Economic growth, Natural resources, Latin America

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Introduction

Developing countries that have abundant natural resources, were initially engaged in the simple exploitation and extraction of funds, in order to obtain the necessary foreign currency to acquire the goods that are not produced internally to the inefficient industrialization. Indeed, many underdeveloped countries play the role of suppliers of raw materials or natural resources, while the industrialized countries are dedicated to the generation of technical progress that make it possible to access the productive phases of higher added value.

However, the economic cycles and the technological advance experienced worldwide caused large fluctuations in the demand for natural resources and, consequently, in their prices. Natural resources are important in Latin America (AL), both for their share of GDP and for their contribution to exports, which make up 50% of the product (IDB, 2009). However, the income generated through them are serious consequences for economic development in the region. This means that the abundance of non-renewable natural resources does not generate sustained economic growth because their prices are highly volatile (Sachs and Warner, 2001).

We can affirm that the generation of natural resources with the account of a country does not have to exert a decisive influence on the historical resolution of its national income, as long as the country has possibilities of trade, what is needed for economic progress is a appreciable amount of capital and labor, an important part of that capital incorporated into the characteristics and social system that favors the improvement of production practices.

The RNR offer a source of national wealth throughout the world, since 1965 has an inverse relationship between economic growth and natural capital in the national wealth of all countries (Navarro and Macario, 2010).

Latin America is a region specialized in the extraction of natural resources, such as Colombia, Venezuela and Ecuador. The extraction of oil from the country is made up of 51% for Ecuador and Colombia and 77% for Venezuela, which means that it is very dependent on this resource, a time that has allowed them to be affected by the price of this resource has declined drastically. On the other hand, Chile has 45% (23% copper and copper derivatives and 23% Gold), 3% Gold for the economy of Argentina, 15% of natural resources (15% copper) and gold derivatives iron ore and its derivatives, 8% Petroleum and 1% Gold) and finally Peru has 47% natural resources (18% gold content, 3% zinc minerals, 3% lead minerals, 13% in gold, 7% refined oil, and 3% in petroleum gas) (Hausmann et al., 2014). According to Bulmer-Thomas (2003) in LA there is a decreasing trend in the primary sector, however, currently this sector represents two thirds of total exports.

Likewise, there are manufacturing activities linked to the external sector that are based on the exploitation of natural resources. That is why the facts in this study did not modify the traditional sectorial process of primary-exporter collection, based on the exploitation of natural resources. There is no doubt that natural resources present distinctive characteristics that distinguish them, but, just as there are countries that suffer their abundance as a "curse", the fact that for others represents a "blessing" shows that the problem is not peculiarities but the way in which each society manages to organize the exploitation of those resources. From the economic point of view, natural resources are simply a part of the capital stock of a country; they must be considered as "equipment" that provides productive services. Hence, in equal conditions, the more resources a country has and the better quality, the better its situation (Gylfason, 2001).

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In the long term it is mentioned that there is a positive relationship between natural resources and economic growth, not only because of the volatile prices that exist, but also because there are other variables that can explain this effect such as corruption, investment, the terms of exchange and schooling, it is important to mention that natural resources are important for a country since with the help of institutions can be implemented public policies capable of making the maximum benefit from them in a sustainable way (Kronenberg, 2004).

The abundance of natural resources can not directly generate a contraction in growth, that is to say, that a greater wealth in this type of goods does not reduce the efficiency with which the factors in the production are combined and the only thing that could generate is a cheapening of the inputs (Morales, 2011). For this reason, there must be intermediate elements or more complex transmission mechanisms through which the richness of natural resources leads to lower growth rates.

In this context, this research examines the relationship between primary income and economic growth in 19 Latin American countries during the period 1980-2015 based on panel data econometrics. Several regressions were estimated in aggregate form (AL), for high income countries (PIA), upper middle income countries (PIMA) and for low middle income countries (LMIC). The same grouping is based on the national per capita income level through the Atlas method of the World Bank. (World Bank, 2017)[1].

An expanded function was estimated, the dependent variable is the logarithm of GDP and the independent variables are logarithms of natural resources, technological progress, capital and employment of country i (i = 1,2, ..., 19) in the period t (t = 1980,1981, ..., 2015), respectively. In order to capture the productive structure of Latin America and the effect of other factors suggested by the theoretical and empirical literature on economic growth, certain control variables were added. In practice, the effect between natural resources and economic growth cannot be expected to be the same in an economy with a high capacity for technological absorption than in a country that is in the initial stages of development (Stiglitz, 1974; Sachs & Warner, 1997).

The aforementioned, has given rise to mention that the relationship between growth and income of natural resources for the countries of Latin America allows the GDP to be very volatile in relation to the prices of commodities; With this background the present article has been developed with the purpose of determining this analogy, with the objective of examining the relationship between primary income and economic growth and therefore responding to it to finally corroborate the established hypothesis "Growth in Latin America depends on the income of raw materials ".

To answer the question and verify the hypothesis, the present investigation has been structured in four sections: the second section refers to the revision of the theoretical framework and the empirical evidence. The third section represents the data and the econometric model is presented.

[1] It is a method that aims to determine a conversion factor, to reduce fluctuations in the exchange rate between countries, for which, it uses gross national income (GNI). The conversion factor of the Atlas method for any year is the average of the exchange rate of a country for that year (t) and its exchange rates for the two previous years (t-1 and t-2), adjusted by the difference between the inflation rate in the country and international inflation.

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In the fourth section we discuss the results obtained, the same ones that were contrasted with the theory and literature mentioned, and finally, the fifth section the conclusions.

Theoretical framework and empirical evidence

Interest in the link between economic growth and natural resources has increased in recent years, due to the deindustrialization of developed countries and the internalization of production, it is here that the economy of natural resources and the environment The environment has been characterized by the exploitation and use of these, offering a service of human needs and social welfare (Labandeira, León, & Vasquez, 2008).

In the theoretical literature, growth models weakly explain the role of natural resources in economic growth, which is associated to some extent with an increase in technological capital. Hotelling (1931) raises the need to study the exploitation of resources, by establishing the form of socially and economically more profitable exploitation of non-renewable resources, before the depletion of mineral supplies and other natural assets that can not be recovered, which has led to a demand to regulate its exploitation through control measures.

A precedent that was previously corroborated by Jevons (1865), in his theory on the exhaustion of resources which raises the extraction of coal as one of the main constraints in the economic development of England, where it is established that rapid industrialization was depleting the reserves what makes the final product more expensive. Similarly, Kuznets and Murphy (1966) mention the relationship of environmental degradation and per capita income when explaining that initially when economies are growing they do so with greater environmental damage.

But as they reach sufficient wealth they use part of that growth for greater environmental protection and this degradation decreases. Mill (1951), raises the idea that the mining sector is characterized by an exchange between present and future productivity, which suggests an optimal planning of these resources, for which it proposes two scenarios to explain the extractive sector: the natural functioning of the The sector leads to diminishing returns and the discovery of new deposits decreases the price of commodities with a higher cost and lower yield. In addition, it states that growth in nature can not be accepted as an unlimited process, so that growth dependent on this sector is not sustainable over time.

From this perspective Pigou (1932) in his theory on welfare economics establishes a series of regulations in case of externalities generated by economic activity, where government intervention is required either with a tax in case of negative externality or a subsidy in case of positive externality. Thus, economic growth has been evolving since a few years ago as much as economic thought. One of his early classics Smith (1776), Ricardo (1817), Malthus (1798), who studied the term and introduced some concepts that helped the study as the diminishing returns and its relationship with the accumulation of physical or human capital, the relationship between technological progress and the specialization of work, in this way new twentieth-century classics emerged such as Ramsey (1928), Young (1928), Knight (1921) or Schumpeter (1950), contributing their knowledge to the determinants of the rate of growth and technological progress (Sala i Martin, 2000). The main economic growth models have initially started from the production function of the Cobb-Douglas type or the same function of fixed coefficients. According to Frankel (1962), this function has been widely used because it leads to relative stability in relationships such as work and capital, one of the facts from which economic growth starts.

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Nordhaus (1992) characterizes a closed economy through a production function of the Cobb-Douglas type which includes natural resources and land as determinant variables of growth, the model allows to conclude that the presence of a fixed supply of land, a The allocation of other scarce natural resources and a continuously growing production can generate a level of pollution and destruction of the environment that puts an end to the growth process.

Making reference to natural resources and economic growth Stiglitz (1974) proposes a new model, introducing the variable of natural resources in the main function of production, with the purpose of knowing what is the effect of that variable on economic growth and counteracting with the hypothesis of the curse of natural resources, that those countries that have the least amount of resources are those that grow much more than countries that are abundant in resources.

There are at least three economic forces that compensate for the limitations imposed by resources: technical costs, substitution of the actors of production (capital) for natural resources and returns to scale. Stiglitz (1974) proposes a model of economic growth in which natural resources are exhaustible, in limited quantities, and is essential for production.

Where the model is considered as the first reasonable approximation, not only is a sustained growth in per capita consumption, it is feasible but the optimal resource utilization rate for the reasonable values of the parameters is of the order of magnitude observed during many resources natural This model is applicable for Latin America due to the importance of natural resources in the region, and the fact that these economies are dependent on it.

The empirical literature on the effect of natural resources on economic growth shows results that there is indeed an inverse relationship. For example, Sachs and Warner (1997) found a negative relationship between the growth and abundance of resources in a sample of 35 developed countries, further sustaining that the effects of the abundance of natural resources in a country depend on the economic rents of these resources and therefore there is a difference in the growth rates of countries with a high presence of mineral resources that maintain high incomes, compared with those with an abundance of agricultural resources, whose rents are lower.

Which, in turn, drove the idea that many countries with abundant resources tend to have high prices and as a result stagnate waiting for growth driven only by exports. On the other hand, a similar study of Ding and Field (2005) which indicates that there is an inverse relationship between the study variables, which apparently confirms the results of the so-called "resources curse".

The work done by Meza, Barrón & Gómez (2011) which aims to analyze the participation of natural resources in economic growth in states of Mexico using a methodology based on the MCO for the period 1993-2003. The results tend to confirm a negative and significant relation with the GDP per capita, indicating that the states are below the 10% of participation with respect to the GDP. This conclusion is similar to the results found by Morales (2011) who verifies the effect of natural resources on economic growth using dynamic estimates for a sample of 152 countries in the period 1962-2000. The results show an inverse relationship between the abundance of natural resources and economic growth, typical of mining varieties and attributable mainly to institutional reasons; forest resources seem, on the contrary, to correlate positively with the growth of nations.

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Finding the same result of an inverse relationship between natural resources and economic growth, the study proposed by Papyrrakis & Gerlagh (2004), using a sample of the states of the United States, adding that states with limited resources have a comparative advantage compared to states with abundant resources, in addition to the abundance of natural resources decreases investment, schooling, the opening of spending on R & D. Sala i Martin & Subramanian (2008), obtain the same conclusion for the case of Nigeria, natural resources such as oil and certain minerals exert a negative and not significant impact on growth, a result that is very robust, as well as waste and the corruption of oil mean that there is poor growth performance in the long term.

There is empirical research that shows a positive influence of resources on the product. Chambers & Ting Guo (2007), developing an endogenous growth model, natural resources constitute a factor of production and a measure of environmental quality, resulting in the economic growth rate being positively related to the steady state level of the use of natural resources in production. A similar result is that of Brunnschweiler (2008), which, by using new measures of resource endowment and considering the role of institutional quality, found a direct relationship between the abundance of natural resources and economic growth by incorporating this variable.

Natural resources are not only associated with economic growth but also with other variables. Stijns (2006), analyzes the abundance of natural resources and the accumulation of human capital measured by education, finding a positive and significant relationship, through the estimation of a VAR panel model, indicating that before the increase of one dollar in the income from natural resources generates an increase of 5% in educational spending.

Likewise, recent studies where this effect was analyzed, the work done by Ji, Magnus and Wang (2014), where they analyze the interaction between the abundance of resources, institutional quality and economic growth for a province of China applying different models of coefficients. The results indicate that the abundance of resources has a positive effect on economic growth at the provincial level in China between 1990 and 2008 and a negative effect on institutional quality.

On the other hand, Joya (2015), through input-output data, built an indicator that captures the diversification of the production structure of the economy and the density of interindustry links. The results show that the abundance of resources exerts a negative impact on growth through the volatility channel. Although the direct effects of natural resources on growth are positive, their indirect adverse effects through volatility could be greater.

Jović, Maksimović & Jovović (2016), investigated 5 natural resource rents to determine which of the rents of natural resources has the greatest influence on economic development. The economic development was analyzed based on the gross domestic product (GDP), using coal revenues, forestry rents, mineral rents, natural gas rents and oil rents. The results showed that forest revenues have the highest prevalence in GDP, that is, GDP has the greatest variation with small changes in forest income. A similar result that of Ouoba (2016), mentions that resource funds have a negative and significant effect on growth and that this finding is robust under alternative estimation techniques. On the other hand, the results do not validate the resource curse hypothesis due to the positive effect of resource dependence on growth. Badeeb and others (2017) examine the curse of natural resources, through which the richness of resources can slow down economic growth and empirical studies that prove a global effect or factors associated with growth.

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The results obtained showed that the dependence on resources negatively affects growth, particularly working through factors closely associated with growth in developing countries. Recent contrary studies show that future research should better address the endogeneity of the dependency measures and extend the years of study and the range of empirical methodologies used.

Finally, Leff (1995) mentions that the overexploitation of natural resources and the degradation of the environment have been the result of economic rationality, as well as that the environmental costs and the valorization of recourses depend on cultural perceptions, because this Production depends on the cultural styles and social interests that define the forms of appropriation, transformation and use of esotos, which are established through power relations between the market and societies.

Because natural resources are scarce, the importance of this is that economies obtain greater welfare, which means that any economy will decide how to make use of its production factors such as human capital, physical capital, resources such as forests, land, water and minerals (Riera, 2005). Natural resources are a source of wealth, however, experience shows that natural wealth is neither necessary nor sufficient for economic prosperity and progress Meza, Barrón and Urciaga (2012)

With this theoretical and empirical background, we verify the Stiglitz model in Latin America is important because by means of it we can know the degree of complexity that these variables have and at the same time corroborate with the results found in the different studies, where it is concluded a negative relationship.

Data

With the purpose of empirically determining the effect that the entry of commodities has on economic growth, we use data obtained through the World Bank (2016). The present investigation is based on the application of the Stiglitz model, for nineteen countries that make up Latin America for the period 1980-2015. The countries included in the research are: Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, El Salvador, Guatemala, Mexico, Peru, Dominican Republic, Uruguay and Venezuela. The restriction of statistical information caused the elimination of the rest of the countries belonging to this region. This research focuses on examining the effect of the income of natural resources on economic growth, in this way the logarithm of GDP will be taken as a dependent variable, as an independent variable the income of natural resources, they are measured at constant prices of 2010, apart from that certain control variables provided later were inserted.

Model

Stiglitz (1974), determines a function of aggregate production, which takes into account capital, labor and natural resources as perfect substitutes. Stiglitz based on modifications of the production function of Cobb & Douglas (1928), proposed the model. In this estimation both authors include natural resources in order to analyze the consequences of these on their postulates and in turn with the theory of distribution (Granda, 2006). It can be deduced that the Stiglitz Model is a continuation of the Cobb - Douglas function, based on the theory of sustainable growth.

The generalized form of the function was estimated as follows:

$$Y = AK^{\propto}L^{1-\propto}R^{\beta}\ e^{e} \quad (1)$$

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Where Y_it represents the gross domestic product of the country in the period t (t = 1980,1981, ..., 2015), A is the state of the technology that is assumed constant, K is the physical capital, L is the labor force, R natural resources and e is the error term distributed with zero mean and with variance σ. In addition, it is worth mentioning that α measures the ratio of K to Y, (1-α) measures L in Y, and β measures R in Y. However, the model proposed by Stiglitz (1974) requires an expansion allowing the effect to be captured that has other variables have on economic growth, some of these: gross fixed capital formation, exports, direct foreign investment, and employment, among other factors that help the behavior of the economy. Adding these variables, you get an expanded economic growth model:

$$lnY_{it} = f(A_{it},\ K_{it},\ L_{it},\ R_{it},\ lnExp_{it}, lnInv_{it}) \quad (2)$$

$$lnY_{it} = f(lnA_{it} + lnK_{it} + lnL_{it} + lnR_{it} + lnExp_{it} + lnInv_{it} + lnAgr_{it} + lnMan_{it} + lnSer_{it} + \varepsilon_{it}) \quad (3)$$

This expansion allows capturing the effect of the productive structure of the region and other factors that influence economic growth according to the theory and empirical evidence. In addition, it is worth mentioning that the estimate of the Stiglitz model will be through panel data, in which they will be applied to independently treat the data set of an individual over time, making the necessary transformations to the variables to express them in the same unit. Through the Hausman test (1978) it will be determined if the data are fixed or random, to consistently estimate the model, in the same cointegrated panel will be applied in order to see if there is a relationship in the long term. As part of the methodological process, the test of stationarity of the variables will be carried out through the Levin, Lin and Chu (2002) test by levels.

First differences and, if necessary, second differences to observe the behavior of the variables will determine through the tests of Kao (1999) and Johansen (1988) if there exist cointegration vectors that are explained in the determined series. The results obtained are discussed in the following section.

Discussion and results

The equation (2) for Latin America was estimated jointly, later we estimate the same effect by group of countries classified in PIA, PIMA and PIMB, the same ones that are based on the level of gross national income per capita. First, the Hausman test (1978) indicates that a random effects model is appropriate for estimating the effect of natural resources on the product of Latin America, with the Chi-squared probability of equation (2) p = 0.0000.

On the other hand, the logarithms of physical capital and labor have a positive and highly significant effect on growth in AL, PIA and PIMA. In the same sense, the logarithm of natural resources has a positive and significant effect on economic growth in LA, in high-income countries, in upper-middle-income countries, while in LMICs the effect is not significant. Regarding technological progress in LA, PIA and in the PIMA, there is a negative and not significant effect, while in the PIMB the effect is positive and not significant.

Var	AL	PIA	PIMA	PIMB
Logrn	0.03*** 3,80	0.12*** 4.88	0.02*** 3.37	0.01 0.56
Logk	0.97*** 76.63	0.50* 2.14	1.00*** 76.95	0.20 0.93
LogA	-0.00 -1.22	-0.00 -0.01	-0.00 -1.58	0.54* 2.55
LogL	0.01*** 3.28	-0.00 -0.92	0.01** 2.75	-0.00 -0.59
Cons	0.62*** 6.57	4.68*** 20.93	0.30** 2.98	3.16*** 11.41

*Note: *p<0.05, **p<0,01, ***p<0,001*

Table 1 Baseline regression

In order to make the estimators of Table 1 robust and unbiased, we proceeded to incorporate control variables provided in equation (3) individually. The introduction of the variables individually is done with the purpose of avoiding the composition effect of the sectoral VABs and the colinearity of the same. The results obtained show that the effect of physical capital, technological progress and employment in economic growth are stable by adding different control variables, such as exports and investment.

The coefficients of exports have the expected signs theoretically and are statistically significant for LA and the classification of them, on the other hand, in terms of investment was found a negative and significant effect for LA and for upper middle income countries, while in high-income countries it is not significant, finally for low-middle-income countries the effect is positive, but not significant. The strong dependence of the region on the primary export model could explain this result.

Var	AL	PIA	PIMA	PIMB
Logrn	0.03*** 4.00	-0.01 -2.26	0.03*** 3.93	0.07** 2.89
Logk	0.93*** 61.40	0.08 0.90	0.97*** 62.70	0.30 1.93
LogA	-0.00 -1.40	0.17 1.83	-0.00 -1.70	-0.02 -0.14
LogL	0.01*** 3.25	-0.00** -3.01	0.01** 2.69	-0.00 -1.44
Logx	0.04*** 4.73	0.43*** 18.24	0.03** 3.86	0.32*** 3.63
LogInv	-0.00* .2.25	-0.00 -1.03	-0.01 -2.65	0.00 0.90
Cons	0.61*** 6.53	3.96*** 39.24	0.31** 2.90	3.89*** 13.08

*Note: *p<0.05, **p<0,01, ***p<0,001*

Table 2 Latin America -PIA-PIMA and PIMB results with control variables

The results obtained in Table 2 confirm the initial effect of natural resources on economic growth, which is positive for LA, upper middle income countries and low middle income countries, while for high income countries the effect is negative and not significant.

This result does not agree with the theory, but it is in accordance with the context of the countries where the research is carried out. Although in Latin America the economies are oriented to the exploitation of certain natural resources, the same ones that are oriented to the external market and to a lesser extent in the manufacturing activities or services. On the other hand, the level of human capital in the region is low, which decreases the absorption capacity of technology in the countries under study (IDB, 2009).

Var	AL	PIA	PIMA	PIMB
Logrn	0.03*** 3.86	-0.01 -0.78	-0.00 -1.56	-0.00 -1.15
Logk	0.91*** 59.13	0.10 0.99	0.10*** 8.43	-0.01 -0.74
LogA	-0.00 -0.92	0.10 0.91	0.00*** 9.22	0.01 0.88
LogL	0.01** 3.15	-0.00* -2.20	-0.00 -1.36	-0.00 -1.21
Logx	0.39*** 4.37	0.49*** 12.76	0.00 1.66	0.00 0.37
LogInv	-0.00** -.2.92	-0.00 -1.19	-0.00 -1.89	-0.00 -0.89
Logvaba	0.10 1.25	-0.24*** -4.31	0.17*** 7.49	0.30*** 8.63
Logvabi	-0.05 -0.66	0.22*** 4.97	0.75*** 30.18	0.38*** 13.85
Logvabs	-0.00* -2.53	0.00 0.07	0.00*** 5.31	0.36*** 13.09
Cons	0.54*** 5.49	3.75*** 28.03	0.16*** 7.18	0.01 0-13

*Note: *p<0.05, **p<0,01, ***p<0,001*

Table 3 Latin America -PIA-PIMA and PIMB results with control variables

In order to decompose the effect of natural resources on the economic growth of the nineteen countries involved in this research, which were grouped by the level of development, the regression provided with the control variables was performed. The first group where equation (3) was estimated was for the PIAs of the region being: Chile and Uruguay the largest copper and gold generators respectively. The results shown are shown in table 3.

Assuming that high-income countries have greater technology capacity, the effect of Natural Resources on the product should be positive, however, this result is contradictory and in turn differ from those obtained in table 1. The effect in this group of countries is negative and not significant. Also, α varies between 0.003-0.03. This result found in the PIAs differs for AL, this effect could be explained because although the economy of these countries is based on the extraction of large quantities of gold and copper, they are exported. A particular point in this group of countries is that, when the covariates are exports, the gross added value of industry and services the coefficient is positive and statistically significant, in other cases the coefficient is not significant at 1%.

With regard to the PIMA, the results obtained, as in the PIAs, have the effect for this group of countries that includes the four largest and most industrialized economies of Latin America: Brazil, Mexico, Colombia and Argentina, it is the same, negative and not significant with respect to LA, likewise employment and investment have the same effect, in the other cases the effect is positive and statistically significant at 1%, which contradicts the results of table 1 that by not inserting the variants control, giving a positive initial effect and statistically significant, however, the elasticity of exports with respect to the product is only 0.003, being lower than that found in the PIA (0.49).

In low-middle income countries, the effect of natural resources remains negative as in the PIAs and PIMAs. This implies that natural resources do not play a relevant role in determining the levels of production in these countries in the period 1980-2015, in some cases they may decrease it. It could also be said that the low capacity of technology and low human capital could explain this result.

In summary, the results found indicate that in the first instance, since no control variables were inserted in the initial model (Table 1), there is a positive and significant relationship in LA. When these are incorporated and in turn the regressions are carried out by level of development of the countries (table 3), natural resources have a negative effect for high-income countries, on the other hand, in high-income countries, the The result is similar, negative effect and not significant, while for low middle income countries it is negative. The results presented in this research give us an initial look at the relationship between natural resources and growth in Latin America.

One point that has been taken into consideration for this research is that the estimated panels can follow non-stationary causes, which can imply that they are spuriously correlated, that is why it is necessary to verify that the series are not stationary, that is to say that present unit root. In this context, it is important that a random and stationary process is fulfilled, where the distribution of its probability is not dependent on time. To verify this condition, the Levin-Lin-Chu test (1993) is used for the variables of this investigation. The results obtained are shown below:

Niveles			
Intercept		**Trend and intercept**	**None**
Variable	*t-stadistic/prob*	*t-stadistic/prob*	*t-stadistic/prob*
Increase	3.08 (0.99)	-4.91 (0.00)	8.42 (1.00)
Nat resources	0.14 (0.55)	-0.01 (0.49)	2.01 (0.97)
Technology	1.76 (9.96)	-3.69 (0.00)	3.37 (0.99)
Investment	-3.85 (0.00)	-7.32 (0.00)	1.94 (0.97)
Capital	1.90 (0.97)	-3.21 (0.00)	3.50 (0.99)
job	214.33 (1.00)	933.56 (1.00)	-3.23 (0.00)
Exports	-5.30 (0.00)	-61.20 (0.00)	8.99 (1.00)
VAB agriculture	2.25 (0.98)	-2.74 (0.00)	9.78 (1.00)
	1.25 (0.89)	-3.52 (0.00)	6.17 (1.00)

VAB industry VAB services	4.00 (1.00)	-5.75 (0.00)	8.24 (1.00)
In differences			
	Intercept	**Trend and intercept**	**None**
Variable	*t-stadistic/prob*	*t-stadistic/prob*	*t-stadistic/prob*
Increase	-6.68 (0.00*)	-5.29 (0.00*)	-5.52 (0.00*)
Natural resources	9.99 (0.00*)	-9.40 (0.00*)	-15.16 (0.00*)
Technology	-9.37 (0.00*)	-7.90 (0.00*)	-12.10 (0.00*)
Investment	-24.35 (0.00*)	-23.62 (0.00*)	-25.44 (0.00*)
Capital	-10.30 (0.00*)	-8.89 (0.00*)	-13.48 (0.00*)
job	2046.63 (1.00*)	2332.30 (1.00*)	-7.11 (0.00*)
Exports	2096.49 (1.00*)	2316.10 (1.00*)	-7.11 (0.00*)
VAB Agriculture	-137.81 (0.00*)	-123.05 (0.00*)	-98.11 (0.00*)
VAB Industry VAB services	-9.42 (0.00*)	-8.03 (0.00*)	-9.01 (0.00*)
	-6.86 (0.00*)	-5.58 (0.00*)	-8.31 (0.00*)
	-6.62 (0.00*)	-5.94 (0.00*)	-5.17 (0.00*)

*Note a: The hypotheses for the stationarity test are the following: H_0: The non-stationary series and H_1: The series is stationary b: * first differences, ** second differences*
c: the probabilities are shown in parentheses

Table 4 Unit root test (Levin-Lin-Chu**)**

In the first instance, the test was carried out by levels, which is measured by intercept, trend and intercept and none. The results obtained were that, through the test by levels, we find a probability close to 1 or what is equal to the series that are stationary, that is, the series follows a trend. However, when performing the Levin-Lin-Chu test in first and second differences for the case of the investment variable, we obtained that the series are non-stationary, that is, the series has a unit root and is integrated in order 1, for the case of the investment, despite having made the second differences, the probability remains the same, however, the coefficient decreases.

Given that the model series are stationary in order one, the cointegration analysis can be considered to determine a balance of the economic model that is stable in the long term. In this perspective, the starting point is to perform tests based on residual estimation and application of unit roots (Kao, 1999).

Equation		**t-stadistic**	**Prob**
Equation 1	ADF Varianza Residual HAC varianza	-7.77 0.00 0.00	0.00
Equation 2	ADF Varianza Residual HAC varianza	-8.61 0.00 0.00	0.00
Equation 3	ADF Varianza Residual HAC varianza	-8.40 0.00 0.00	0.00

Table 5 Results of the Kao test

The results found indicate that when estimating Equation (1), the cointegration hypothesis is met since the probability is 0.0000, that is, there is a long-term relationship between the variables that make up the same. When the regressions incorporate certain control variables, Equation (2) and (3) the effect does not change, the hypothesis is still fulfilled when making use of these, there is a joint movement between the variables over time, we could talk about a long-term balance in the series.

Equation Inicial		
Hypotesis	Statistical Fisher-trace test/ Prob	Statistical de Fisher-max-einge value test/Prob
None	164.4 (0.00)	126.9 (0.00)
At least 1 vector	68.84 (0.00)	40.63 (0.01)
Equation 2		
Hypotesis	Statistical Fisher-trace test/ Prob	Statistical de Fisher-max-einge value test/Prob
None	429.5 (0.00)	227.6 (0.00)
At least 1 vector	210.7 (0.00)	103.4 (0.00)
At least 2 vectors	122.1 (0.00)	63.17 (0.00)
At least 3 vectors	76.09 (0.00)	36.56 (0.04)
Equation 3		

Hypotesis	Statistical Fisher-trace test/ Prob	Statistical de Fisher-max-einge value test/Prob
None	1636 (0.00)	360.8 (0.00)
At least 1 vector	3161 (0.00)	438.6 (0.00)
At least 2 vectors	691.3 (0.00)	245.7 (0.00)
At least 3 vectors	432.0 (0.00)	141.7 (0.00)
At least 4 vectors	327.9 (0.00)	104.1 (0.00)
At least 5 vectors	228.6 (0.00)	81.67 (0.00)
At least 6 vectors	166.1 (0.00)	72.69 (0.00)
At least 7 vectors	113.2 (0.00)	56.70 (0.00)
At least 8 vectors	80.59 (0.00)	51.16 (0.00)
At least 9 vectors	59.02 (0.00)	59.02 (0.00)

Table 6 Results of the Fisher Johansen test Note: the probabilities are shown in parentheses

On the other hand, under the conception of the Fisher Johansen test, the same one that determines the number of cointegration relationships in the system, it was determined that in the Equation (1) there is at least 1 cointegrating vector that gives indications that a relationship exists of long-term cointegration in the series, in the same way when determining the Equation (2) incorporating certain control variables such as exports and investment, it is observed that there are at least 3 cointegrating vectors in the presented series, finally when estimating the Equation (3) with the vabs we see that the series presents at least 9 cointegrating vectors, that is, the whole estimate presents a balance in the long term since the probabilities are less than 5%, therefore the cointegration hypothesis is fulfilled.

In summary, it can be concluded that the results about the main variables of the model are quite robust using the Kao and Fisher Johansen's test, it was found that there is a cointegration relationship or what is the same a long-term relationship between the variables.

So also that natural resources alone do not ensure sustained development and growth, they simply offer an opportunity that any economy should take advantage of (Ramos, 1998).

Conclusions

The strong dependence on natural resources, the internalization of production processes and the need for raw materials have caused economic growth to increase in recent decades. Literature in a theoretical and empirical context has tried to answer the question, studying if this effect generates benefits or losses for the recipient countries. The results with the empirical evidence are fulfilled for LA whereas for the classification of the countries by level of income per capita they are contradictory in certain cases. The econometric regressions consider the level of development based on the level of per capita income reached by the countries of the region through the World Bank classification.

The main results show that natural resources have a positive effect on the growth of Latin America compared to high income countries. The effect is negative and not significant, in high middle income countries and in low middle income countries the effect continues being the same when incorporating control variables such as exports, investment and GVA, this implies that natural resources do not play a relevant role in determining production levels in these countries in the investigation period.

These results are compatible with the conclusions presented by Sachs & Warner (1997) when finding a negative relationship between growth and abundance of resources. On the other hand, certain studies find a positive relationship such as Chambers & Guo (2007) and Brunnschweiler (2008), because when incorporating variables of an institutional nature, the results vary.

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It is worth mentioning that different tests have been applied such as: Kao, Fisher and Johansen which allow to establish the existence of cointegrating vectors, in this sense one can observe balance of the variables in the long term, which leads to a positive relationship between natural resources and economic growth, not only because of the volatile prices that exist, but also because of the existence of other variables that can explain this effect such as corruption, investment, terms of trade and schooling.

Likewise, taking Ruiz as reference (2007), it is pointed out that natural resources are being subjected to ever greater pressure, since the economies of the world are making use of these resources, which implies that time is limited so that they are regenerated, it is important to mention that natural resources are important for a country because with the help of institutions, innovation in technology can be implemented public policies capable of making the most of them in a sustainable way and therefore have a sustained growth based on the extraction of these.

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