TRADE OPENING AND ECONOMIC GROWTH: AN EMPIRICAL APPROACH

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ABSTRACT

Economic growth has beneficial effects on the general well-being of a society. Identifying and analyzing its determining factors becomes essential to improve economic policy decisions. Among these factors, the effects of trade openness are widely debated in the literature. Although there are various works that study the relationship between trade openness and economic growth, the results are heterogeneous and differ depending on the level of development of the economies, the openness variable considered, among other conditions.

The main objective of this work is to investigate the existence of a relationship between trade openness and economic growth in a large group of developed and developing countries, considering different openness measures, and thus outline economic policy recommendations that promote growth. The central hypothesis is that trade openness has a different effect on the economic growth rate depending on the degree of development of the economies and the openness variable analyzed. To meet the objective, parametric estimates were used for the period 1960-2019, and alternative openness measures were constructed to the conventional indicator defined as the sum of exports and imports in relation to the Gross Domestic Product (GDP). The results obtained in this work differ depending on the level of development of the countries analyzed and the openness measures used.

KEYWORDS: Economic growth; Commercial opening; Determinants; Economic policy.

El crecimiento económico tiene efectos beneficiosos sobre el bienestar general de una sociedad. Identificar y analizar sus factores determinantes se vuelve fundamental para mejorar las decisiones de política económica. Entre dichos factores, los efectos de la apertura comercial son ampliamente debatidos en la literatura. Si bien hay diversos trabajos que estudian la relación apertura comercial - crecimiento económico, los resultados son heterogéneos y difieren según el nivel de desarrollo de las economías, la variable de apertura que se considere, entre otros condicionantes.

El presente trabajo tiene como objetivo principal indagar la existencia de una relación entre la apertura comercial y el crecimiento económico en un amplio grupo de países desarrollados y en desarrollo, considerando distintas medidas de apertura, y así esbozar recomendaciones de política económica impulsoras del crecimiento. La hipótesis central es que la apertura comercial ejerce un efecto diferente sobre la tasa de crecimiento económico según el grado de desarrollo de las economías y la variable de apertura analizada. Para el cumplimiento del objetivo se utilizaron estimaciones paramétricas para el período 1960-2019, y se construyeron medidas de apertura alternativas al indicador convencional definido como la suma de exportaciones e importaciones en relación al Producto Bruto Interno (PBI). Los resultados obtenidos en este trabajo difieren según el nivel de desarrollo de los países analizados y las medidas de apertura utilizadas.

PALABRAS CLAVE: Crecimiento económico; Apertura comercial; Determinantes; Política económica.

INTRODUCTION

Economic growth is a necessary, although not sufficient , condition for a country to achieve a certain level of development and social well-being. Identifying the determining factors and knowing how they impact the growth rate of an economy is essential to identify those driving and retarding factors, and thus be able to outline economic policy recommendations that promote growth, with the consequent improvements it entails for the well-being of the population. population. These factors can be classified as internal, such as investment, human capital, political stability, among others; and external factors, among which trade openness, the terms of trade, the growth of the trade balance, among others, stand out.

One of the factors that presents the greatest debates and controversies is trade openness. There are numerous works that study the relationship between trade openness and the economic growth of countries. However, the results are heterogeneous and differ depending on the level of development and income of the economies, the openness variable used and also depending on the other conditions that are incorporated into the analysis.

In a context of globalization and growing regional integration, it is essential to analyze the effects of trade openness on the long-term macroeconomic performance in the different groups of countries according to their level of development. Its relevance is based on the fact that it allows the formulation and implementation of more precise and accurate economic policy measures to promote growth and the consequent development of an economy. As mentioned above, empirical works obtain results that are far from homogeneous. While some authors find a positive relationship between growth and trade openness (Dollar 1992, Sachs and Warner

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1995, Edwards 1998, Yanikkaya 2003, Chang et al., 2009), others contradict these results and question their robustness (Harrison 1996, Rodriguez and Rodrik 2000, Astorga, 2010, Adhikary, 2011, Abbas 2014, Musila and Yiheyis, 2015). Likewise, other works find non-linear relationships and differences in results depending on the income level of the countries (Kim and Lin 2009, Zahonogo 2016, Vilchez Espejo 2018) .

The general objective of this work, motivated by the lack of homogeneity in the results of the literature, is to investigate the possible existence of a relationship between trade openness and economic growth in a large group of developed and developing countries, considering different measures. opening. Thus, this work aims to be a contribution to the literature that studies this relationship, in order to formulate economic policies aimed at promoting growth and development. To meet the objective, parametric estimates were used for the period 1960-2019, and alternative openness measures were constructed to the conventional indicator defined as the sum of exports and imports in relation to the Gross Domestic Product (GDP).

DEVELOPMENT
Background

From the theoretical literature, a first view linked to the neoclassical and traditional theory of international trade, postulates a positive relationship between openness and economic growth. Openness could facilitate growth through increased productivity, the transmission of technical progress and scale effects (Bhagwati, 1969; Krueger, 1983; Grossman and Helpman, 1991; Coe et al., 1997, etc.). Thus, liberalization programs (perhaps with protection of nascent industries and selective export promotion) would be sufficient to achieve sustained economic growth (Adelman, 1999).

After the meager results in developing countries following the implementation of the recommendations of the Washington Consensus, a more lax position established that government subsidies and direct interventions were crucial for cases such as the Asian miracle (Stiglitz, 1996). Successful opening processes required intervention, investment in education, correct control of the real exchange rate and adequate attention to institutional structures (Rodrik, 1998; Stiglitz, 2000; Andersen and Babula, 2009; Todaro and Smith, 2020). The Keynesian-tinged approximations of two- and three-gap models (Thirlwall, 1979; Bacha, 1990; Chisari and Fanelli, 1990); those linked to the structuralist school (Prebisch, 1963; Furtado, 1983; Rodriguez, 2006) and dependency theories (Dos Santos, 1986, 2007; Baran, 2019), provide a rather pessimistic view of the link between openness and growth for developing countries. These, conditioned by their initial endowments, their geography and history, achieved a type of productive specialization compatible with a chronic current account imbalance and the aggravation of internal problems in the face of trade liberalization (Acosta

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el al., 2014; Cruces et al., 2018). The current account deficit (the "third gap") is, in turn, a consequence of growth and is accentuated by indebtedness and the processes of financial opening from the 70s onwards (Chisari and Fanelli, 1990, Ocampo, 2011; Bárcena and Prado, 2015;

For its part, the empirical literature has not yet found robust general conclusions. While Dollar (1992), Sachs and Warner (1995), Edwards (1998), Frankel and Romer (1999), Yanikkaya (2003), Chang et al., (2009), find a positive effect of the degree of openness on the growth for a large group of economies, other authors contradict those results or question their robustness (Harrison, 1996; Rodriguez and Rodrik, 2000; Abbas, 2014; Adhikary 2011; Hye 2012; Eriş and Ulaşan 2013; Musila and Yiheyis 2015). Hallak and Levinsohn (2004) conclude that it is more relevant to investigate the mechanisms by which trade affects growth instead of analyzing only correlations, to establish successful trade policies. For their part, some studies obtain a bidirectional causal relationship (Idris et al., 2016; Alam and Sumon, 2020; Oliva et al., 2020). Finally, works such as that of Ulaşan (2015) do not find a significant relationship between both variables.

Other authors analyze the relationship between trade barriers (synonymous with less commercial freedom) and the growth rate. Lee (1993) verifies a negative relationship between tariff rates and growth rates for developed and developing countries, while O'Rourke (2000) finds a positive correlation between trade protection and growth for the period 1875-1914 for developed economies; and Clements and Williamson (2001) find heterogeneous results for the period before World War II (positive correlation between those variables in rich countries, and weak and negative correlation for lower-income countries).

A series of studies find a non-linear relationship between openness and economic growth (Kim and Lin, 2009; Zahonogo, 2016; Vilchez Espejo, 2018). For example, Kim and Lin (2009) find that greater openness positively impacts economic growth in high-income economies, but negatively in low-income economies. On the contrary, Tahir and Azid (2015) obtain a positive and significant relationship for 50 developing countries, while Zahonogo (2016) finds a non-linear relationship for Sub-Saharan African countries. At the same time, another group of works focuses their analysis on the impact of trade openness on productivity and, consequently, on economic growth, finding dissimilar results depending on the degree of development of the countries (Edwards, 1998; Alcalá and Ciccone, 2004; González and Constantin, 2009; Bekaert et al., 2011).

Part of the works cited above evaluate different measures of openness (Dollar, 1992; Edwards, 1998; Yanikkaya, 2003). In this sense, it is necessary to consider the conditions of openness and not rely only on the conventional openness indicator (defined as the sum of exports and imports in relation to GDP), controlling for geographical and population factors, by

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exporter profile, among others. others (Babula and Andersen, 2009; Vilchez Espejo, 2018). By identifying the factors that affect openness and knowing how they affect it, it is possible to improve the economic policy measures implemented.

In short, there is no clear and univocal relationship between trade openness and economic growth. The type of relationship, the indicators used and the way in which they are related are still far from being conclusive. It is necessary to expand the study of this relationship, in a context of growing globalization and regional integration, distinguishing between groups of countries, in order to improve decision making when formulating economic policies.

Data

Based on data availability, a panel was constructed with 175 developed and developing countries for the period 1960-2019, based on the World Bank's [1]*World Development Indicators* database . Descriptive statistics and econometric estimates were carried out with STATA 16 software.

There are various works that study the determining factors that explain economic growth (Levine and Renelt, 1992; Barro, 1996; Dabús and Laumann, 2006). The control variables used in this work were selected from the contributions of Rojas et al., (2019) and Rojas et al., (2021). The endogenous variable is the annual growth rate of real GDP per capita (expressed as a percentage). For their part, the control variables are:

● *Initial GDP per capita*, which allows evaluating convergence, defined as the logarithm of GDP per capita lagged by one period;

● the *degree of openness* expressed as a percentage as the share of exports and imports in GDP;

● the *level of investment*, such as gross fixed capital investment as a percentage of GDP;

● *public spending*, defined as the government's final consumption in relation to GDP;

● *population growth* (expressed as a percentage);

● *human capital* as the logarithm of life expectancy at birth [2].

In addition to the variable degree of openness defined above, alternative measures were evaluated in order to strengthen the results found. Finally, following Vilchez Espejo (2018) An

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[1]. The list of countries used and other details can be requested from the author.

[2]. Although parametric estimates were made considering among the control variables the terms of trade both in logarithm, its growth rate, as well as interactions of said variable with those of commercial openness, robust results were not obtained. The analysis of this variable in relation to economic growth constitutes a possible line of future research.

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openness variable was formulated from the residual of a regression that seeks to obtain a pure measure of said indicator by controlling for all the factors that are assumed to determine openness. The details of these measurements are provided in the results section.

Finally, it is important to highlight that, although human capital has two fundamental dimensions, health and education, due to the controversy generated around this last dimension (Rojas et al., 2019), it was decided to use an identifying variable of the health dimension. As can be seen, the variables in levels are expressed in logarithms.

Rojas et al., 2019, study the relationship between human capital and growth in a sample of developed and developing countries for the period 1960-2010, under parametric and semi-parametric approaches, with the objective of evaluating the presence of non- linearities and threshold effects. Under the first approach, they find that the health dimension of human capital is more significant in driving growth than the education component. In particular, the education variable is generally non-significant in the parametric fixed effects and *Panel Corrected Standard Errors methodologies*. For its part, under the second approach they obtain a non-linear relationship between health status and the level of education on growth. Likewise, they find a great dispersion in the education-growth relationship at medium and high income levels. The results found suggest that policies aimed at reducing infant mortality boost growth, although this positive effect decreases in high-income countries. Regarding the education variable, it becomes relevant to exceed a certain threshold of years of education to boost growth. However, the authors establish that, in low-skilled economies, an increase in investment or physical capital formation may not be used to expand productive sectors, although the lack of complementarity between physical and human capital would not be beneficial in the long run either. term. Based on these results, in this work a variable from the health dimension was used.

Methodology

Parametric estimations were carried out for panel data. In general terms, the model is defined as follows:

$$Y_{it} = X_{it}\beta + u_{it}$$

With $i = 1, ..., N$ and $t = 1, ..., T$, being the total number of observations $N.T$.

Where:

●Y_{it} represents the dependent variable for the country i at the moment t. In this case, it represents the growth rate of GDP per capita expressed as a percentage of the country i between the year $t - 1$ and t.

●X_{it} represents the dimension matrix $k \times t$ of the explanatory variables;

●β represents the vector $k \times 1$ of parameters to estimate.

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●u_{it} is the stochastic component of the model.

Based on the selected variables, the model is specified as follows:

$$Crecimiento_{it} = \beta_i + \beta_1 PBI\ inicial_{it} + \beta_2 Apertura_{it}^* + \beta_3 Inversión_{it} + \beta_4 Gasto\ Público_{it}$$
$$+ \beta_5 Capital\ Humano_{it} + \beta_6 Población_{it} + \mu_{it} \qquad (1)$$

* In different measures implemented in the analysis.

The sample was divided according to the level of gross national income (GNI) in current US dollars, following the Atlas method, as a proxy variable for the level of development of a country, taking as reference the World Bank criteria according to income levels. for fiscal year 2024. Although the classification proposed by the World Bank consists of four groups of countries (low, lower-middle, upper-middle and high income), it was decided to consider upper-middle and high-income countries together. In this way, economies are classified into three groups: low-income countries if they have an annual gross national income of less than US$1,135, medium if it ranges between US$1,136 and US$4,465, and high-income if it is equal. or greater than US$ 4,466. Consequently, the sample was divided into three subsamples: 49 "Low Income" countries, 60 "Middle Income" and 66 "High Income" countries.

The methodology used in this work is based on the Panel Corrected Standard Errors (PCSE) Model. This is a robust estimation method, which admits first-order serial autocorrelation and heteroscedasticity.

First, the existence of random effects was evaluated using the Lagrange Multiplier test of Breusch and Pagan (1980). Secondly, the existence of fixed effects and their significance were verified based on the F restrictive test. Then, the Hausman test (1978) was carried out in order to compare the coefficients of the estimates under random effects and under fixed effects. From the results obtained in these tests, it was concluded that the true regression method to estimate was the fixed effects method, under the Ordinary Least Squares (OLS) methodology. Finally, the existence of first-order serial autocorrelation and heteroscedasticity was analyzed, in order to satisfy the Gauss-Markov assumptions and thus obtain the Best Unbiased Linear Estimators (MELI). The errors must be homoscedastic and distributed independently of each other, that is: $Var(\varepsilon_{it}) = \sigma_\varepsilon^2$ and $E(\varepsilon_{it}\varepsilon_{is}) = E(\varepsilon_{it}\varepsilon_{jt}) = 0 \ \forall\ i \neq j;\ t \neq s$. To verify this, the Wooldridge (2002) and Modified Wald tests proposed by Greene (2002) were implemented. Given that the estimates presented both problems, it was decided to estimate a robust model, PCSE, these being finally the estimates presented in the body of this work. These tests were implemented for the different groups of countries, as well as for the general sample, and for each openness measure analyzed, obtaining very similar results and the same conclusions.

Results

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Descriptive statistics analysis

Table 1 presents the main descriptive statistics for the entire sample of countries. The data in general present great variability for the total number of countries due mainly to the time horizon considered and the heterogeneity of the economies incorporated into the analysis. In particular, the variables associated with the external sector present greater variability. The conventional indicator of trade openness is the variable with the largest standard deviation, followed by exports, imports and net exports. Furthermore, the latter present a negative average value. Additionally, it is important to highlight that the average annual growth rate of GDP per capita for the entire sample is 2.11%, which reflects a positive trend worldwide.

Table 1.

Descriptive statistics.

Variable	Observations	Half	Standard deviation	Minimum value	Maximum value
GDP growth per capita	8279	2,113	6,085	-64,425	140.48
Initial GDP per capita	8136	8,231	1,460	4,970	11,644
Opening	7851	75,566	50,158	0.020	442.62
Exports	7851	35,343	26,923	0.005	228,993
Imports	7860	40,234	25,848	0.015	221.01
Net exports	7851	-4,878	16,477	-164,766	81,697
Investment	7148	22,292	8,273	-2,424	93,547
Public spending	7673	16,040	8,067	0.911	147,718
Human capital	10452	4,146	0.194	2,484	4,444
Population	10324	1,774	1,671	-27,722	19,360

Source: own elaboration.

For its part, Table 2 shows the descriptive statistics for each group of countries depending on the level of development. For each of these groups, the mean and standard deviation of each analyzed variable are presented. Statistics show that high-income countries are those that grow the most on average, and are also the economies most open on average to international trade. Thus, the results would show a positive relationship between the level of development and the degree of openness.

Table 2.

Descriptive statistics according to the level of development of the countries.

Entry level	low income		Average income		High income	
Variable	Half	Standard deviation	Half	Standard deviation	Half	Standard deviation

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GDP growth per capita	1,291	5,489	2,446	6,992	2,487	5,504
Initial GDP per capita	6,681	0.639	7,981	0.667	9,829	0.786
Opening	55,254	29,411	74,316	36,376	93,565	66,053
Exports	22,614	14,289	33,344	18,097	47,793	35,289
Imports	32,640	17,741	40,971	22,616	45,788	32,112
Net exports	-10,025	13,147	-7,627	18,835	2021	14,013
Investment	20,042	9,775	23,244	8,889	22,999	5,850
Public spending	13,319	6,847	16,559	10,232	17,680	5,790
Human capital	3,956	0.180	4,149	0.153	4,286	0.089
Population	2,450	1,238	1,767	1,328	1,277	2020

Source: own elaboration.

Regarding public spending, human capital, exports, imports and net exports, high-income countries have higher average values of these variables than other groups of countries, while low-income economies have the highest average annual population growth. The trade balance becomes surplus on average for the group of richest countries. It should be noted that the average investment is slightly higher in middle-income countries than in high-income countries. Most of these observations are consistent with what was intuitively expected.

In summary, these results seem to indicate that the higher the level of development of the countries, the greater their degree of trade openness and the better their long-term macroeconomic performance.

Empirical estimates

Opening measurements

The traditional measure of the degree of openness of an economy is defined as the sum of exports and imports of goods and services in relation to the GDP of an economy. However, there is no agreement that this indicator is the best to capture the trade openness of a country, given that product fluctuations alter the measure, without necessarily the economy having been opened or closed to foreign trade. Although it is true that all the indicators used in the empirical literature are not exempt from criticism (they all have advantages and disadvantages), the traditional indicator leaves aside certain critical factors that affect a nation's international trade.

Firstly, there are geographical factors that are decisive for the flow of trade (Frankel and Romer, 1999): the fact that a country has access to the sea is vital for the development of international trade, which, added to the number of inhabitants of the country, accounts for the size of the economy. Secondly, the surface area of the country is also a factor to consider. Although this variable per se does not say much about trade, the truth is that the size of a

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country, as well as its location, play a fundamental role for trade, since they influence the costs associated with transportation, logistics, infrastructure, connectivity and other factors that impact international commercial traffic. These trade costs are considered permanent since they are associated with geographical and structural characteristics (Moncarz et al., 2021). Finally, it is important to consider the type of products that lead the countries' export matrix. In this sense, it was controlled by those oil exporting countries.

In order to improve the conventional indicator of the degree of openness of an economy, the following model was estimated [3]:

$$Apertura \left(\frac{X + M}{PIB} \right) = \beta_1 petróleo + \beta_2 sin\_litoral + \beta_3 pop + \beta_4 superficie + \mu \ (2)$$

Where *oil* is a dummy variable that takes a value of one if the country is an oil exporter; *sin_litoral*, is also a dummy variable that takes a value of one if the country does not have access to the sea; *pop* , is the logarithm of the total amount of population for each country; Finally, the *surface variable* is the logarithm of the surface area in square kilometers of each country. From this regression, the residual was considered as the new measure of trade openness. When controlling for those variables that are exogenous to economic policy decisions and affect international trade, the residual obtained from (2) represents a "clean" or "genuine" measure of the degree of openness of an economy. This measure is one that is closer to the opening produced by economic policy measures and idiosyncratic factors, since it controls for geographical factors and productive specialization in the case of oil.

Table 3.
Estimation of the new opening measure.

Control variables	Coefficient	Standard Deviation
Surface	-12,972***	0.301
Population	-1,312***	0.368
Landlocked	6,601***	1,211
Export of oil	20,217***	1,016
Intercept	239,804***	4,087
R^2	0.352	
EMC	40,062	

Note: ***, ** and *: statistically significant at 1%, 5% and 10%, respectively.

Source: own elaboration.

From this new measure of openness, a regression model was estimated with the same control variables as (1), both for the entire sample and for the different groups of countries. As can be seen in Table 3, all variables are statistically significant.

Additionally, the following variables are tested as a proxy for trade openness:

[3]. For a similar adjustment see Vilchez Espejo (2018) and Chang et al., (2009).

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- Exports and imports, both as a percentage of GDP.
- Net exports, defined as the difference between exports and imports in relation to GDP (expressed as a percentage).

The results for the internal factors of economic growth obtained for the entire sample are in general terms as expected, while they are compatible with the empirical evidence. However, this is not verified for each subsample, given that the results vary according to the level of development of the countries and according to the openness variables analyzed.

Table 5.

Estimates with the PCSE methodology for the total sample.

Returners	PCSE			
	(1)	(2)	(3)	(4)
Initial GDP per capita	-0.867*** (0.112)	-1,121*** (0.131)	-1,068*** (0.132)	-0.864*** (0.112)
Opening	0.008*** (0.001)			
Exports		0.040*** (0.011)		
Imports		-0.024** (0.011)		
Expo. net			0.033*** (0.011)	
Opening (new measure)				0.008*** (0.002)
Investment	0.091*** (0.013)	0.103*** (0.013)	0.109*** (0.013)	0.090*** (0.013)
Public spending	-0.104*** (0.017)	-0.078*** (0.020)	-0.073*** (0.020)	-0.100*** (0.016)
Human capital	5,624*** (1,149)	6,185*** (1,155)	6,589*** (1,141)	5,860*** (1,147)
Population	-0.548*** (0.107)	-0.596*** (0.107)	-0.582*** (0.107)	-0.551*** (0.107)
Intercept	-14,265*** (4,215)	-14,951*** (4,197)	-16,704*** (4,133)	-14,713*** (4,214)
R^2	0.043	0.045	0.043	0.043
Est. Wald Test *(p-value)*	193.38 (0.0000)	223.74 (0.0000)	199.56 (0.0000)	196.02 (0.0000)

Note: ***, ** and *: statistically significant at 1%, 5% and 10%, respectively. Standard errors in parentheses.

Source: own elaboration.

When analyzing the general sample, the results are in line with what is stated in the literature. The coefficients of the control variables are significant, at least at the 5% level.

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Investment and human capital favor economic growth, while population, public spending and initial GDP affect it negatively. In particular, the fact that the coefficient that accompanies the variable that represents the initial GDP per capita presents a negative sign, verifies the hypothesis of conditional convergence. For its part, public spending also negatively affects economic growth. Analyzing the variables of the external sector for all countries as a whole, it can be seen that both the conventional measure of trade openness (defined as imports plus exports in relation to GDP), the variable of exports and net exports, as well as as the new measure of openness constructed from regression (2), positively affect economic growth, while on the contrary imports harm growth. All the opening variables considered are statistically significant.

Table 6.

Estimates with the PCSE methodology for low-income countries.

Returners	PCSE			
	(1)	(2)	(3)	(4)
Initial GDP per capita	-1,871*** (0.294)	-2,053*** (0.318)	-1,914*** (0.306)	-1,825*** (0.284)
Opening	0.008 (0.005)			
Exports		0.027 (0.017)		
Imports		-0.006 (0.014)		
Expo. net			0.010 (0.014)	
Opening (new measure)				0.009* (0.005)
Investment	0.051*** (0.016)	0.055*** (0.016)	0.058*** (0.016)	0.047*** (0.017)
Public spending	-0.066*** (0.024)	-0.058** (0.024)	-0.050** (0.024)	-0.066*** (0.023)
Human capital	8,423*** (1,304)	8,538*** (1,312)	8,963*** (1,292)	8,279*** (1,286)
Population	-0.490** (0.192)	-0.509*** (0.192)	-0.519*** (0.192)	-0.488** (0.191)
Intercept	-19,268*** (5,004)	-18,605*** (4,967)	-20,821*** (4,782)	-18,358*** (4,912)
R^2	0.069	0.070	0.068	0.070
Est. Wald Test *(p-value)*	120.19 (0.0000)	121.19 (0.0000)	120.18 (0.0000)	122.24 (0.0000)

Note: ***, ** and *: statistically significant at 1%, 5% and 10%, respectively. Standard errors in parentheses.

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Source: own elaboration.

Regarding the subsample of low-income countries, control variables such as physical investment and human capital positively impact the economic growth of these countries, unlike initial real GDP per capita, public spending and population growth. , which impact negatively. For its part, the effects of trade openness on growth are not robust, depending on the openness measures considered. Under this PCSE methodology, the only openness measure that is significant (only at 10%) is the new "genuine" measure created from (2), and it positively impacts growth. These results obtained for low-income countries are striking, as the new measure of openness constructed from the regression is the only one that is significant. This suggests that regardless of geographical, demographic factors or oil export capacity, appropriate *pro-* openness policies could contribute to improving long-term macroeconomic performance in the most backward economies.

Table 7.

Estimates with the PCSE methodology for middle-income countries.

Returners	PCSE			
	(1)	(2)	(3)	(4)
Initial GDP per capita	-2,183*** (0.341)	-2,382*** (0.352)	-2,299*** (0.347)	-2,224*** (0.342)
Opening	0.006 (0.005)			
Exports		0.031* (0.018)		
Imports		-0.017 (0.017)		
Expo. net			0.024 (0.017)	
Opening (new measure)				0.010* (0.005)
Investment	0.130*** (0.026)	0.139*** (0.026)	0.144*** (0.024)	0.127*** (0.026)
Public spending	-0.095*** (0.022)	-0.071** (0.028)	-0.065** (0.028)	-0.092*** (0.020)
Human capital	4,927*** (1,832)	5,422*** (1,840)	5,591*** (1,838)	5.101*** (1,825)
Population	-0.144 (0.185)	-0.185 (0.184)	-0.200 (0.183)	-0.165 (0.183)
Intercept	-2,510 (6,496)	-3,376 (6,505)	-4,446 (6,462)	-2,382 (6,449)
R^2	0.048	0.049	0.048	0.049
Est. Wald Test *(p-value)*	97.44 (0.0000)	107.71 (0.0000)	101.86 (0.0000)	102.25 (0.0000)

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Note: ***, ** and *: statistically significant at 1%, 5% and 10%, respectively. Standard errors in parentheses.

Source: own elaboration.

In middle-income countries, the variables of initial GDP per capita, investment and human capital are significant and with the expected sign, as is the sample of low-income countries. For its part, the population growth rate is not statistically significant for the different estimates, while public spending has a negative effect on growth. When the openness variables are analyzed, it is observed that the only variables whose coefficients are significant, although at 10%, are exports and the constructed measure of openness, evidencing in both cases a beneficial effect for growth.

Table 8.

Estimates with the PCSE methodology for high-income countries.

Returners	PCSE			
	(1)	(2)	(3)	(4)
Initial GDP per capita	-0.601* (0.339)	-1,292*** (0.465)	-1,400*** (0.453)	-0.668* (0.355)
Opening	0.009*** (0.001)			
Exports		0.073** (0.029)		
Imports		-0.058* (0.031)		
Expo. net			0.078*** (0.029)	
Opening (new measure)				0.011*** (0.003)
Investment	0.080*** (0.030)	0.128*** (0.031)	0.143*** (0.030)	0.081*** (0.030)
Public spending	-0.235*** (0.064)	-0.205*** (0.067)	-0.212*** (0.066)	-0.233*** (0.065)
Human capital	-13,770*** (4,614)	-10,269** (4,642)	-8,178* (4,444)	-12,961*** (4,719)
Population	-0.867*** (0.190)	-0.914*** (0.190)	-0.878*** (0.189)	-0.837*** (0.188)
Intercept	69,972*** (17,421)	60,219*** (17,118)	52,657*** (16,509)	67,862*** (17,904)
R^2	0.086	0.092	0.089	0.084
Est. Wald Test *(p-value)*	191.47 (0.0000)	191.62 (0.0000)	162.95 (0.0000)	170.50 (0.0000)

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Note: ***, ** and *: statistically significant at 1%, 5% and 10%, respectively. Standard errors in parentheses.

Source: own elaboration.

Finally, when studying the subsample of high-income countries, the results are not entirely compatible with the empirical evidence. Regarding the initial GDP per capita, real investment and the population growth rate, the results are consistent with the evidence. However, with respect to human capital and public spending, a negative impact on the GDP per capita growth rate is evident in all cases, contrary to what was expected. The effects of human capital on growth are especially striking, both because of the sign of their coefficients and their magnitude. This may be due to an association between the logarithm of life expectancy at birth and the population growth rate. In this sense, a first test exercise consisted of estimating the models without the *Population variable*, where human capital no longer has a significant effect on growth. In relation to the openness measures, it is observed that all of them are statistically significant (at least 10%) and present an effect in line with what was expected: the conventional measure, net exports, exports and the constructed measure of trade openness, are beneficial. for growth, unlike imports that negatively affect it. Net exports exhibit the highest magnitude coefficient among the openness measures analyzed.

In summary, the results indicate that, in general, there is a positive relationship between the rate of economic growth and trade openness in both developing and developed countries, which is consistent with the contributions of authors who find a positive relationship between both variables. , such as Yanikkaya (2003), Chang et al. (2009), Tahir and Azid (2015), among others. However, the effects of openness differ depending on the alternative measures considered and the group of countries analyzed. The results obtained are especially relevant for those developing economies that have an unbalanced productive structure, with an industry largely dependent on imports of inputs and intermediate goods for production, oriented mainly towards a relatively limited internal market. This makes the foreign exchange generating capacity of other sectors of the economy essential, generally linked to primary sector activities. Additionally, for developing countries it is essential to have sufficient foreign currency to meet the external debt commitments assumed. Added to this are the problems of *sudden stops*, which highlight the fragility of the financial sector in these countries.

Economic policy recommendations

Based on the results obtained, it is possible to formulate certain recommendations towards foreign economic policy in order to improve long-term macroeconomic performance. Regarding the internal determinants of growth, the general recommendations aim to favor

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physical investment, adequately manage fiscal accounts, focusing the applications of state expenditures on improving, mainly, health and educational services.

The liberalization of foreign trade has a beneficial effect on the growth rate of economies, making it convenient to apply policies that tend to improve the trade balance. However, it is necessary to highlight that, to achieve adequate insertion into world trade, it is necessary to previously apply reforms and measures that resolve the internal problems of each economy, which in turn depend on the idiosyncratic characteristics of each nation. In particular, it is necessary to achieve short-term macroeconomic stability, mitigating the effects of product and price level volatility, through countercyclical monetary and fiscal policies, since in this way it becomes more favorable to apply reforms in the long run. term. Additionally, the effects of trade liberalization are influenced by the characteristics of each economy such as an adequate institutional design, the degree of financial development, sociopolitical stability, the productive structure, among other factors.

Economic policy recommendations aimed at the external sector must take into account the level of development of the economies. In low-income countries, the effects of trade openness on economic growth are not robust, since not all measures of openness are significant. That measure that is significant (the pure measure of openness) has a positive effect on the growth rate. Consequently, the recommendations in these countries are oriented towards trade openness, although it is not clear that this significantly favors growth. On the other hand, in middle-income countries the most convenient thing would be to promote exports, for example, through tax advantages and incentives towards the exporting sectors, given that it is the external sector variable that has a greater impact in relation to the new opening measure, in addition to exerting a positive and significant effect on growth. Finally, in higher-income countries it is clear that openness favors growth considering the different measures analyzed, so that policies that promote foreign trade will benefit economic growth.

CONCLUSION

In this work, the existence of a relationship between trade openness and the economic growth rate of real GDP per capita was evaluated for a sample of 175 countries during the period 1960-2019 with a parametric approach. The sample was divided into three subsamples according to the income level of the economies. To fulfill the general objective, a descriptive analysis was carried out, which was complemented with time series graphs for the period analyzed, and panel econometric estimates were made, under the panel-corrected standard errors methodology. The traditional control variables considered in the economic growth literature were incorporated in addition to the trade openness variables, such as initial GDP, investment, human capital, public spending and population growth rate.

In order to strengthen the results, different alternative measures were used as a proxy for trade openness. On the one hand, the conventional indicator of openness was used $\left(\frac{M+X}{PBI}\right)$, then exports and imports separately, net exports and finally a measure of "clean" openness of those factors that influence international trade and that in turn are, at least directly , outside the reach of economic policy makers, such as the country's population, surface area, whether it has a maritime coastline and whether it is an oil exporting country.

The results obtained in this work differ depending on the level of development of the countries analyzed. In low-income countries, the effects of trade openness on the economic growth rate do not seem to be significant, because the *genuine measure* of openness is the only one that is statistically significant, but only at 10%. This raises a question about the existence of non-linear effects of trade openness on economic growth. The fact that significance improves when controlling for geographical factors, such as surface area and access to the sea, finds support in theories of economic development that explain underdevelopment based on these factors. In this way, these factors become especially relevant when explaining the conditions of underdevelopment in lower-income economies. Regarding middle-income countries, the only openness variables that are significant, although only at 10%, and favor growth, are exports and the new openness measure. In relation to high-income countries, openness benefits growth considering the different measures analyzed, except for imports, and, therefore, policies that promote foreign trade will boost economic growth in these countries.

For its part, in relation to the internal determinants of growth, the recommendations for the entire sample are aimed at promoting physical investment, improving health and education services in order to contribute to the formation of human capital, and adequately managing the public spending. Although for the general sample the results obtained for the internal determinants of growth are compatible with the empirical evidence, this does not occur for each group of countries. In particular, in developed countries, human capital has a negative effect on the growth rate and the magnitude of the impact is relatively high.

In light of the results obtained, policy recommendations aimed at the external sector also differ depending on the degree of development of the countries. In lower-income economies, *pro- openness* policies will not boost growth significantly. The opposite occurs with higher-income countries, where the application of opening measures will promote growth. For its part, in middle-income countries it is recommended to boost exports.

Finally, future research aims to deepen the analysis of the relationship between openness and economic growth, incorporating the financial channel and the terms of trade. Regarding this last factor, it is relevant to investigate possible alternative measures, and the application of different methodologies. Additionally, it is hoped to carry out a non-linear analysis

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for the internal and external factors of economic growth for each group of countries, since this would contribute to a better understanding of the effect of these determinants on the growth rate. In particular, an attempt is made to deepen the analysis of human capital and public spending in future work.

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