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Human Capital and Non-Renewable Natural Resources in Latin America and the Caribbean: 'Is It a Curse or a Blessing'?

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Abstract: This study examines the role of non-renewable natural resources in the accumulation of human capital in a sample of eighteen Latin American and Caribbean countries from 1995 to 2018. We assess the influence of non-renewable resources through six distinct variables and employ panel data co-integration techniques (PMG-ARDL). Our findings reveal a positive long-run effect, whether measured by abundance or dependence indicators. Even in cases where negative short-run effects are observed, the positive impact is consistent in the long term. Furthermore, physical capital stock, institution quality, and a more open economy are the most important drivers of human capital accumulation in the region. Although the long-run effect of non-renewable natural resources on human capital was positive, the estimated elasticities account for a relatively low effect. Consequently, even in the absence of the 'curse' effect, we do not deem it appropriate to consider these results as a blessing.

Keywords: human capital; natural resource dependence; natural resource abundance; 'curse' hypothesis; Latin America and the Caribbean

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1. Introduction

Since the seminal works of Auty [1], the natural resource 'curse' hypothesis (NRCH) has generated numerous studies. Although empirical works from the outset have yielded mixed results [2,3], this line of research has flourished vigorously. The NRCH asserts that natural resource endowments can slow down economic growth. However, several studies have shown that both renewable and non-renewable natural resources serve as important drivers of growth and productivity in Latin American and Caribbean (LAC) economies [4–7].

The evolution of this topic has led to the emergence of various branches of study in different waves [8]. In this regard, the contributions of Gylfason, Herbertsson, and Zoega [9] and Gylfason [10–12] have played a significant role in opening new avenues of research exploring how the natural resource 'curse' may affect sustained economic growth. One of these avenues examines the impact of natural resources on human capital accumulation, given the interesting bidirectional nature of this relationship, since all forms of capital derive their value, utility and application from human mental awareness, creativity, and social innovation. This makes human capital, including social capital, the central determinant of resource productivity and sustainability [13].

The unsustainability of resource-rich economies emerges as a significant concern when resource management is not carried out properly. In this regard, the experience in different contexts, such as the African [14], the Latin American [15], or the Asian [16] contexts, among others, has illustrated how overexploitation and lack of planning in the management of valuable natural resources can lead to depletion of reserves and environmental degradation. These studies have also highlighted that the unsustainable exploitation of mineral and agricultural resources can cause the loss of biodiversity and foster socio-economic tensions, exacerbating existing disparities. In addition, the lack of responsible management can generate unstable economic cycles and increase the dependency of certain sectors, making economies vulnerable to fluctuations in prices and global demand.

Thus, considering the relevance of human capital for economic and environmental sustainability, as well as the effect of natural resources on the former, it is of singular importance to understand these relationships more clearly, because it is crucial to implement a responsible and sustainable management of natural resources to ensure the well-being of current and future generations, based on human capital accumulation and environment conservation.

In a recent literature review focused on this specific topic, Mousavi and Clark [17] demonstrated that the majority of studies have pointed out the adverse effects of natural resources on human capital accumulation, with only a small minority finding positive or mixed effects. Surprisingly, only one study examined this topic in the LAC region, conducted by Blanco and Grier [18], who analyzed a sample of seventeen LAC countries during the period 1975–2004.

Although Blanco and Grier's work has made a valuable contribution to the subject, it has certain limitations, e.g., they analyzed only the 'dependence' effect. Moreover, they only measured it as export dependence, which is a measure that has received some strong criticism from scholars such as Stijns [19,20], Brunnschweiler [21], Brunnschweiler, and Bulte [22], among others.

There are also some weaknesses in the variable used to measure human capital, as it only considers the average years of primary schooling of the population aged 15 and over. In this regard, while this level of education may have been relevant in the 1970s or the early 1980s, it has been overshadowed by the importance of secondary education in the last three decades. Consequently, a variable that solely measures primary education provides limited information about current levels of human capital. On the other hand, a virtue of this study is that it included the stock of physical capital and institutions as control variables.

Furthermore, Blanco and Grier [18] obtained mixed results. On the one hand, they state that overall resource dependence, measured as exports divided by gross domestic product (GDP), does not have a significant direct effect on human capital. However, they later state: 'We find little evidence that overall resource dependence has a direct and statistically significant effect on human and physical capital accumulation in the region. We find that the long-run effect of total primary commodity exports has a positive quantitative effect on the accumulation of both human and physical capital' (p. 282).

Additionally, they also obtained mixed results when they divided natural resources into three groups: oil, mining, and agriculture, while always measuring dependence as exports/GDP. In the case of oil exports, they found a significant negative effect on human capital. However, they estimated positive coefficients for agriculture and mining dependence, although none were statistically significant.

Thus, this paper aims to contribute to the ongoing debate by expanding the initial contribution made by Blanco and Grier [18] and investigating non-renewable natural resource effects on human capital in the LAC region. Therefore, our study aims to provide a more comprehensive, broader, and updated analysis by considering both abundance and dependence measures. We focus our analysis on non-renewable natural resources as these are the original foundations for the NRCH.

Additionally, we utilize more recent data, enabling us to update the contribution of Blanco and Grier [18]. This is critical since the non-renewable resource industry now requires more expertise in geological knowledge, and more skilled workers for managing new extraction and refining technologies than in the past [23–25].

The great economic and technological transformation that the world has undergone in the last two decades may have produced some changes that affected human capital accumulation. For that reason, it would be important to verify if Blanco and Grier's conclusions prevail. In any case, an updated study will provide more accurate results for evaluating and designing policies in this area. Furthermore, apart from its valuable contribution to the regional debate, it also offers another innovation for applying studies in this field since we used the human capital stock variable offered by the World Bank [26], which is a monetary measure based on the lifetime income approach. This measure has some advantages that will be discussed in the next section. Notably, based on the extensive review conducted by Mousavi and Clark [17], this is the first study to incorporate a monetary measure of human capital stock in this specific branch of research.

Another relevant contribution is the use of a co-integration technique for our panel data regressions. This is important because most of the studies in this field employ cross-country or panel regressions using averaged data [17,27], which are subject to omitted variable bias. This procedure of averaging data also softens the business cycle effects, causing the loss of valuable information. Even more important is that many studies are probably obtaining spurious results by using ordinary least-square regressions since most of the data are not stationary, and averaging periods does not solve the unit root problem in the data [28].

Specifically, we have chosen the Pooled Mean Group estimator proposed by Pesaran, Shin, and Smith [29], which allows for estimating both long-run and short-run coefficients. As a result, we have discovered that the 'curse' effect does not exist in the long run and only affects a few LAC countries in the short run. In fact, to the best of our knowledge, Kim and Lim [28] are the only ones in this specific field that use co-integration techniques.

The paper is organized as follows: Section 2 develops the theoretical framework, identifying the main variables of the model. In Section 3, we introduce the model, defining the variables and the data used. Section 4 presents the methodology and discusses the results gathered. Finally, in Section 5, we provide concluding remarks.

2. Theoretical Framework

A solid theoretical approach and an appropriate econometric specification of the model are crucial for obtaining accurate results. Both the inclusion of irrelevant variables and the exclusion of relevant ones in the model may bias the estimates of resource effects [17]. In practice, achieving an adequate balance between an over- or sub-specified model is not easy. Indeed, it can be challenging to follow the principle of parsimony without omitting relevant variables. Nonetheless, in this section, we will develop a theoretical framework that we believe achieves the balance required. Firstly, we will discuss the two most important variables, namely the human capital stock and the dependence and abundance indicators. Later, we will present the foundation of the three control variables: level of development, institutional quality, and outward policy orientation.

2.1. Human Capital Measures

Human capital is a broad concept that involves different aspects, not only education. It also includes health conditions, experience, and talent, among others. All these attributes determine labor productivity and consequent earnings.

There are three broad approaches to measuring human capital: the indicator approach, the cost approach, and the income approach [30]. However, nearly all studies in this field employ a traditional indicator-based approach to measure human capital stock (refer to the extensive review conducted by Mousavi and Clark [17]). These traditional variables can be divided into two main categories: input and output. In the former category, the most common variables include public education expenditures in relative terms, e.g., relative to GDP [10,25,31,32] or relative to the aggregate expenditure [20,25,33], as well as other similar measures. Other authors, such as Mousavi and Clark [17], consider three categories: input, output and participation. However, the last two categories are closely related, and the main difference is that 'participation' includes output variables expressed in relative terms.

In the output category, the most commonly used variables are the average year of education [11,18,27,34], expected years of schooling [10,20], or school enrolment rates at the primary, secondary, or tertiary level [3,10,11,20,25,33], among other variables that represent a particular result type.

The indicator-based approach is not without criticism. This is not only due to errors in the measurement of schooling data [35–38], but also because traditional indicators suffer from omitted variables bias, which is caused by differences in the content and quality of education, and because of the effect of human capital depreciation, which reduces workers' qualifications and earnings [37,39,40]—a critical factor in today's globalized world with accelerated technological change.

Furthermore, they are not appropriate for cross-country and temporal comparisons, or for comparisons with other stock measures such as physical capital stock [41]. In summary, these indicators are not an accurate measure of human capital stock [42,43].

Some of these drawbacks are avoided by implementing a monetary valuation of human capital stock, as it encompasses other attributes that contribute to the accumulation of human capital. As Abraham and Mallatt [30] (p. 108) pointed out: 'Monetary measures are more appropriate for any analysis that considers human capital investment in the context of investment and capital accumulation more broadly'.

Furthermore, the lifetime income approach, employed by the World Bank [26] for measuring human capital stock, offers several advantages. This approach takes into account sundry factors of human capital stock besides formal education, e.g., the importance of demography, including births, deaths, age structure, as well as immigration and outmigration. In addition, it considers labor market conditions, such as the depreciation and revaluation of human capital [26,30,41,44].

2.2. Abundance and Dependence Variables

The relationship between human capital and natural resources also depends on how the effect is defined and how resources are measured [20]. For instance, Gylfason [12] found a positive relationship between resource abundance and school life expectancy, while the relationship with the dependence measure was negative.

Conceptually, the common approach considers two effects: abundance and dependence. Nevertheless, the difference between resource abundance and dependence can be ambiguous in empirical works. For instance, the seminal works of Sachs and Warner [2,45] discuss abundance and measure it as the share of natural resources in a nation's exports relative to GDP—a variable that nowadays might be considered a variable of dependence by many other authors. Furthermore, Gylfason [10] proposes the capital's share of total wealth as an indicator of abundance, while Gylfason [11] use the same variable as an indicator of dependence [17].

Gylfason [12] (pp. 16–17) defines abundance as 'the amount of natural capital a country has at its disposal' and dependence as 'the extent to which the nation in question depends on these natural resources for its livelihood'. Hence, abundance can be seen as a measure of wealth and dependence as an indicator of a resource-based economy, i.e., the extent to which a country relies on its natural resources for growth [17]. Moreover, a country can be rich in natural resources, but this abundance does not necessarily imply that its economy is dependent on them [12]. Other categories also exist, for example, Brunnschweiler and Bulte [22] consider measures of 'abundance', 'dependence', and 'rent'.

However, empirically, the difference can be also murky. For example, we can identify variables of abundance as those which include measures of the natural capital stock relative to another stock variable. In this sense, natural capital stock relative to population can be considered as a variable of abundance. Nevertheless, with other measures, the difference is not so clear, e.g., if it is measured relative to total wealth or physical capital stock, is it a measure of abundance or dependence? On the other hand, dependence can be identified as a flow variable, e.g., rent/GDP or natural resources exports/GDP are normally considered measures of dependence, but is rent/population a variable of dependence or abundance?

Several variables have been employed to measure abundance and dependence (see Mousavi and Clark, [17]. In this paper, similar to Gylfason [11], Brunnschweiler [21], Philippot [25] and Cocks and Francken [31], we consider natural resource per capita and rent per capita as variables measuring abundance. All other relative measures, such as natural resources wealth divided by either total wealth or by physical capital stock, and rent divided by GDP, are considered variables measuring dependence.

However, it is worthwhile to say that some variables, such as natural resources wealth divided by physical capital stock, are considered by other authors as abundance variables, e.g., Philippot [25]. This is part of the ongoing debate. However, two variables are essentially undisputed: natural resource per capita, which measures abundance and rent/GDP and is an indicator of dependence.

Finally, it is important to point out that there are other commonly used variables, particularly those based on export intensity measures. However, similar to other authors, we do not consider these appropriate proxies of natural resource abundance or dependence [19–22,46]. Therefore, similar to Kurtz and Brooks [46], to avoid the potential bias produced by the inclusion of export proxies for measuring abundance or dependence effects, we will not consider them in our analyses. Indeed, we agree with Brunnschweiler and Bulte [22] and Cocks and Francken [31] in that stock variables are preferable for measuring abundance, and that variables based on resource rent are better measures of dependence [25,47,48].

2.3. Some Common Control Variables

Based on the review conducted by Mousavi and Clark [17] it is evident that the literature devoted to this field has used a wide range of control variables. However, due to the monetary nature of the human capital indicator, the present study focuses on three primary categories of interest: (a) variables measuring the level of economic development, (b) variables capturing the impact of the institutional framework, and (c) variables identifying the economic policy orientation. Thus, for this study, we will carefully consider these three aspects to select one control variable from each category.

2.3.1. Level of Development

The level of economic development is widely recognized as one of the most popular control variables in research, owing to the strong correlation identified between human capital proxies and the level of development. Consequently, several works include GDP per capita as a measure of development [25,27,31,33,49–53]. As an example of the inconvenience of using this kind of variable, see the controversial results obtained by Amir-ud-Din, Usman, Abbas, et al. [53] when using real GDP as a control variable.

However, an influential strand of literature, exemplified by Lucas [54] and Mankiw, Romer, and Weil [55], among others, considers human capital as a factor in the production function. According to this perspective, there exists a clear causal relationship between human capital and economic growth, with a clear causal direction from human capital to economic growth, but not the other way around. Consequently, regressing human capital on GDP per capita may introduce a significant bias in the coefficients, especially in time series or panel data regressions.

From another theoretical perspective, the accumulation of human capital can be viewed as a sequential process, akin to the models of Graca, Jafarey, and Philippopoulos [56] and Oded and Moav [57]. In this framework, the initial stage of economic development is characterized by the dominance of physical capital accumulation, while human capital is stagnant. Once the physical capital accumulation increases, the relative price of it declines, the financial constraints diminish, and the human capital accumulation increases. The underlying rationale is that by augmenting the ratio of physical capital per worker, workers' productivity rises, and as productivity determines real wages, the return on investing in education increases. In other words, capital deepening occurs.

Other effects can also be considered. For instance, Caballé and Santos [58] developed a model that demonstrates two possible patterns that human capital accumulation could follow. The first pattern occurs when an increase in physical capital raises labor productivity and wages. Consequently, the opportunity cost of education is higher than before, which hampers human capital accumulation as people become more motivated to work. This contradicts the findings of Oded and Moav [57]. The opposite effect occurs when this increase in physical capital reduces the rate of growth in consumption and investment, which in turn encourages human capital accumulation.

However, the special case of Caballé and Santos' model is especially interesting to us, specifically when considering physical capital as an input to the production of human capital, as we will do in our empirical model. In this case, the effect is always positive, arriving at the same conclusion as Graca, Jafarey, and Philippopoulos [56] and Oded and Moav [57].

For all these reasons, we believe that the stock of physical capital is a superior measure compared to income or GDP since it is both a good proxy of the level of development and a key driver of labor productivity. Moreover, the spillover effects between human and physical capital accumulation are crucial and have been confirmed in Latin America by Grier [59], and more recently by Blanco and Grier [18], who also verified a positive effect from physical capital stock to human capital.

Furthermore, Amir-ud-Din, Usman, Abbas, et al. [53] studied a wide sample of countries over a long period, confirming that physical capital has a positive and statistically significant effect on human capital accumulation for low- and upper-middle-income countries. However, the inverse positive relationship varies depending on the choice of the human capital proxy used. Therefore, the causal effect of physical capital on human capital is quite clear, whereas the reverse relationship is not as evident.

2.3.2. Institutional Framework

Many authors consider the institutional framework as another crucial factor influencing human capital [18,21,22,27,31,50,51]. Both the institutional framework and economic policies provide incentives for economic agents to promote efficient resource utilization, which contributes to the generation of new knowledge and capital accumulation. This can be accomplished through the implementation of stable macroeconomic policies, the promotion of economic competition, the facilitation of regulatory policies, and the enhancement of property rights and democratic standards [37]. In summary, improvements in the quality of institutions foster the accumulation of human capital.

While there is some controversy regarding the causal direction from institutions to human capital accumulation, there is relevant evidence supporting it [60–62]. For example, Dias and Tebaldi [63] developed a theoretical model that demonstrates how institutions shape the path of human capital accumulation, leading to productivity gains and increased returns on investment in education.

The impact of the institutional framework is particularly significant in the LAC region. As Duryea and Pages [64] (p. 28 assert), '. . .while education can increase the labor earnings of a person relative to the earning of someone who does not have education, educated workers will not be able to productively use their skills if the economic and institutional environment in which they live and work is not sufficiently fertile'. To put it another way, low institutional quality can be critical in determining earnings since it affects the marginal value of human capital [42].

In addition, Bravo-Ortega and De Gregorio [65] and Ebeke, Omgba, and Laajaj [66] have noted the misallocation effect that low-quality institutions produce. Consequently, countries with poor institutions offer incentives towards rent-seeking activities, which produce a misallocation of talent where a relevant number of students choose professions that ensure rent, which in turn dampens the entrepreneurial spirit.

To put it differently, the institutional framework influences individuals' personal choices in various ways. For example, 'good' institutions can enhance entrepreneurship by attracting highly skilled workers to become entrepreneurs, which in turn promotes the creation of new firms that foster economic development, whereas 'bad' institutions produce the opposite effect [67].

2.3.3. Outward Policy Orientation

The study of the relationships between economic openness and human capital is another thriving area of research. One mechanism through which trade liberalization can have a positive impact on human capital is the wage-price process. According to this approach, a more open economy relaxes constraints on investment in human capital, leading to an increase in the skill premium, which triggers a process of human capital accumulation and potentially enhances intergenerational mobility [68–70]. In general, Le Clech and Guevara-Perez [7] and Le Clech [71] have found that pro-market policies and strong institutions boost the productivity of the LAC region.

As Bonfatti and Ghatak [70] (p. 44) explain: 'Our results provide a possible explanation for the fact that trade liberalization in unskilled labor-abundant Latin America led to an increase in the skill premium in both Latin America and its skill-abundant trade partners. One implication of this is that the increase in the skill premium in Latin America does not necessarily need to result in a massive increase in income inequality, as it may be (at least partly) due to a better allocation of talent and more intergenerational mobility'.

Not only do exports promote the accumulation of human capital, but imports and foreign direct investment (FDI) also play a significant role. Regarding imports, we may consider the learning-by-importing hypothesis, which suggests that firms can benefit from global specialization by using forefront technology inputs [46,72]. Moreover, the technology embodied in capital goods promotes a catching-up process that also raises productivity [73,74]. International technology diffusion serves as the primary driver for increasing the demand for skilled workers and raising wages due to gains in productivity, which in turn reduces credit constraints. Once again, the wage-price mechanism comes into play.

The transfer of technology and knowledge associated with FDI and the global relationships that this promotes extend beyond the technology embodied in capital goods or raw materials. The transmission channels also encompass other intangible assets such as patent rights, new production processes, and management skills, among other things. Consequently, the demand for new skilled workers increases [75,76]. Furthermore, the capacity of these workers can also be enriched by new training for local employees [77]. The presence of foreign firms and the immigration of skilled workers to the host economy positively impact the accumulation of human capital in the recipient economy [78,79].

3. The Model and the Data

Based on the theoretical framework discussed above, we can write a general model as follows:

$$\mathrm{HPC} = \mathrm{f}(\mathrm{NNR}; \mathrm{KPC}; \mathrm{INST}; \mathrm{OPEN}) \tag{1}$$

where HPC is human capital stock per capita, NNR is a non-renewable natural resource, KPC is produced (or physical) capital stock per capita, INST measures the quality of institutions, and OPEN measures economic openness.

Our dependent variable, HPC, is from the World Bank [26]. It accounts for the present value of future earnings for the working population over their lifetimes by measuring the knowledge, skills, and experience embodied in the workforce. The values are measured at market exchange rates in constant 2018 USD, using a country-specific GDP deflator.

Our main explanatory variable is NNR. It will be measured by six distinct indicators. This will allow us to estimate six models. Models 1–4 include non-renewable natural capital stock that embodies fossil fuel energy (oil, gas, hard and soft coal) and minerals (bauxite, copper, gold, iron ore, lead, nickel, phosphate, silver, tin, and zinc). Thus, Model 1 includes NNR per capita, identified as NNRPC, which measures the abundance effect.

Models 2–4 assess the dependence effect through three indicators. Model 2 includes the ratio of NNR and capital produced (K), represented as NNRK. Model 3 is NNR/(N + K), where N is total natural resources wealth; the variable is denoted NNRNK. Model 4 is NNR/W, where W is the total wealth; thus, the variable is identified as NNRW. All these indicators are measured at market exchange rates in constant 2018 USD, using a country-specific GDP deflator. The source is the World Bank [26]. In addition, it is important to mention that produced capital is the denomination used by the World Bank [26], which is similar to physical capital stock. In this paper, we will use both synonymously.

Model 5 includes total resource rents as a percentage of GDP, which are the sum of oil, gas, coal (hard and soft), mineral, and forest rents. This captures the dependence effect and is identified as RENTGDP. This variable is based on the information provided by the World Development Indicators of the World Bank.

Finally, Model 6 measures the abundance effect through total rent per capita, represented by RENTPC. We calculate this indicator by multiplying RENTGDP/100 by the total annual GDP to obtain the value of rent (RENT). Subsequently, we divide RENT by the population to obtain RENTPC. GDP is measured in constant 2018 USD. Both GDP and population figures are from the Economic Commission for Latin America and the Caribbean (ECLAC). It is important to mention that in the case of Venezuela, it does not report data for the variable rent as a percentage of GDP for the period 2015–2018. Thus, this was completed by applying the rate of growth of the NNRPC to the series. In addition, since few data have a zero value, we summed up 1×10^{-6} in all cases before applying logarithms.

The variable KPC includes the value of machinery, buildings, equipment, and residential and non-residential urban land. It is measured at market exchange rates in constant 2018 USD using a country-specific GDP deflator, and the source is the World Bank [26].

Regarding INST, it measures the quality of institutions and is assessed using the average of four indexes obtained from the Global State of Democracy dataset of the International Institute for Democracy and Electoral Assistance (International IDEA). This database offers information that depicts several aspects of the democratic trends within each country. We consider four main areas: (1) Representative Government (variable C_A1), (2) Fundamental Rights (variable C_A2), (3) Checks on Government (variable C_A3), and (4) Impartial Administration (variable C_A4). Therefore, INST is the simple average of these four variables. The index is scaled from 0 to 1. The higher its value, the higher the quality of democracy. All the data are available at http://www.idea.int/data-tools/tools/global-state-democracy-indices. It is also recommended to check the technical book available on the same website.

Finally, we measure the variable OPEN using the Economic Globalization Index from the KOF Globalization Index [80]. This index includes two categories: trade and financial openness. These indexes are constructed by averaging two subcomponents of each index: '*de facto*' and '*de jure*'. For instance, the Trade GI *de facto* includes categories such as trade in goods and services and a measure of trade diversity. In addition, the Trade GI *de jure* includes regulations, taxes, and tariffs on trade as well as trade agreements. On the other hand, the Financial GI *de facto* includes variables such as portfolio and foreign direct investments, international debts, reserves, and income payments. Finally, the Financial GI *de jure* considers investment restrictions, capital account openness, and international investment agreements.

All variables are in logarithms and therefore the estimated parameters represent elasticities, i.e., each parameter measures the percentage effect on the dependent variable by increasing (or decreasing) the independent variable by one percent. The advantage of measuring elasticities is that the units of measurement of each independent variable do not matter. This allows for direct comparison between the estimated parameters.

Based on the available data, we included eighteen countries, which are: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Guatemala, Honduras, Jamaica, Mexico, Nicaragua, Panama, Peru, Trinidad and Tobago, Uruguay, and Venezuela. Lastly, the analysis period spans from 1995 to 2018.

4. Methodology and Results

Considering the structure of our panel, the first step is to evaluate certain properties of the variables by checking CSD and whether the variables are stationary or not. Hence, we will check cross-sectional dependence (CSD) for each variable to decide whether to employ a first- or second-generation panel unit root test. We consider the CD test proposed by Pesaran [81], as it is robust even in the presence of structural breaks and I (1) variables. It also performs well in panels with short time and cross-sectional dimensions [82]. It tests the null hypothesis of cross-sectional independence (or weak CSD).

The results reported in Table 1 indicate the presence of CSD in all series except 'INST'. Therefore, by taking into account the CSD issue, we implement the second-generation panel unit root test developed by Pesaran [83], which accounts for CSD and allows for heterogeneity in the autoregressive coefficient of the regression as well as among the units. We will report the truncated CIPS statistics as was recommended by Pesaran [83] for a dataset size similar to ours. The selection of lag length was conducted automatically by the Akaike criteria.

Table 1. Pesaran [81] CSD test and Pesaran [83] unit root tests.

	Pesaran's CDS Test	**Pesaran's Unit Root Test**			
		Level		**First Difference**	
Variables	**CD-Stats.**	**C Truncated CIPS**	**C and T Truncated CIPS**	**C Truncated CIPS**	**C and T Truncated CIPS**
HPC	34.661 ***	−1.345	−2.584	−3.454 ***	−3.242 ***
NNRPC	33.983 ***	−2.137	−1.517	−2.342 **	−2.900 **
NNRK	29.522 ***	−1.961	−1.251	−2.107	−2.963 ***
NNRNK	30.239 ***	−1.633	−1.319	−2.199 *	−2.967 ***
NNRW	27.555 ***	−1.847	−1.424	−2.220 *	−2.697 *
RENTGDP	20.977 ***	−1.892	−2.342	−4.104 ***	−3.614 ***
RENTPC	27.650 ***	−1.939	−2.034	−3.807 ***	−3.558 ***
KPC	54.294 ***	−2.010	−2.120	−2.430 ***	−1.872
INST	1.140	−1.383	−2.454	−3.553 ***	−3.249 ***
OPEN	8.226 ***	−2.166	−2.699	−3.768 ***	−4.352 ***
Im et al. (2003). [84] Panel unit root test					
		C	C and T	C	C and T
INST	W-Stat.	0.306	0.871	−12.129 ***	−11.381 ***

Note: C = Constant. T = Trend. Critical values: ***, **, and * denote statistical significance at 1%, 5% and 10%, respectively.

We additionally report the first-generation tests of Im, Pesaran, and Shin [84] for the variable 'INST'. Both tests—those of Pesaran [83] and Im, Pesaran, and Shin [84]—assume the null hypothesis that the series contains a unit root. Based on the results reported in Table 1, we have strong evidence that the variables are I (1).

On the other hand, when including institutions, policy, and human capital in a regression, the potential endogeneity problem arises [62,85]. For that reason, in a model with this structure of data, it is critical to check co-integration. As Pedroni [86] (p. 257) has asserted: '. . .the presence of cointegration brings with it a form of robustness to many of the classic empirical problems that lead to the so-called violation of exogeneity condition for the regressors. Obvious examples include omitted variables, measurement error, simultaneity, reverse causality, or anything that leads the data generating process...' Furthermore, it proves the existence of a long-run relationship between the variables in the model, i.e., co-integration implies that the I (1) series are in long-run equilibrium.

Thereby, for estimating the long-run parameters of the model, we propose implementing the Pooled Mean Group (PMG) estimator of Pesaran, Shin, and Smith [29], which is an autoregressive distributed lag model (ARDL). This method is efficient and consistent because it verifies co-integration. This also avoids endogenous and correlation issues. In addition, it performs well when working with relatively limited sample data. The PMG estimator estimates the long-run parameters by maximum likelihood, assuming homogeneous coefficients (pooled). The short-run coefficients are estimated by OLS, assuming heterogeneous coefficients (mean group), i.e., for the short-run parameters, it allows the variability of the intercepts, the coefficients, and the co-integrating terms across the cross-sections.

Additionally, we check for the absence of CSD in the PMG estimates. To accomplish this, we employ the CD test proposed by Pesaran [81] and the bias-corrected scaled LM test introduced by Baltagi, Feng, and Kao [87]. Furthermore, we assess the homogeneity of slopes using a novel test proposed by Bersvendsen and Ditzen [88], which builds upon the work of Peasaran and Yamagata [89]. It tests the null hypothesis that parameters are homogeneous across cross-sectional units versus the alternative, which states that parameters are heterogeneous. The test includes the possibility of estimating HAC robust standard errors following the contributions made by Blomquist and Westerlund [90]. The Quadratic-Sphere kernel was chosen, and the bandwidth was set by following the rule of thumb 4(T/100) (2/9), which is, for our dataset, approximately equal to three, and the HAC option was implemented.

Table 2′s results show that there is no CSD. Both the CSD test and bias-corrected scaled LM test confirm this. In addition, the homogeneity test confirms the validity of the assumption of slope homogeneity for all models, i.e., we fail to reject the null hypothesis at a high significance level in all cases.

Table 2. Pesaran [81] CSD test, Baltagi et al. [87] bias-corrected scaled LM test, and Bersvendsen and Ditzen [88] slope homogeneity test. Dependent variable HPC.

	Model 1		**Model 2**		**Model 3**	
CSD test	CD-Stats. −1.681	*p*-value 0.093	CD-Stats. −1.682	*p*-value 0.093	CD-Stats. −1.707	*p*-value 0.088
Bias-corrected scaled LM test	LM-Stats. 1.034	*p*-value 0.301	LM-Stats. 1.028	*p*-value 0.304	LM-Stats. 0.971	*p*-value 0.331
Homogeneity test	Delta Adj. 0.411	*p*-value 0.681	Delta Adj. 0.415	*p*-value 0.678	Delta Adj. 0.41	*p*-value 0.862
	Model 4		**Model 5**		**Model 6**	
CSD test	CD-Stats. −0.900	*p*-value 0.368	CD-Stats. −1.110	*p*-value 0.267	CD-Stats. −1.156	*p*-value 0.248
Bias-corrected scaled LM test	LM-Stats. 1.363	*p*-value 0.173	LM-Stats. −0.632	*p*-value 0.527	LM-Stats. −0.608	*p*-value 0.543
Homogeneity test	Delta Adj. 0.133	*p*-value 0.894	Delta Adj. 0.002	*p*-value 0.998	Delta Adj. 0.155	*p*-value 0.877

4.1. Panel Data Co-Integration Results and Discussion

After reporting the absence of CSD and the slope homogeneity, we show in Tables 3 and 4 the results of the PMG estimates for the six models. For the model specification, we chose the ARDL lag order automatically using the Schwarz Bayesian criterion (SBC). We allowed a maximum lag of three for the dependent variable and covariates, which is the maximum lag possible given the length of our dataset. The SBC indicated an ARDL (p = 1, q's = 1) structure for all models.

Furthermore, before delving into the analysis of the covariates, it is relevant to highlight that the error correction terms (ECTs) exhibit negative and statistically significant values across all six models. These results confirm the existence of long-term relationships. In addition, these findings indicate that the speed of convergence to equilibrium is almost 1/5 for all models, representing a relatively low speed of adjustment.

Regarding the long-run estimates, we can confirm that all the parameters are significant at standard levels. The results do not account for any 'curse' effects, and the coefficients for both abundance (Models 1 and 5) and dependence (Models 2–4 and 6) for all the variables are positive, with values ranging from 0.056 to 0.08. Similar to Blanco and Grier [18], when using total commodity exports for measuring the dependence effect, we found a positive long-run dependence effect on human capital. These results closely align with those obtained by Kim and Lin [27], who also used panel data co-integration techniques and estimated a dependence elasticity to education between 0.0115 and 0.0380, which corresponds to the dependence effect measured by the relation of primary exports to GDP.

Table 3. Pesaran et al. [29] ARDL-PMG. Dependent variable HPC. Models 1–3.

	Model 1		**Model 2**		**Model 3**	
Variable	**Coef.**	***p*-Value**	**Coef.**	***p*-Value**	**Coef.**	***p*-Value**
Long-Run Equation						
NNRPC	0.078	0.000	-	-	-	-
NNRK	-	-	0.078	0.000	-	-
NNRNK	-	-	-	-	0.080	0.000
KPC	0.899	0.000	0.978	0.000	0.925	0.000
INST	1.138	0.000	1.137	0.000	1.179	0.000
OPEN	0.123	0.016	0.123	0.016	0.133	0.012
Short-Run Equation						
ECT	−0.197	0.000	−0.197	0.000	−0.199	0.000
D(NNRPC)	−0.018	0.558	-	-	-	-
D(NNRK)	-	-	−0.018	0.558	-	-
D(NNRNK)	-	-	-	-	−0.034	0.158
D(KPC)	1.582	0.000	1.564	0.000	1.585	0.000
D(INST)	0.492	0.102	0.492	0.102	0.490	0.103
D(OPEN)	−0.006	0.935	−0.006	0.933	−0.005	0.940
C	0.253	0.001	0.253	0.001	0.363	0.000

Table 4. Pesaran et al. [29] ARDL-PMG. Dependent variable HPC. Models 4–6.

	Model 4		**Model 5**		**Model 6**	
Variable	**Coef.**	***p*-Value**	**Coef.**	***p*-Value**	**Coef.**	***p*-Value**
Long-Run Equation						
NNRW	0.056	0.001	-	-	-	-
RENTGDP	-	-	0.066	0.004	-	-
RENTPC	-	-	-	-	0.070	0.001
KPC	0.927	0.000	0.899	0.000	0.837	0.000
INST	0.592	0.000	0.574	0.000	0.559	0.000
OPEN	0.180	0.002	0.167	0.022	0.152	0.035
Short-Run Equation						
ECT	−0.218	0.000	−0.188	0.000	−0.190	0.000
D(NNRW)	−0.165	0.035	-	-	-	-
D(RENTGDP)	-	-	−0.023	0.099	-	-
D(RENTPC)	-	-	-	-	−0.020	0.142
D(KPC)	1.417	0.000	1.645	0.000	1.637	0.000
D(INST)	0.414	0.141	0.614	0.099	0.611	0.102
D(OPEN)	−0.010	0.885	0.004	0.946	0.007	0.902
C	0.257	0.000	0.291	0.000	0.401	0.000

These findings enable us to draw the same conclusions as Stijns [20,34] and Kim and Lin [27], which suggest that natural resources enhance the accumulation of human capital. In fact, using a similar measure to Gylfason [10], namely NNRW, we discovered a positive impact that contradicts the findings of the aforementioned authors. However, similar to Stinjs [20], we do not consider this to be an appropriate measure for testing the 'curse' hypothesis, particularly when assessing the effect on human capital.

In summary, while the 'curse' effect is not verified, the low elasticity observed in the NNR variables does not provide sufficient evidence to support a blessing either. For instance, the maximum elasticity estimated for non-renewable natural resources was 0.08, whereas the maximum for produced (physical) capital was 0.978, from which it follows that non-renewable resources account for an impact that is ten times lower than that exhibited by physical capital. In other words, by increasing the physical capital by 1%, human capital will increase by almost another 1%. While increasing the NNR stock by 1%, human capital will increase by only 0.08%.

On the other hand, it is also interesting to observe the consistency shown by the control variables. For example, the elasticities estimated for KPC fell within the range of 0.837 and 0.978. These results resemble those of Amir-ud-Din, Usman, Abbas, et al. [53], who estimated the effect of physical capital on different proxies for human capital. They reported a coefficient of 0.85 when human capital was measured at the primary level of education; the coefficient was 2.29 when measured at the secondary level and 3.21 when measured at the tertiary level. They also estimated a coefficient of 1.076 when human capital was measured by the human capital index of the Penn World Table. This last result closely aligns with ours, both in terms of the coefficient estimated for physical capital and the dependent variable used.

Furthermore, our findings are also consistent with those of Blanco and Grier [18], who also identified the significant and positive impact of physical capital on human capital, with values ranging from 0.256 to 0.354. Finally, this conclusion receives support from certain theoretical models, such as those proposed by Caballé and Santos [58], Graca, Jafarey, and Philippopoulos [56], and Oded and Moav [57].

When it comes to the elasticities of INST, the range is a little bit wider—from 0.559 to 1.179. This is likely because the difference measures of NNR and the institutional variable may interact in some way. However, our results are similar to those of Cockx and Francken [31], who found a positive impact of institutional variables such as 'Accountability' or 'Electoral Competition' on human capital accumulation.

In general, our findings are also supported by the theoretical model of Dias and Tebaldi [63], which asserts that institutions play a crucial role in driving human capital accumulation. According to this model, institutions promote technology adoption and economic growth, which raises productivity and increases the returns on human capital accumulation. This induces a mechanism whereby uneducated workers are motivated to invest in education, resulting in a positive feedback loop within the system.

A similar consistency in the outcomes was achieved by the variable OPEN, which displayed a minimum value of 0.123 and a maximum of 0.180. These results are similar to some of those gathered by Philippot [25], especially for the estimates that consider tertiary school enrolment as a proxy for human capital. Consequently, it can be inferred that a more open economy creates incentives that foster the accumulation of human capital, thereby transforming the 'curse' into a blessing [46].

Although we have verified a significant and positive long-run impact of NNR on human capital, there are some disparities concerning the short-run effect. In Models 1–3, we did not obtain any significant parameters, despite the fact they were negative. On the other hand, in Model 4, we found a significant and negative effect. However, this result should be taken with caution, because the variable NNRW has received some criticism as it includes human capital in the denominator and it could bias the results [20].

In Models 5 and 6, which include rent measures, we only found significant results at a level of 10% for Model 5. Therefore, we can easily conclude, as did Erdoğan, Yildirim, and Gedikli [52], that the average short-run effect of NNR on human capital does not exist or, at least, is negligible.

In the short run, the most relevant variable is KPC. It ranges between 1.417 and 1.585, which means that investment in new capital is the major driver of human capital. However, INST and OPEN do not obtain any significant results. This can be explained by two main reasons. Firstly, it can be attributed to statistical reasons as these variables display minimal intertemporal variation. Secondly, it can be due to the dynamic effect of these variables, since changes in political and economic institutions are typically intended to bring about structural transformations, with expected outcomes in the long term.

4.2. Short and Long-Run Differences

One of the advantages of the PMG estimator proposed by Pesaran, Shin, and Smith [29] is that it allows for observing the individual short-run effects, i.e., the short-run effect of natural resources on human capital for each country. Therefore, in Table 5, we present the value of each coefficient for Models 1 and 5. We chose these two models because they include the 'purest' variables of abundance (NNRPC) and dependence (RENTGDP), respectively. Nonetheless, it is worth noting that the results obtained with the other models are nearly identical.

Table 5. Cross-section short-run coefficients. Models 1 and 5.

Countries	NNRPC	RENTGDP	Countries	NNRPC	RENTGDP
Argentina	−0.2111 ***	−0.0991 ***	Honduras	0.0050 ***	0.0393 ***
Bolivia	−0.1766 ***	−0.0259 ***	Jamaica	−0.0702 ***	−0.0468 ***
Brazil	0.0365 ***	0.0058 ***	Mexico	−0.2090 ***	−0.1038 ***
Chile	−0.1018 ***	−0.0187 ***	Nicaragua	−0.0227 ***	−0.0316 ***
Colombia	−0.0527 ***	−0.0449 ***	Panama	0.0343 ***	0.0001
Costa Rica	0.0004 *	0.0904 ***	Peru	0.1485 ***	−0.0804 ***
Dominican Rep.	0.0087 ***	−0.0034 ***	Trinidad and Tobago	0.0060	−0.1093 ***
Ecuador	−0.0549 **	0.0752 ***	Uruguay	−0.0363 ***	0.0089 **
Guatemala	0.0462 ***	0.0175 ***	Venezuela	0.3331	−0.0873 ***

***, ** and * denote statistical significance at 1%, 5%, and 10%, respectively.

The results reported in Table 5 reveal some disparities in the short-run impact of non-renewable resources on human capital. Firstly, the abundance effect, measured by the variable NNRPC, obtained a significant and negative parameter for nine countries: Argentina, Bolivia, Chile, Colombia, Ecuador, Jamaica, Mexico, Nicaragua, and Uruguay. Secondly, the dependence effect, captured by the variable RENTGDP, obtained a significant and negative parameter for eleven countries: Argentina, Bolivia, Chile, Colombia, Dominican Republic, Jamaica, Mexico, Nicaragua, Peru, Trinidad and Tobago, and Venezuela.

This means that there exists a 'curse' effect in the short run for these economies, which could be attributed to the economic cycles of resource-based economies. Thus, the variability of international prices produces income uncertainty, which has a negative impact on human capital investment. However, this effect can be controlled by contracyclical policies and economic diversification [91]. In other words, the short-run effect can be altered through appropriate measures.

Once these differences were detected, and we conducted deeper analyses, we could explore whether the long-run parameters varied for these two samples. We believed it would be riveting to compare the results obtained from Models 1 and 5 with their counterparts (that we define as Models 1a and 5a), which include the nine countries that showed a short-run abundance 'curse' effect and the eleven countries that showed a short-run dependence 'curse' effect, respectively. This comparison serves as a valuable robustness check for the long-run parameters. Moreover, in Appendix A, we present some additional results wherein we ran twenty-two additional regressions testing different specifications and variables of our general model. The results reported confirm the consistency and robustness of our analyses.

The results reported in Table 6 show several important findings. Firstly, it is worth noting that the two new models had a significant and negative ECT along with a higher speed of adjustment, thus confirming co-integration. Secondly, we can confirm almost the same long-run parameters for different samples, whereby slope homogeneity is guaranteed, and this brings robustness and consistency to our results. Thirdly, and very important for our analysis, all the coefficients show the same long-term picture: the positive impact of NNR and positive impacts of the three control variables. Both physical capital and institutions constitute the major drivers of human capital for the LAC region in the long term.

Table 6. Pesaran et al. [29] ARDL-PMG. Dependent variable HPC. Models 1 (N = 18), 1a (N = 9), 5 (N = 18), and 5a (N = 11).

	Model 1		Model 1a		Model 5		Model 5a	
Variable	**Coef.**	***p*-Value**	**Coef.**	***p*-Value**	**Coef.**	***p*-Value**	**Coef.**	***p*-Value**
				Long-Run Equation				
NNRPC	0.078	0.000	0.083	0.000	-	-	-	-
RENTGDP	-	-	-	-	0.066	0.004	0.068	0.005
KPC	0.899	0.000	0.985	0.000	0.899	0.000	0.938	0.000
INST	1.138	0.000	0.908	0.004	0.574	0.000	0.527	0.000
OPEN	0.123	0.016	0.098	0.064	0.167	0.022	0.195	0.022
				Short-Run Equation				
ECT	−0.197	0.000	−0.278	0.004	−0.188	0.000	−0.219	0.006
D(NNRPC)	−0.018	0.558	−0.101	0.000	-	-	-	-
D(RENTGDP)			-	-	−0.023	0.099	−0.060	0.000
D(KPC)	1.582	0.000	2.119	0.002	1.645	0.000	1.608	0.010
D(INST)	0.492	0.102	0.693	0.170	0.614	0.099	0.479	0.152
D(OPEN)	−0.006	0.935	0.036	0.776	0.004	0.946	−0.046	0.514
C	0.253	0.001	0.048	0.402	0.291	0.000	0.148	0.008

After examining these findings, it can be concluded that although the short-run effect of NNR can be negative, the long-run effect is consistently positive. This lends support to the notion that the resource 'curse' can be transformed into a blessing. Several studies align with this perspective, whereby countries can invert the 'curse' effect by improving their political and economic institutions [92–96] and promoting economic openness [97].

5. Conclusions

This study investigated the effect of non-renewable natural resources on the accumulation of human capital in eighteen Latin American and Caribbean countries during 1995–2018. We examined both abundance and dependence effects through six different variables. Our main dependent variable was the stock of human capital per capita, measured by a monetary proxy, which represents a notable improvement over the proxies used in previous studies. In addition, we have tested other specifications of the model, wherein we consider another dependent variable (namely human capital) as an absolute value and obtain the same results (findings in Appendix A).

In addition, based on the theoretical framework discussed in Section 2, we have incorporated three additional determinants of human capital, namely: (a) the level of economic development, measured by the physical capital stock, (b) the institutional quality, measured by the average of four components of the Global State of Democracy dataset including representative government, fundamental rights, checks on government, and impartial administration, and (c) the outward policy orientation, measured by the Economic Globalization index of KOF.

We have implemented panel data co-integration techniques (PMG-ADRL), which allowed us to estimate long-run and short-run coefficients. In this regard, we are convinced that it is the appropriate technique given the structure of our sample and the characteristics of our variables. Indeed, the results gathered remained unchanged even with changes in the model specification and in the sample included in the analysis (see Appendix A for further results). Consequently, we can confirm the consistency and robustness of our analyses.

Our main conclusion differs from those of several other works as we claim that non-renewable natural resources have a positive impact on human capital accumulation in the long term. However, despite rejecting the existence of a 'curse' effect, our estimates demonstrate a relatively low impact. Therefore, it is inappropriate to label it a blessing.

Another significant finding is that we were able to confirm that the long-run positive impact was always verified, even for samples of countries that showed negative short-run effects. The observation of a short-run 'curse' effect for some economies while the long-run effect was positive has huge implications as it is clear evidence that, with appropriate reforms, such as reforms that promote institutional, macroeconomic, and fiscal improvements, the negative effect can be reversed. It is probable that this negative short-run effect could be explained by the impact of commodity price shocks (which constitute another interesting topic for our future research agenda) and other effects from macroeconomics policies.

We could also confirm that physical capital and the institutional framework are the main determinants of human capital in our model. Similar to other studies reviewed, physical capital is a key driver of human capital in the LAC region. This has important consequences for policymakers since our estimates showed that by increasing the physical capital stock by 1%, the human capital would increase by approximately another 1%. Therefore, the policies that stimulate investment in physical capital would enhance human capital accumulation as well.

On the other hand, it is clear that institutional quality matters. In general, good institutions such as accountability, state transparency and efficiency, property and fundamental human rights protection, and democracy development create incentives for the accumulation of human capital in the LAC region.

Our research also indicates that economic opening promotes human capital accumulation. Thus, making trade and financial openness markets more efficient could be a channel for enhancing human capital accumulation. Despite this evidence, we acknowledge that this is a promising line of research that requires more attention because of international technology diffusion and the possibility that trade-openness pledges could be baulked by differences in the capacity for absorbing these new technologies due to institutional or human capital shortcomings. In addition, it would be interesting to analyze the different effects of policies affecting international trade and others affecting international capital flows.

On the other hand, a limitation to the scope of the present study results from the fact that human capital is also affected by variables that are difficult or even impossible to quantify, such as tradition or cultural patterns that may determine social behavior, the propensity to undertake education, etc., which suggests that the results should be treated with the same caution as those of any other study that addresses the same topic.

In general, we can conclude that policy and institutional reforms should be aimed at reducing market interference, ensuring property rights, and improving democracy, which, in turn, will promote human capital accumulation in the region. Furthermore, these reforms also strengthen the accumulation of physical capital, which also boosts human capital. Even more important is the fact that these reforms would have the capacity to transform the short-run 'curse' into a blessing.

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Appendix A

In order to check the robustness of our estimates, we present in this appendix several other possible models. In all of them, we include the same variable—OPEN. We did not test other variables related to opening since it was not the main purpose of this study to verify this particular variable, and it would generate numerous other possible combinations. Such exploration extends beyond the normal scope of this article. However, we recognize that this represents another riveting line of research that we will consider for future research.

In our analysis, we consider various measures of institutional quality using the four areas included in the variable INST. These areas are as follows: (1) Representative Government (variable C_A1), (2) Fundamental Rights (variable C_A2), (3) Checks on Government (variable C_A3), and (4) Impartial Administration (variable C_A4). All these areas are defined in Section 3.

In addition, we examine two variables of human capital: human capital per capita (HPC) and the absolute value of human capital (H). We follow the same approach for the variable of produced capital, resulting in two variables—KPC and K. Finally, we consider three measures of non-renewable natural resources: NNRPC, RENTGDP, and NNR. However, we obtained similar results with other measures as well. Consequently, we present a total of twenty-four different combinations, which are summarized in Table A1.

Table A1. Models to test robustness. Abundance and dependence.

Abundance. Dep. Variable NNRPC					Dependence. Dep. Variable RENTGDP				
Model	**Dep. Var**	**Resource**	**Capital**	**Institution**	**Model**	**Dep. Var.**	**Resource**	**Capital**	**Institution**
1	HPC	NNRPC	KPC	CA	5	HPC	RENTGDP	KPC	CA
A1	HPC	NNRPC	KPC	CA_1	D1	HPC	RENTGDP	KPC	CA_1
A2	HPC	NNRPC	KPC	CA_2	D2	HPC	RENTGDP	KPC	CA_2
A3	HPC	NNRPC	KPC	CA_3	D3	HPC	RENTGDP	KPC	CA_3
A4	HPC	NNRPC	KPC	CA_4	D4	HPC	RENTGDP	KPC	CA_4
A5	HPC	NNRPC	K	CA	D5	HPC	RENTGDP	K	CA
A6	H	NNR	K	CA	D6	H	RENTGDP	K	CA
A7	H	NNR	K	CA_1	D7	H	RENTGDP	K	CA_1
A8	H	NNR	K	CA_2	D8	H	RENTGDP	K	CA_2
A9	H	NNR	K	CA_3	D9	H	RENTGDP	K	CA_3
A10	H	NNR	K	CA_4	D10	H	RENTGDP	K	CA_4
A11	H	NNRPC	K	CA	D11	HPC	RENTGDP	KPC	

Finally, in Tables A2 and A3, we present all the results of the twenty-four regressions.

Table A2. Pesaran et al. (1999) [29] ARDL-PMG. Dependent variable HPC. Abundance effect.

	Model 1		**Model A1**		**Model A2**		**Model A3**		**Model A4**		**Model A5**	
Variable	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value
Long-Run Equation												
Resource	0.078	0.000	0.057	0.000	0.062	0.000	0.062	0.000	0.063	0.000	0.087	0.000
Capital	0.899	0.000	0.908	0.000	0.674	0.000	0.998	0.000	0.863	0.000	0.949	0.000
Institutions	1.138	0.000	0.467	0.000	1.043	0.000	0.287	0.001	0.875	0.000	1.213	0.000
Openness	0.123	0.016	0.178	0.005	0.033	0.485	0.163	0.004	0.193	0.001	0.119	0.016
Short-Run Equation												
ECT	−0.197	0.000	−0.213	0.000	−0.227	0.000	−0.206	0.000	−0.216	0.000	−0.195	0.001
D(Resource)	−0.018	0.558	−0.013	0.649	−0.027	0.217	0.007	0.864	−0.013	0.627	−0.014	0.635
D(Capital)	1.582	0.000	1.573	0.000	1.563	0.000	1.644	0.000	1.583	0.000	1.431	0.000
D(Institutions)	0.492	0.102	0.125	0.533	−0.027	0.935	0.384	0.033	−0.089	0.514	0.517	0.086
D(Openness)	−0.006	0.935	0.017	0.819	0.018	0.830	−0.026	0.717	−0.006	0.938	−0.016	0.818
C	0.253	0.001	0.126	0.000	0.903	0.000	−0.046	0.136	0.319	0.000	0.316	0.002
	Model A6		**Model A7**		**Model A8**		**Model A9**		**Model A10**		**Model A11**	
Variable	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value
Long-Run Equation												
Resource	0.085	0.000	0.056	0.000	0.065	0.000	0.062	0.000	0.069	0.000	0.087	0.000
Capital	0.913	0.000	0.948	0.000	0.778	0.000	0.989	0.000	0.883	0.000	0.949	0.000
Institutions	1.220	0.000	0.415	0.000	0.900	0.000	0.286	0.000	0.848	0.000	1.213	0.000
Openness	0.119	0.019	0.186	0.005	0.051	0.305	0.170	0.004	0.211	0.000	0.119	0.016
Short-Run Equation												
ECT	−0.195	0.001	−0.211	0.000	−0.219	0.000	−0.203	0.000	−0.213	0.000	−0.195	0.001
D(Resource)	−0.014	0.635	−0.007	0.803	−0.024	0.234	0.012	0.769	−0.010	0.710	−0.014	0.635
D(Capital)	1.431	0.000	1.377	0.001	1.321	0.002	1.529	0.000	1.446	0.001	1.431	0.000
D(Institutions)	0.517	0.086	0.152	0.433	0.037	0.913	0.405	0.028	−0.081	0.542	0.517	0.086
D(Openness)	−0.016	0.818	0.004	0.958	0.009	0.914	−0.038	0.584	−0.017	0.820	−0.016	0.818
C	0.316	0.002	0.020	0.444	1.179	0.000	−0.209	0.002	0.406	0.000	0.316	0.002

Table A3. Pesaran et al. (1999) [29] ARDL-PMG. Dependent variable HPC. Dependence effect.

	Model 1		**Model D1**		**Model D2**		**Model D3**		**Model D4**		**Model D5**	
Variable	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value
Long-Run Equation												
Resource	0.066	0.004	0.081	0.000	0.070	0.000	0.101	0.000	0.085	0.000	0.085	0.000
Capital	0.899	0.000	0.885	0.000	0.820	0.000	0.934	0.000	0.866	0.000	0.943	0.000
Institutions	0.574	0.000	0.533	0.000	0.842	0.000	0.333	0.000	0.852	0.000	0.525	0.000
Openness	0.167	0.022	0.190	0.016	0.038	0.439	0.214	0.016	0.163	0.028	0.206	0.011
Short-Run Equation												
ECT	−0.188	0.000	−0.178	0.000	−0.194	0.000	−0.165	0.000	−0.184	0.000	−0.178	0.000
D(Resource)	−0.023	0.099	−0.029	0.073	−0.027	0.060	−0.023	0.098	−0.033	0.029	−0.026	0.069
D(Capital)	1.645	0.000	1.486	0.000	1.688	0.000	1.667	0.000	1.605	0.000	1.373	0.002
D(Institutions)	0.614	0.099	0.173	0.453	0.109	0.626	0.344	0.075	0.010	0.959	0.613	0.089
D(Openness)	0.004	0.946	0.006	0.914	−0.002	0.968	−0.015	0.789	−0.011	0.835	−0.008	0.883
C	0.291	0.000	0.264	0.000	0.593	0.000	0.165	0.000	0.420	0.000	0.342	0.000
	Model D6		**Model D7**		**Model D8**		**Model D9**		**Model D10**		**Model D11**	
Variable	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value
Long-Run Equation												
Resource	0.085	0.000	0.084	0.000	0.088	0.000	0.105	0.000	0.091	0.000	0.046	0.003
Capital	0.943	0.000	0.920	0.000	0.917	0.000	0.958	0.000	0.916	0.000	1.341	0.000
Institutions	0.525	0.000	0.521	0.000	0.707	0.000	0.325	0.000	0.816	0.000		
Openness	0.206	0.011	0.212	0.009	0.124	0.064	0.241	0.010	0.195	0.008		
Short-Run Equation												
ECT	−0.178	0.000	−0.178	0.000	−0.183	0.000	−0.161	0.000	−0.182	0.000	−0.213	0.003
D(Resource)	−0.026	0.069	−0.030	0.070	−0.031	0.045	−0.025	0.072	−0.033	0.029	−0.031	0.049
D(Capital)	1.373	0.002	1.256	0.005	1.345	0.006	1.442	0.001	1.468	0.001	1.599	0.000
D(Institutions)	0.613	0.089	0.182	0.425	0.162	0.468	0.344	0.077	0.018	0.922		
D(Openness)	−0.008	0.883	−0.002	0.966	−0.018	0.718	−0.025	0.659	−0.021	0.700		
C	0.342	0.000	0.423	0.000	0.570	0.000	0.218	0.000	0.552	0.000	−0.509	0.002

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