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Landlocked Countries, Natural Resources and Growth: The Double Economic Curse Hypothesis

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ABSTRACT

In this paper, we discuss the hypothesis of a double effect of economic slowdown on economic growth, resulting by the income of natural resources and being a landlocked country. We considered the problem of heterogeneity as conditioned functions to quantile moments in response of economic growth. To do this, groups of 97 countries are considered for the period 1970-2014. The results suggest that the "double economic curse" presents an annual impact of -3% in quantiles of medium-low growth countries. Subsequently, additive effects between human capital and trade openness are evaluated to mitigate the lag impacts on growth: Decreasing approximately between 20% and 40% of the negative effect for low growth countries and contracting around 10% and 50% for countries with medium growth rates.

Keywords: Landlocked Countries, Economic Growth, Natural Resources, Human Capital, Trade Openness, Quantile Regressions
JEL Classifications: O43, O47, O57, P48, C21

1. INTRODUCTION

This document aims to answer two research questions: What are the individual and combined effect of being a landlocked country and dependent of natural resources on economic growth? How can growth-retarding effects be mitigated or decreased?

The term of economic curse is considered for its academic and exemplary use of the English Language, whose term was coined by Auty (1993) to characterize and provide the analogy between rich economies in natural resources and its low economic performance (e.g., Bolivia, Nigeria et al.) (Venables, 2016. p. 161).

In this sense, the first hypothetical curse would come from the natural resources dimension (The resource curse hypothesis): On a greater dependence on the export or income from the extractive activities, the countries would show less growth (Sachs and Warners, 1995). The second economic curse would be presented by the conditioning of being landlocked or mediterranean countries (the curse of being landlocked) as a generally expected negative effect (Moore, 2017; Carmignani, 2015; Paudel, 2014).

To answer the second question, an hypothesis of additive effects is used between the human capital and the level of trade openness, in order to mitigate the retarding effects on growth (Romer, 1986; 1990; Levine and Renelt, 1992).

Unlike previous studies, it starts from the premise that there are differentiated effects between the strata of countries, according to their levels of economic growth (low, medium, high); therefore, such differentiation would make it possible to discern and distinguish the responses among the effects and their respective quantifications as additive contribution to the existing literature.

Consequently, an assumption of heterogeneity by growth ranges is assumed, based on cross-sectional data from 97 countries, and its main emphasis on the variation of per capita income for the period 1970-2014 as a process of individual characterization with ordered and filtered samples to the conditioned quantiles on the response variable to its explanatory factors (Koenker and Hallock, 2001; Buchinsky, 1998). To this end, the document comprises four sections: The first one addresses the relationship between natural resources and landlocked country as the double-curse hypothesis on the economic growth; the second one indicates the data and methodology used; the third section contemplates the results of the estimates; and the last one deals with the discussion of the findings. At the end, the main inferences and conclusions of the documents are emitted.

1.1. Natural Resources and Landlocked Countries: Double-curse Hypothesis on the Economic Growth

Economic growth is likely to constitute one of the most discussed aspects among economists, academics and politicians. It is interpreted as a searching area in its determinants factors, with more than 60 explanatory variables, linked in some cases with the perspective of "nothing is robust," "they are fragile relationships" or even in times of the Big Data. Hence, it arises the need for new consistent methods to test relationships in different ways (Varian, 2014; Rodrik, 2005; Rodriguez and Rodrik, 2001; Sala-i-Martín, 1997; Levine and Renelt, 1992; Barro, 1991).

In this sense, the determinants have been addressed through cross-sectional regressions on the economic growth of countries, such as technological change, investment level, education or human capital, government spending, trade openness, initial income level, the role of financial development, among other variables; in addition, the role of natural resources has been considered with a probable negative and significant relationship on the economic growth (Mankiw et al., 1992; Sachs and Warner, 1995).

On the other hand, it is assumed that institutional quality factors as elements that positively affect the economic growth; this, under the idea that the quality and productivity of the resources will be influenced by the institutional and political environment (Gwartney et al., 2004); consequently, it is expected that the effect of institutional quality is not the same in all countries because there are factors that model the positive effect, such as the individual perception of the institution and social norms in certain groups. Many times, countries with similar characteristics demonstrate very divergent results (Nawaz et al., 2014).

For this document, the first considered hypothesis related to the economic curse coming from natural resources, in terms of Sachs and Warner (1995) is: The greater dependence on natural resources, in terms of GDP, the lower economic growth. It is evident that the higher income of natural resources (as GDP percentage), there is more institutional deterioration in terms of corruption and reduction of democracy, among other related variables (Banegas; 2015; Busse and Gröning, 2013; Mo, 2001; Papyrakis and Gerlagh, 2004): Therefore, the role of the institutions is argued as a determining factor in the curse of natural resources (Mehlum et al., 2006; Salti, 2007).

Further discussions point out that the role of natural resources may not necessarily cause negative effects on growth, but also mixed impacts can be seen: Positive in the initial stage and negative in the final (Lagerlöf and Tangerås, 2008).

The second hypothesis of economic curse is presented in a context of landlocked countries without access to the sea, which tend to show less economic growth compared to those countries that have sovereign exit to the sea and its negative incidences on international trade and the quality of their institutions (Moore, 2017; Paudel, 2014; Dollar and Kraay, 2003).

In contrast, from the decade of the 80s, geographic effects were considered within the incidents variables for economic growth (Srinivasan, 1986), establishing agendas to minimize the effects of being landlocked or being a small economy. From the decade of the 90s, the topic of landlocked was addressed from a quantitative perspective, in which the incorporation of a dichotomous or dummy variable was used in representation to the effect of landlocked within the econometric estimations (1 = landlocked country; 0 = in another case).

In this sense, the estimates of Gallup et al. (1999) show that a landlocked country may have a disadvantage due to three reasons: (1) Migration between workforce frontiers is more difficult than internal migration; (2) the infrastructure development on the frontiers between countries is more difficult to schedule with similar investments; (3) the coastal economies can have military or economic incentives to impose on the Mediterranean countries.

Consequently, when measuring the landlocked condition, a negative and statistically significant relationship has been shown on the economic growth, about 1.5% slower (MacKellar et al., 2000); although, it is true that landlocked countries are among the poorest countries, this does not necessarily imply a slow growth (Barro, 1991).

The condition of being a landlocked country has also been approached under the segmentation of the development level of the landlocked country: Developed and developing economies from the perspective of studying the isolated effects in these two types of countries (Paudel, 2014). Currently, 15 landlocked countries are in Africa, 12 countries in Eastern Europe, two in Eurasia and two countries in Latin America. Switzerland and Luxembourg are two developed countries that are landlocked or landlocked because of their per capita income levels. On the other hand, it is presented the only worldwide case of double landlocked, which is Uzbekistan, a country with double that is surrounded by other countries without access to the sea.

There are many factors explaining the landlocked countries, whether the origin is related with wars or political divisions; thus, for example, since the 90s, with the breakup of the former Soviet Union and other factors in central Europe, new countries emerged and several of them were landlocked born, which led to a change in the geographical configuration of Mediterranean countries.

Consequently, the problem arises of a probable double economic curse condition, as the result of individual or combined effects between dependence on natural resources and the condition of the landlocked (Sharma and Davaakhuu, 2015; Arvis et al., 2007).

1.2. The Role of Human Capital and Trade Openness in Economic Growth

A plausible solution to reduce a possible double-cursed economic situation (income of natural resources and being a country with no exit to the sea), can be guided by the individual or combined effects between human capital and trade openness (Romer, 1986; 1990; Levine and Renelt, 1992).

In this way, the combination of physical capital, the export of natural resources and human capital determine the abundance of natural capital, as a transmission channel about growth, without necessarily becoming a curse (Sandonato and Willebard, 2018); therefore, it can be considered as an endogenous factor in the process of natural capital. (Sunde and Vischer, 2015).

Likewise, since the seminal contribution of Romer the knowledge is contemplated as a productive factor in the macro-aggregate function of the economy; therefore, the human capital has been directed in the endogenous theory of economic growth, which it has its foundation in Solow (1956) during a schooling year and returns of education (Abrigo et al., 2018). It has strong criticisms for not measuring skills and abilities of knowledge instead of quantity of study (Hanushek, 2015) or even that the human capital is evolving through overlapping generations; in the sense that parents allocate resources between consumption and a better education for their offspring, which accumulates in time (Cavalcanti and Giannitsarou, 2017).

The discussion focuses on a possible absence of causality between trade openness and human capital on a long-term economic growth (Tsaurai, 2017). It includes a sample of 108 countries; often the weak statistical relationship encountered between human capital and economic growth is due to a problem of specification or manipulation of variables, even by trying to measure isolated effects without considering an adequate transmission channel (Sunde and Vischer, 2015).

In the literature review, on the other hand, when comparing the levels of economic growth between developed countries (e.g., Finland, Sweden and Norway) and developing economies (e.g., Bolivia, Chile and Peru), variables related to the mechanism of trade openness, the diversification of their exports in natural resources, the accumulation of human knowledge, and the differences in the institutional framework (the role of state and fiscal contract) have been considered as the main factors of explanation (Ducoing et al., 2018).

To this end, the capital accumulation is a variable that has evolved over time: From the literacy level (17th and 18th centuries); technical skills, engineering and industrialization process (19th and 20th centuries), to business innovations (21st century).

The importance of the related variables to human capital (education) and trade openness, focus as incidents on economic growth, both variables have a positive and statistically significant impact (Paudel, 2014). The role of trade openness and infrastructure has been addressed as a determinant that significantly affects landlocked countries. Some ways of measuring the landlocked country impact have been made through gravitational models; thus, for example, Raballand (2003) estimates the reduction of 80% on the commerce coming from the landlocked countries. This reduction is due to factors related to high transport and infrastructure costs in neighboring countries that discourage economic development in landlocked countries. In addition to the distance and infrastructure as incidents facing the landlocked countries, political relations between landlocked countries and their neighbors produce favorable conditions or not from which commercial flows improve (Faye et al., 2004).

Overall, when addressing the determinants factors of economic growth, there is a battery of associated elements and methods of broad estimation, where two of the related factors include the rent of natural resources and the condition of being landlocked country with negative effect in an isolated and joint way, so you would expect a double economic curse. In contrast, to mitigate the expected adverse situation, it could be expected through individual additive effects between human capital and trade openness as the mitigating elements of other retarding elements on economic growth.

2. DATA AND METHODOLOGY

This section details the applied process to obtain the data and the methodology used. Data were obtained from official sources of information from the World Bank and Penn World Table 9.0, which can be seen in Annexes 1 and 2. Annual data were used for the periods from 1970 to 2014 for 97 countries in order to explain the relationship between natural resources, landlocked and economic growth.

First, preliminary relationships are presented between the per capita income and the natural resources income, considering a segmentation of the trade openness level and the condition of being a landlocked country (Figures 1 and 2). In general, preliminary evidence of an inverse partnership between natural resource income and economic growth during the period of 1970-2014 was appreciated.

On the other hand, when addressing the descriptive statistics of the variables (Annex 3), the average growth in the per capita income was 2.05% and showed a dispersion level of 76%.

In addition, when observing the associations between the variables (Annex 4) the following situations were appreciated: (1) The income of natural resources was negatively and significantly associated with the income per capita and the human capital. (2) The per capita income and the trade openness were positive and significantly related to human capital (at a significant level of 5%); similarly, for every +1% in the human capital index, +0.24% in the variation in per capita income (or vice versa) was linked. In contrast, a significant association was not evidence between

Figure 1: Dispersion and adjustment between per capita income and registered nurse income (Trade Openness)
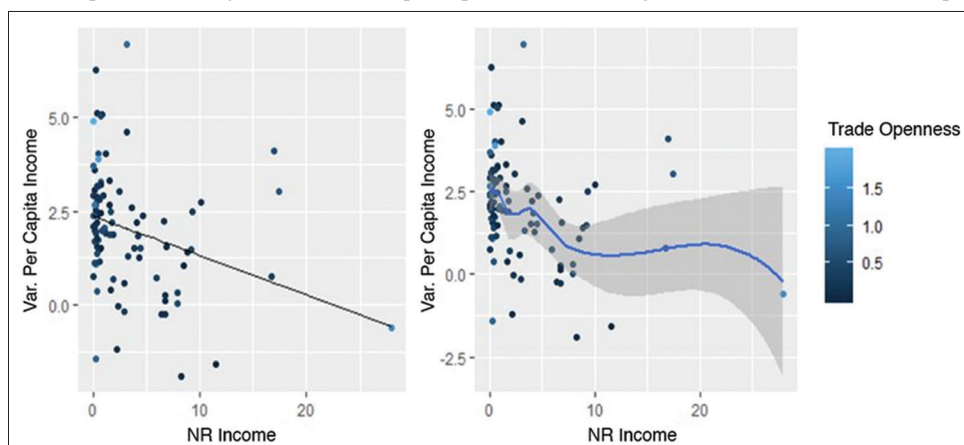
Source: Own estimations

Figure 2: Dispersion and adjustment between per capita income and non-resident income (Landlocked and not landlocked countries)
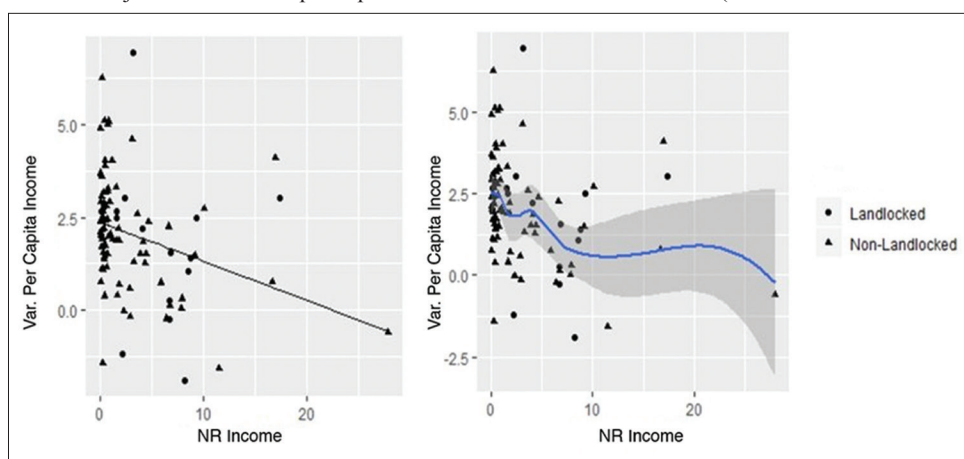
Source: Own estimations

per capita income, trade openness and physical stock of capital; however, simple correlations do not imply causality.

The considered methodology is regression by quantiles or also called quantile regression, a proposal that was initiated with Koenker and Basset (1978), where the regressions of the conditional functions of the dependent variable were estimated. The used definition for the approximation of the quantile regression method is given by the following expression (Allison, 1977; Jaccard et al., 1990):

$$\min_{b \in R} \left[\sum_{y_i \geq b} \theta \left| y_i - b \right| \sum_{y_i \leq b} (1-\theta) \left| y_i - b \right| \right] \tag{1}$$

Where: θ is the quantile (0.10 for the first decile, 0.25 for the first quartile, 0.50 for the median, etc.), y_i the different values that take the sample observations for the dependent variable and b stands for the value that minimizes the expression. They also indicate that the value b that minimizes the previous expression is the observation that leaves a proportion θ of the sample below and a proportion $(1-\theta)$ above, being θ; therefore, a value between 0 and 1 corresponding to the quantile to be estimate.

Consequently, the econometric model raised is as follows:

$$\left(\Delta Per\,Capita\,Income_i \right)_q = \alpha_q + \psi_q * Landlocked\,Country_i +$$

$$Y_q * \left(\frac{NR\,Income}{Y} \right)_i + \delta_q * \Delta \left(\frac{K}{Y} \right)_i + \tau_q$$

$$* \left(\frac{TradeOpenness}{Y} \right)_i + \eta_q * Human\,Capital_i$$

$$+ \lambda_{1q} * Landlocked\,country_i * \left(\frac{Income\,NR}{Y} \right)_i$$

$$+ \lambda_{2q} * Landlocked\,Country_i * \Delta \left(\frac{K}{Y} \right)_i +$$

$$\lambda_{3q} * Landlocked_i * Human\,Capital_i + \varepsilon_i$$

(2)

Where: $(\Delta Ing.\,per\,Capita_i)_q$ is the q-th quantile of the logarithm of the per capita income (real to the Purchasing Power Parity – [PPP]) conditional to the explanatory variables that are accompanied by ψ_q, Y_q, δ_q, τ_q, η_q, λ_{1q}, λ_{2q} y λ_{3q} (parameters), the subscript q in the parameters denoted that they vary according to the quantile and ε_i s the component of stochastic disturbance.

Therefore, in (2) the base model of estimation (model 1) was specified, where the dependent variable focused on the economic growth, measured by the variation of the real per capita income

(at constant prices of 2011, considering the PPP). In addition, the explanatory variables were: The growth of the Physical stock of capital, the human capital index and the trade openness in individual and combination mechanisms (Annex 1).

Furthermore, additional control variables were added to the effects of robustness analysis and consistency verification in the model estimations: Years of trade openness and land area as a geographic size measure (models 2 and 3, respectively).

In this sense, two hypotheses were considered from individual effects and interaction between the parameters:
- Double economic curse:

$$Landlocked\ Country + \left(\frac{NR\ Income}{Y}\right) + Landlocked\ Country$$

$$*\left(\frac{NR\ Income}{Y}\right) = \psi_q + ¥_q + \lambda_{1q} \qquad (3)$$

- Reversal or mitigation of the double economic curse:

$$\left(\frac{Commercial\ Openness}{Y}\right) + Human\ Capital + Landlocked$$

$$Country * Human\ Capital = \tau_q + \eta_q + \lambda_{3q} \qquad (4)$$

Consequently, when combining (3) and (4), the net effect of the unidirectional impacts and the interaction between landlocked country and natural resources can be obtained, contemplating possible mitigation factors based on trade openness and human capital, as additive and interaction effects between estimated parameters.

3. RESULTS

Based on Table 1, consistently implications can be inferred for estimated models 1, 2 and 3, according to the statistical significance levels at 1, 5 and 10%, respectively:
a) The condition of being a landlocked country negatively affects economic growth in countries located in quantiles medium-low (Ψq).
b) The income from natural resources has a negative impact on economic growth in countries located in all predominantly quantiles (Γq).
c) Trade openness has a positive impact on economic growth in countries located in the highest quantile (Tq).
d) The interaction between human capital and landlocked countries has a positive impact on economic growth in countries located in the lower quantile ($\lambda_1 q$).
e) The interaction between natural resource income and landlocked countries positively affects economic growth in countries located in all quantiles predominantly ($\lambda_2 q$).
f) The interaction between physical stock of capital and landlocked countries is positively link to economic growth in countries located in the lower quantile ($\lambda_3 q$).

Based on the estimated parameters and combining individual and interaction effects, the two hypotheses raised can be answered (Table 2):
- The first hypothesis indicated that the individual and interaction effects between the income of natural resources and the condition of being landlocked country exerted a negative impact on the economic growth differentiated by quantiles of economic growth (low, medium and high). To this end, empirical support is evidence in a *double economic curse*: Between −2.74 and −3.45% for the lowest quantile and between −3.24 and −3.44% for the median quantile.
- On the other hand, according to the second hypothesis of mitigation/reduction of the negative impact, the impacts are reduced to −1.11 and −0.75% for the lowest quantile and −1.68 −0.43 for the median quantile, this happens when considering the individual and combined effects through the trade openness and human capital. The impact reduction in the lowest quantile would be between 20 and 40% approximately and between 10 and 50% for the medium quantile.

For the highest quantile of growth, the hypothesis of double economic curse is not fulfill, where the role of the trade openness becomes an economic blessing (at the level of the 0.01 of statistical significance).

In Table 2, an additional factor is the neutralization of the net effect originated from the interaction between landlocked countries and income of the natural resources in the lowest quantile (−1.11 and −0.75); adding the interaction between landlocked countries and variation of the physical stock of capital of the Table 1 (λ_3q+0.59 and +0.82), at a significance level between 0.10 and 0.05 respectively, thus, the double curse would be nullified for economies with the lowest quantile level.

4. RESULTS AND DISCUSSION

The findings of the document allow to interpret and clarify when the interaction between landlocked countries and natural resources is a blessing or a curse on economic growth, including the net effect of human capital and trade openness. Consequently, the management and filtration of economic growth by levels and stratum (low, medium and high) is a plausible response of conditioned explanation to its explanatory factors.

The estimates made are compatible with the general negative effects of the being a landlocked country, with previous estimates between −15.59 and −0054, on economic growth (Paudel, 2014; Carmignani, 2015; MacKellar et al., 2002; Sachs and Warner, 1997).

On the other hand, there is contrariety on the implications of economic growth, according to its natural resource measurement form: a) Negative effect, between −6.92 and −0.03, coming from the exports proportion of natural resources in GDP (Mitton, 2016; Brunnschweiler, 2008; Leite and Weidmann, 1999; Sachs and Warner, 1997; 1995); b) positive implications, between 0.047 and 0.751 when considering the rent of natural resources as a percentage of GDP (Carmignani, 2015; Paudel, 2014).

To this, the findings allow to conclude that in countries with the highest rates of growth, the hypothesis of economic curse of natural resources or the so-called Dutch disease is not fulfilled, which is coincidental in situations of countries with the highest income (Allcott and Keniston, 2017), the effect is not significant.

In contrast, the double economic curse hypothesis is presented in the strata or quantiles of low-median growth in the situation of income of natural resources and condition of being landlocked country with greater explanatory effect on the part of the condition of Mediterranean-ness.

On the other hand, it is evident that in countries with higher levels of growth, an interpretation of economic blessing is observed, which it relates to the dynamic productivity of the sectors (Bjørnland et al., 2018), which can be interpreted as a proxy variable in the interaction between human capital, the physical stock of capital and trade openness. This would be reflected in the specialization, efficiency and improvement in productivity, especially for countries in a context of being a landlocked country.

On the human capital side, there is greater agreement on the positive (unidirectional or combined) role on economic growth. However, in the trade openness, it is possibly one of the explanatory factors with more contradictory results in the literature; not yet resolved, and in theoretical and empirical controversies, many times by the

Table 1: Quantile models

Dependent Variable: Per capita income (average variation), PCI								
Method: Quantile Regressions								
Standard error and Covariance from Huber Sandwich								
Sparsity Method: Kermel (Epanechnikov) using the residuals								
Bandwidth Method: Hall-Sheather, bw=0.21145								
Estimation identifying an optimal solution								
Explanatory elements	Quantiles	Parameter	Model 1		Model 2		Model 3	
			Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Constant	0.25	αq	0.24	0.54	−0.35	1.33	−1.4	1.66
	0.5		1.79***	0.64	1.75	1.1	−0.71	1.73
	0.75		3.59***	0.7	1.86	1.33	0.28	1.25
Landlocked countries	0.25	Ψq	−2.80*	1.41	−3.18**	1.52	−3.51**	1.64
	0.5		−3.28**	1.52	−2.68*	1.6	−3.46**	1.69
	0.75		−2.61	2.34	−3.81***	1.37	−1.39	1.75
NR income (% of GDP)	0.25	Γq	−0.10**	0.04	−0.17	0.14	−0.16**	0.07
	0.5		−0.12***	0.04	−0.14***	0.04	−0.15***	0.05
	0.75		−0.18***	0.03	−0.15***	0.03	−0.14***	0.03
Trade openness (% of GDP)	0.25	Tq	0.99	0.65	1.09	0.76	1.27**	0.54
	0.5		0.92	0.57	1.24***	0.4	1.45***	0.45
	0.75		0.99***	0.3	1.00***	0.31	1.38***	0.4
Human capital	0.25	Hq	0.48*	0.25	0.53	0.33	0.48	0.32
	0.5		−0.01	0.31	−0.03	0.3	−0.23	0.35
	0.75		−0.50*	0.3	−0.23	0.35	−0.12	0.38
Δ Physical stock of capital in terms of GDP	0.25	Δq	0.13	0.14	0.07	0.15	−0.02	0.15
	0.5		0.36	0.27	0.44	0.28	0.25	0.24
	0.75		0.22	0.33	0.43	0.42	0.61**	0.3
Landlocked country*Human capital	0.25	λ1q	1.15*	0.64	1.27*	0.7	1.43*	0.74
	0.5		1.56*	0.84	1.08	0.79	1.56*	0.88
	0.75		1.21	1.15	1.47**	0.64	0.42	0.98
Landlocked country* NR income (% of GDP)	0.25	λ2q	0.16***	0.05	0.24	0.15	0.22***	0.08
	0.5		0.16***	0.05	0.16***	0.05	0.17***	0.06
	0.75		0.16***	0.05	0.19***	0.04	0.14***	0.04
Landlocked country*Δ Physical stock of capital in terms of GDP	0.25	λ3q	0.59*	0.33	0.68**	0.31	0.82**	0.38
	0.5		0.23	0.33	0.11	0.34	0.34	0.35
	0.75		0.18	0.52	0.28	0.43	−0.05	0.35
Years of trade openness	0.25	Mq			0.01	0.01	0.01	0.01
	0.5				0	0.01	0.01	0.01
	0.75				0.01	0.01	−0.01	0.02
In (Area)	0.25	Θq					0.06	0.12
	0.5						0.17	0.11
	0.75						0.24	0.15
Number of countries			97		80		77	
Pseudo R²			0.18		0.26		0.28	
Adjusted R²			0.11		0.16		0.17	
Standard error of the regression			1.25		1.23		1.23	
Quantile dependent variable			2.01		1.95		1.95	
Mean of the dependent variable			1.95		1.93		1.92	
Standard error of the dependent variable			1.4		1.47		1.49	
Prob. No Normality (JB)			0.44		0.59		0.71	

Significance Level: *** of 1%, ** of 5%, * of 10%.

Source: Own estimations. GDP: Gross domestic product, NR: Non-resident

Table 2: Summary effects

Hypothesis	Variables	Parameters	Quantile	Models 1, 2 y 3
				Significant annual impacts[η]
Economic double curse	Landlocked country + Income NR + Landlocked country* Income NR/Y	$\psi_q+\gamma_q+\lambda_{2q}$	0.25	[−2.74 y − 3.45]
			0.50	[−3.24 y − 3.44]
			0.75	[−0.02 y 0.00]
Reversal of the double Economic curse	Trade openness + Human capital + Landlocked country* Human capital	$\tau_q+\eta_q+\lambda_{1q}$	0.25	[+1.63 y + 2.70]
			0.50	[+1.56 y + 3.01]
			0.75	[+0.99 y + 1.38]
Net effect		$\psi_q+\gamma_q+\lambda_{2q}+\tau_q+\eta_q+\lambda_{1q}$	0.25	[−1.11 y − 0.75]
			0.50	[−1.68 y − 0.43]
			0.75	[+0.97 y + 1.38]

[η]It is considered parameters that are significant to the 1, 5, 10%, respectively

		Quantile	Reduction of the negative impact (%)
		0.25	[22 y 41]
		0.50	[13 y 52]
		0.75	[>100]

GDP: Gross domestic product, NR: Non-resident

mechanism in which the variable is calculated or operationalizes (Banegas, 2015; Baldwin, 2015). This document found a positive unidirectional effect of trade openness on economic growth, in the quantile of countries with the highest growth rates.

## 4.1 Implications for Public Policies and Research Agenda

On certain occasions, the landlocked country or Mediterranean-ness is not controllable, difficult to completely reverse and with the presence of a permanent negative effect in the long term; however, based on the estimates made, there are implications for the use of natural resources (petroleum, hydrocarbons, mining and others) to promote the development of human capital, physical capital wealth, international commercial management and the generation of economic growth (Venables, 2016), especially for countries with medium-low growth strata.

In a natural way, for countries that have access to the sea and do not have natural resource income, the per capita income will increase 5 times in a period of 50 years compared to Mediterranean countries, under natural resources dependency (Figure 3). However, by including the net mitigation effect of 1% on human capital and on trade openness jointly, the gap would be reduced by 41% and the ratio would decrease by up to three times in terms of per capita income.

On the other hand, in accordance with Figure 4, assuming countries with the same initial levels of per capita income (PPP): USD 1000 in year 0 become USD 2 813 at the end of 50 years for natural resource dependent and landlocked countries; USD 4 703 for countries growing in an additional 1% of human capital and trade openness; USD 14 067 for countries that have access to the sea and are not dependent on natural resources.

Therefore, in a period of 50 years, in a cumulative form, economic growth would be improved by 68% (Figure 4), compared to doing nothing and/or the gap would be reduced by 41%, compared to those countries that have access to the sea and do not have natural resources. Consequently, a relevant task for public policy focuses on the institutional strengthening of channeling actions,

Figure 3: Reasons for per capita income between countries of different conditions (In a period of 50 years) Where: (a) Countries with access to the sea and without NR; (b) Landlocked countries and with non-resident (medium quantile); (c) Mitigated effect with an additional 1% of human capital and trade openness
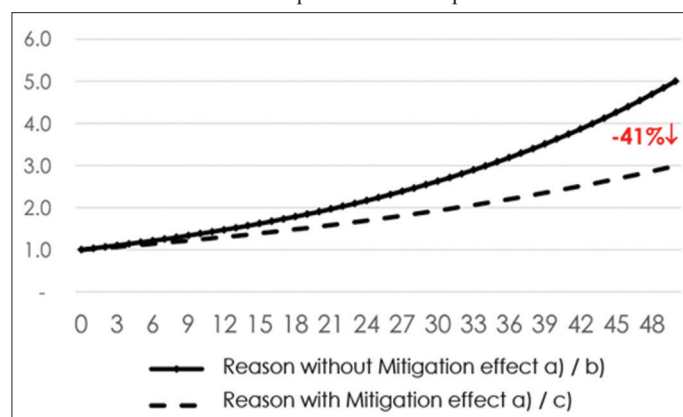
Source: Own estimations

Figure 4: Simulated scenarios of per capita income (In a period of 50 years) (Initial condition of 1000 USD at purchasing power parity) Mitigated effect with an additional 1% of human capital and trade openness
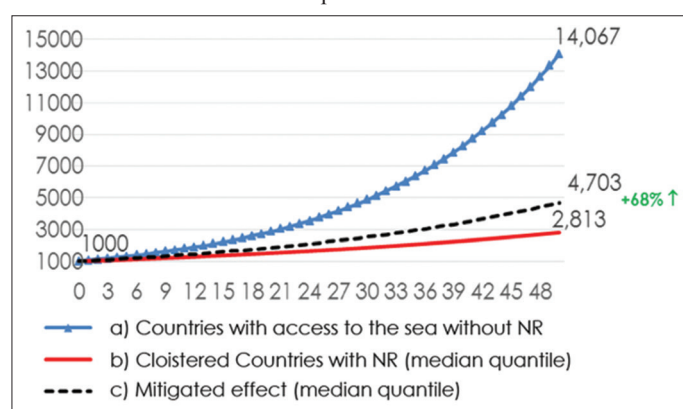
Source: Own estimations

and medium and long-term planning in order to strengthen the sustained growth of human capital and trade openness.

4.2 Limitations and Research Agenda

A limitation of the study is directed to a possible condition of endogeneity in its explanatory variables: Human capital and commercial openness, which is aimed at future research, as well as the use of instrumental variables that are explained below.

A strong criticism in the economic philosophy is the exogeneity assumption of the explanatory factors, which an alternative of endogeneity on the control variables would indicate: What promotes the human capital?, the formation sources of cognitive and non-cognitive skills based on micro-founded foundations: Academic institutions, firms and family environment factors in overlapping[18] generations, as sources of knowledge and policies to increase the skills of the non-skilled (Heckman, 2000).

In addition, when the trade openness is endogenous, previous studies reflect that commercial liberalization, or elimination of commercial restrictions, does not guarantee the promotion of trade openness (non-significant weak relationship) (Subasat, 2008). Consequently, the level of trade openness is based on the development of industrialization, investment and the financial market, the size of government, the variability of intermediate goods and capital goods (Rodrik, 1998; Grossman and Helpman, 1989).

On the other hand, a large number of studies have addressed the dynamic relationship between trade openness and growth, evaluating causal relationships of one or two directions, both short and long term (Hye and Lau, 2015; Yucel, 2009; Rodrik, 1997). It is cited as an example the Wagner´s law, where the performance of the economic growth promotes future trade openness.

Another limitation on the study was the difficulty to model the institutional component in the effects of additional interaction with the used combined effects, which is planned for future research; a lack of studies is identified in the demonstration of the interaction in three factors: Dependence on natural resources, landlocked countries and institutions. Ross (2015) mentions three impacts, not yet proven in a robust and consistent way, but stylized in academia: More durable authoritarian regime; increased in the corruption; and increased in the internal conflicts in middle and low-income countries, whose deterioration could have an impact on the explanation of the adverse effect on economic growth.

On the other hand, for future research, the challenge is to quantify the role of natural resources (unobservable variable) in different forms and their impact on economic growth (Banegas, 2015; Willebald et al., 2015): (a) Abundance of natural resources (wealth acquis); (b) the income of natural resources (unexpected income); (c) dependence (concentration of exports in raw materials), under conditions of Mediterranean-ness or landocked.

Finally, it is thought that access to the sea does not guarantee growth and development in the long term; in fact, countries with lower per capita income worldwide have free access to the sea (e.g., Madagascar, Mozambique, and Congo), which is interpreted as transgression into the inferences made.

5. CONCLUSIONS

In this document, two research questions were raised, the first one linked with the individual and combined effect between the condition of being landlocked country and natural resource income, which was estimated at −3% per annum on economic growth, and interpreted as a double economic curse for countries with per capita growth rates, exclusively in low-medium quantiles. On the other hand, for high-rate countries (highest quantile), the combined negative-effect hypothesis was not fulfilled.

On the other hand, the second question was linked to the mechanism of mitigation or reduction of the retarding effects of economic growth. In this sense, it was found that the individual effects between human capital and trade openness, under conditions of landlocked countries, would reduce between 20% and 40% the negative condition for countries with low growth, and between 10% and 50% in the impact contraction for countries with medium growth rates. For countries at the highest growth (highest quantile), the role of trade openness is interpreted as an economic blessing, given its positive net effect on economic growth.

Additionally, it was demonstrated that the interaction between landlocked countries and the growth of the physical stock of capital would allow the net effect of the double economic curse to be nullified, only for countries with growth rates in the lowest quantile.

The additive contribution to the existing literature focuses on the differentiation of the economic growth of the conditioned countries to their heterogeneous strata in the presence of landlocked countries and natural resource income.

However, for future research, new challenges arise in the understanding linked to the inclusion of institutional interaction, the endogenization of human capital and trade openness to explain the dynamics of growth (known explanations in new knowledge perspectives).

Finally, it is thought that access to the sea does not guarantee the growth and development of countries. In fact, countries with lower per capita income at the global level exercise sovereign access to the sea; however, the effect of being a landlocked country contains a negative implication that can be mitigated with sustainable actions over time, for segmented countries in medium-low type, with a range of differentiating results in the long term.

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1   [18]The family environment factors considered by Cameron and Heckman (1998) are: numbers of children, family income, education attributes (elementary, university, etc.), among others, with probability of transition. The model of overlapping generations considers the dynamics in the investment of human capital in families of two or more periods, in distinction of public education versus private education (effect of parents on children in their formation) (Glomm and Ravikumar, 1992).

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ANNEXES

Annex 1: Used variables

Name of the variable	Definition of the variables	Period	Source of information
Δ Per capita income	Per Capita Income in dollars from 2011–Purchasing Power Parity (average variance)	1970-2014	Own Calculations from the data of Penn World Table 9.0
Δ Physical stock of capital in terms of GDP	Physical stock of capital in terms of GDP (average variation)	1970-2014	Own Calculations from the data of Penn World Table 9.0
Human Capital	Human capital index, based on years of schooling and return to education	1970	Penn World Table 9.0
Exports (% of GDP)	Exports as a percentage of GDP (adjusted to purchasing power parity)	1970	Penn World Table 9.0
Imports (% of GDP)	Imports as a percentage of GDP (adjusted to purchasing power parity)	1970	Penn World Table 9.0
Trade Openness (% of GDP)	Is the sum of exports and Imports as a percentage of GDP	1970	Own Calculations from the data of Penn World Table 9.0
NR Income (% of GDP)	Natural resource income as a percentage of GDP (for the year 1970)	1970	World Bank
Landlocked Countries	It is considered a dichotomous variable, which takes the value of "1" for countries that do not have sea exit, otherwise "0"		
Years of Trade Openness	Years that the country is open to commerce according to Sachs and Warner	2014	
Area	Land area in square kilometers	2014	World Bank

GDP: Gross domestic product, NR: Non-resident

Annex 2: Countries list

Condition	Countries
Non-Landlocked	Argentina, Australia, Belgium, Benin, Bangladesh, Belize, Brazil, Brunei Darussalam, Canada, Chile, China, Côte d'Ivoire, Cameroon, D.R. of the Congo, Congo, Colombia, Costa Rica, Germany, Denmark, Dominican Republic, Algeria, Ecuador, Egypt, Spain, Finland, Fiji, France, Gabon, United Kingdom, Ghana, Gambia, Greece, Guatemala, China, Honduras, Indonesia, India, Ireland, Iran, Iraq, Israel, Italy, Jamaica, Jordan, Japan, Kenya, Cambodia, Republic of Korea, Kuwait, Liberia, Sri Lanka, Morocco, Madagascar, Mexico, Mauritania, Malaysia, Nigeria, Netherlands, Norway, Pakistan, Panama, Peru, Philippines, Portugal, Qatar, Saudi Arabia, Sudan, Senegal, Singapore, Sierra Leone, El Salvador, Sweden, Syrian Arab Republic, Togo, Thailand, Trinidad and Tobago, Tunisia, Turkey, Uruguay, United States, Venezuela
Landlocked	Austria, Burundi, Burkina Faso, Bolivia, Botswana, Central African Republic, Lesotho, Luxembourg, Mali, Malawi, Niger, Nepal, Paraguay, Rwanda, Swaziland, Uganda

Annex 3: Descriptive statistics

	Per capita income	Δ Δ Physical stock of capital in terms of GDP	Huma capital	Trade openess (% PIB)	NR rent (% of PIB)	Years of trade openness	ln (Area)
Obs.	97	97	97	97	97	78	91
Mean	2.05	0.67	1.64	0.37	3.00	82	12.05
Median	2.09	0.62	1.47	0.27	0.82	90	12.35
Max.	6.94	5.05	3.06	1.98	27.95	100	16.05
Min.	−1.89	−1.64	1.01	0.01	0.00	50	5.70
Stan. Dev.	1.57	1.01	0.57	0.35	4.62	17.89	2.11
Coef. of variation (%)	76.4	151.4	35.0	95.0	154.1	21.8	17.5
Asymmetry	0.18	0.93	0.92	2.20	2.70	−0.63	−0.64
Kurtosis	3.89	5.73	2.68	8.80	12.12	1.83	3.88
Jarque-bera	3.74*	44.05	14.00	214.45	453.48	9.57	9.19***

Significance Level:***1%; **5%; *10%. GDP: Gross domestic product, NR: Non-resident

Annex 4: Correlations

	Per capita income	Δ Physical stock of capital in terms of GDP	Human capital	Trade openness (% of GDP)	NR rent (% of GDP)
Per capita income	1				
Δ Physical stock of capital in terms of GDP	0.13	1			
Human capital	0.24**	0.04	1		
Trade openness (% of GDP)	0.14	−0.11	0.21**	1	
NR rent (% GDP)	−0.30***	0.02	−0.33***	0.11	1

Significance level: ***1%, **5%.

	Per capita income	Δ Physical stock of capital in terms of GDP	Human capital	Trade Openness (% of GDP)	NR Rent (% of GDP)	Years of trade openness	ln (Area)
Obs.	97	97	97	97	97	78	91
Mean	2.05	0.67	1.64	0.37	3.00	82	12.05
Median	2.09	0.62	1.47	0.27	0.82	90	12.35
Max.	6.94	5.05	3.06	1.98	27.95	100	16.05
Min.	−1.89	−1.64	1.01	0.01	0.00	50	5.70
Stan. Dev.	1.57	1.01	0.57	0.35	4.62	17.89	2.11
Coef. of variation (%)	76.4	151.4	35.0	95.0	154.1	21.8	17.5
Asymmetry	0.18	0.93	0.92	2.20	2.70	−0.63	−0.64
Kurtosis	3.89	5.73	2.68	8.80	12.12	1.83	3.88
Jarque-Bera	3.74*	44.05	14.00	214.45	453.48	9.57	9.19***

Significance Level: ***1%, **5%, *10%. GDP: Gross domestic product, NR: Non-resident