Social-economic Analysis of Physical Integration between Brazil and Peru: Focus for the Regions Linked to the Interoceanic Highway

Jorge Luis Sanchez Arevalo*, Edgard Monforte Merlo

Federal University of Mato Grosso do Sul and University of São Paulo, Brazil. *Email: jorgesarevalo@gmail.com

ABSTRACT

The objective of the study was to estimate the impact of the interoceanic highway construction on trade facilitation between Brazil and Peru, especially in the states linked to the highway. The methodology starts from a panel data econometric approach. The results indicate a positive impact of highway construction on trade facilitation for the linked states. On the other hand, a positive relationship was found between greater distance and trade flow, which is justified by the fact that the more developed states and, therefore, with greater trade flow are located farther than the border of both countries.

Keywords: Physical Integration, Border, Flow of Trade, Gravitational Model
JEL Classifications: F1, F15, H54

1. INTRODUCTION

The physical integration between countries aims to strengthen bilateral relations, reflecting, among other consequences, the increased flow of trade. In the study in question, the premises that involve the relationship of physical integration go through political and social aspects. The social aspects, seen from the need to provide further strengthening of communications and trade in border regions. As a result, political aspects have gained prominence as they are crucial for integration to take place by mutual agreement.

Political aspects are important, but so are social aspects, since the social context provides for planning and hence future integration. The social context (or social evidence) can be observed through the need to improve the logistics infrastructure for transportation, as well as to foster the growth of the regions located in the border zone of both countries, which is one of the reasons why boosted physical integration. Linked to the previous motive is the political issue (or political evidence), which is all bilateral efforts and strengthening made towards integration.

In South America, this theme gained notoriety in the early 1990s, with the development of the "new regionalism" theory driven by the Economic Commission for Latin America - ECLAC (ECLAC, 1994; 2009). The new regionalism, also called open regionalism, emerges as a new way of including the new economic theories about international trade and development, in the context of regional integration that took place in various regions of the world from 1960, most notably the 1980s. and principles of 90 (Lobos and Frey, 2015; Gómez-Mera and Barrett, 2012).

The South American physical integration began in 2000 with the creation of the IIRSA South American Regional Infrastructure Integration Initiative. This attendant began the subsequent construction of the Interoceanic Highway, with which bilateral relations between Brazil and Peru reached their best level of strengthening. It is important to mention that IIRSA was conceived at a time when practically all the countries of the region had been adopting neoliberal policies, which contributed positively to the negotiations.

In speaking of the border regions linked to the inter-oceanic highway, the context between both countries is similar, regarding the infrastructure. The reality of Peru is that the logistical aspect was seen (even before the highway was built) as a barrier to both internal and external trade relations. External relations, in the sense of relating Peru to Brazil, via a mode of transport that could reduce costs and at the same time foster trade in regions considered to be remote from the country - largely apart from the topographic condition.

In the Brazilian context, the theme "physical integration" is also a much-discussed aspect, especially concerning the logistic improvement (physical infrastructure) that helps to reduce the transportation costs for the commerce. Focusing on the states under study - which are close to the highway - it is clear that the discussion about infrastructure conditions is very wide, often conditioning trade exchanges. Still in Brazil, the construction of the Interoceanic Highway is seen differently from the Peruvian design and is considered as an important opportunity to exit Brazilian exports to the Pacific Ocean.

In Peru, the construction of the Interoceanic Highway is seen as a big step, as a way of strengthening bilateral relations with Brazil, especially in order to increase the flow of trade, either by increasing exports or by gaining competitiveness of products exported to Brazil.

On the theoretical side, the study is located in the context of "international trade" and "new regionalism," with emphasis on contributions to physical integration and economic cooperation between countries (Alschner, 2014; Vicente, 2011; DE LIMA, 2010; Krugman and Obstfeld, 2010; ECLAC, 2009; Huerta, 2006; Bouzas, 2005). Studies on the "new regionalism" derived from regionalism (Agur, 2008) highlight the importance of policy changes South American countries, as well as the urgency of creating regional integration links, which goes beyond mere economic discussion (Cihelkova and Frolova, 2014; Riggirozzi, 2014), with the purpose of facilitating trade exchanges.

By focusing on the South American scenario, Palestini (2017) reinforces the urgency of strengthening these regional cooperation modalities, moreover, considering the particularly difficult global economic context for Latin America. The term difficult is related to the sharp dissociation between countries located in the Pacific and the Atlantic, for which open regionalism emerges as a measure of approximation.

It is worth noting that for bilateral strengthening to be effective, programs must follow a recognized planning model - cases seen in Central America and the United States - that is, successful integration processes that allow thinking of a regionalization model aimed at of cooperation (Herrero, 2016; Riggirozzi, 2014; Rojas, 2013). Specifically, regional agreements, accompanied by improvements in infrastructure conditions, as well as the protection and / or encouragement of foreign investment strengthen bilateral and trade relations (Alschner, 2014; Okabe and Urata, 2014; Herz and Wagner, 2011).

The previous is reinforced by the study by Kohli and Basil (2011), in which these authors emphasize the need for infrastructure investment - these authors determined a desirable estimate of infrastructure investment for South American countries -, being the same understood as a condition for economic growth.

Considering the above, this study attempts to highlight and discuss the proposed objective of physical integration, that is, the social and economic effect on the linked states of both countries. Specifically, the objective was to determine whether the purposes of greater trade flow, greater frontier relationship and social development are being met and to what extent. Neighboring/ border states are expected to see trade gains after the completion of the highway, and distances in turn become a minor problem.

Most of the literature related to the study of the interoceanic highway involves empirical studies aiming to analyze the benefit of this enterprise for both countries, but without having been analyzed by each particular State, as it was done in the study in question (Barrientos, 2012). In some cases, studies focus on discussing the opportunity of leaving Brazil to the Pacific Ocean aiming at exports to the Asian market (Almeida and Seleme, 2013). Other studies, discussing the differences in competitiveness in relation to products offered between these states, and that in some cases, would hinder trade relations (Bicalho, 2013; Bonifaz et al., 2008) Figure 1.

2. STRIKING ASPECTS IN THE BILATERAL RELATIONS BETWEEN BRAZIL AND PERU REGARDING THE INTEROCEANIC HIGHWAY

In the late nineties, more specifically in 1999, in a meeting with both presidents of each government - by Brazil, Fernando Henrique Cardoso and Alberto Fujimori by Peru - signed the so-called "Lima Action Plan," in which the importance of a possible "physical integration," which would also be the subject of discussion at the "South American Meeting" of the year 2000. Other topics discussed included: The importance of conservation of the Amazonian environment, economic and commercial promotion and cultural relations (Embperu, 2015).

In 2000, the call was held in Brasilia for the first "South American Meeting," which took place on August 31st and September 1st, and IIRSA began. The discussion focused on themes such as the use of geography, natural resources and, mainly, the promotion of "physical integration," understood as a favorable factor for economic growth, especially in border regions (Embperu, 2015).

The following year, in 2001, Peruvian Foreign Minister Diego García Sayán officially visited Brazil to strengthen bilateral relations. The meeting between García Sayán and Celso Lafer (Minister of Foreign Affairs of Brazil) highlights the relevance of physical integration, discussed in IIRSA discussed the previous year. Thus, the "physical integration" became reality, since the theme was always separated in the Brazilian - Peruvian agenda (historically the relations have been cordial, but distant), mainly due to the low population and income of the border regions in relation to the ones most developed regions of both countries.

Figure 1: The route of the interoceanic highway, described according to its scope between Brazil and Peru
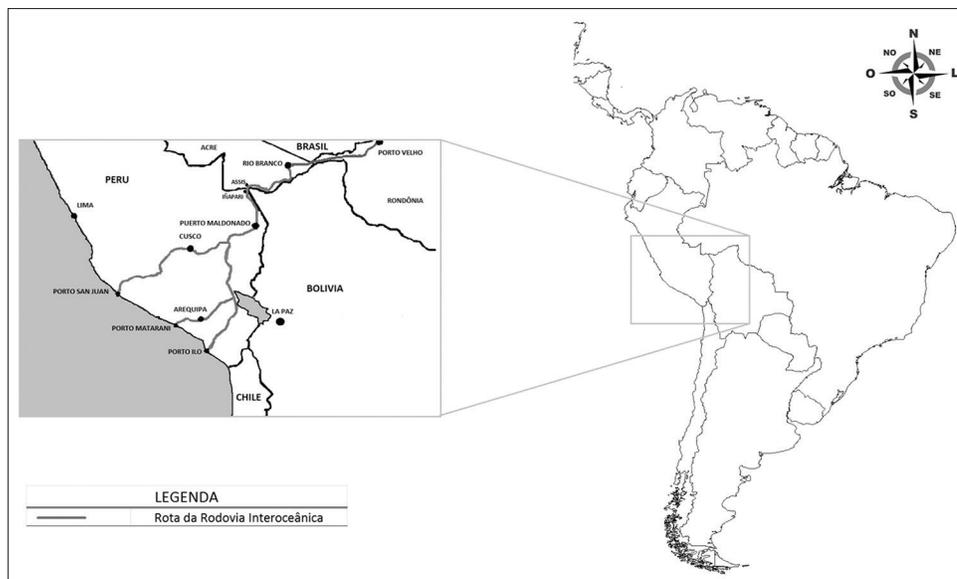
Source: Prepared with information from IIRSA (2019)

Also, in 2001, under the IIRSA initiative, the government of President Alejandro Toledo of Peru called for pre-feasibility studies, considering the possible routes for the execution of the Interoceanic. However, a conflict was generated in the southern regions of Peru, mainly in the regions of Ica and Moquegua that requested their inclusion on the highway axis, considering that these regions were initially not considered on the axis through which the highway would pass (Balvin and Patron, 2008).

In 2003, the presidents of Brazil - Luz Inácio da Silva - and Peru - Alejandro Toledo - stressed the importance of establishing a new strategic link in such a way as to form the basis for the design of a possible broad and integrated geographical space. in South America. Initially, bilateral market liberalization was seen as a problem in the Peruvian market, considering the greater competitiveness of Brazilian industry and the inflow of manufactured goods from the Manaus Free Zone. In the same year, the agreements of "physical integration" and economic, consolidated in three axes, which were denominated Amazon, Central Interoceanic and Interoceanic South, were ratified, being the last one the object of discussion.

In 2004, the third meeting of presidents of South America took place in the cities of Cusco and Ayacucho - Peru. The purpose was to discuss the consensus implementation agenda (AIC) 2005-2010, which consisted of a set of 31 priority regional physical integration projects, of which 28 were related to the transport area. Specifically, this meeting served as a support for the construction of the interoceanic highway to be positive - the harmonization of regulatory frameworks took a good course, something that was not progressing satisfactorily.

Consequently, linked to the ratification of the agreements, the construction works of the project started in 2003 in the Brazilian stretch continued and, in 2005, the Peruvian stretch began. In 2006, the Mercosur bloc incorporated Peru as a participating country, whereby some products that Peru exports to Brazil began to enter free of tariffs. Also, that same year, the presidents inaugurated the bridge that connects the two countries on the Brazil-Peru axis, known as the "integration bridge," thus joining the neighboring cities of Assis (Brazil) and Iñapari (Peru). Subsequently, given the first efforts in 2000 and 2001 - for integration to take place - in 2008 the Brazilian stretch of the Southern Interoceanic Highway was finalized and in 2010 the Peruvian stretch. In such a way that since 2011 the road has been fully utilized.

3. RELEVANCE OF ROAD MODALITIES AND SOCIAL EFFECTS IN THE BOUND STATES

3.1. Peruvian Context

The "physical integration" through the interoceanic highway between Brazil and Peru is an old desire, especially of the population near the border region. Historically, the Madre de Dios region (Peruvian-Brazilian border) has always been isolated from the rest of the country, mainly due to its poor infrastructure for land transport, which meant that consumer goods for trade were transported. especially by air mode. Previously, the cost of goods was the most expensive compared to that practiced in other regions; whereas the demand for consumer goods (food) mostly originates from the coastal regions, which in turn are the most developed in this country.

Since the use of the interoceanic highway is underway, several changes have been observed, such as the increased use of the modal road (Figure 2) - from 2011 to 2017. Namely, trade with the Brazilian states of Acre, Rondônia, Amazonas and Mato Grosso, began to gain emphasis. Previous years, from 2000 to 2008 (this period being part of the study), exports via this mode were not significant, and they eventually happened with the help of smaller barges, which in many cases increased the cost of transport.

Figure 2: Evolution of the use of road modal for exports from Peru to Brazil. Period 2011 to 2017
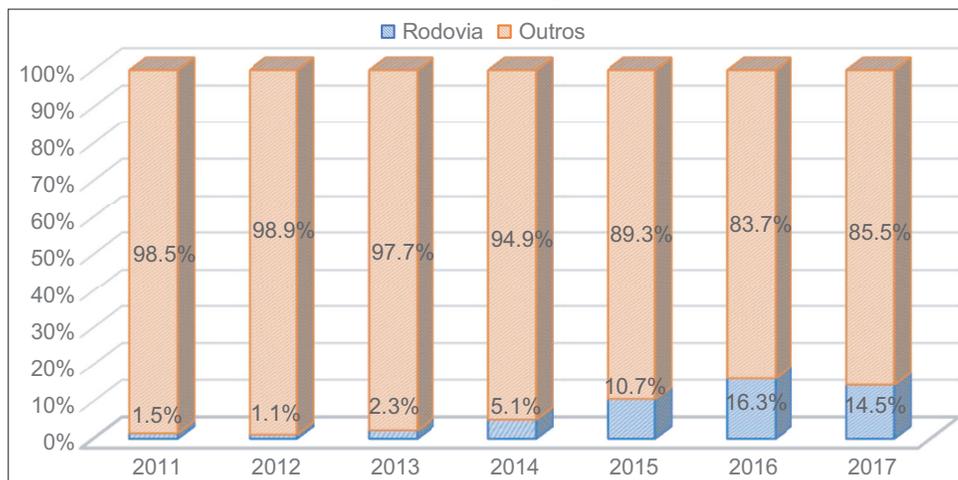
Source: Mincetur – platform Siicex Peru (2019)

In addition, the population increase was notable in the border region. For example, high income increases in the border state (Madre de Dios), as well as population increases, mainly due to migration from other states of Peru, attracted by employment opportunities (Table 1).

Table 2 shows that the number of inhabitants in Madre de Dios has increased at higher rates compared to the other states that form part of the Southern Peruvian Macrorregion. In the same state of Madre de Dios, from 2010 to 2014, the number of new companies almost doubled, from 6592 in 2010 to 11,400 in 2014.

Regarding income, Madre de Dios has a better behavior, it was found that the average income of employed persons - which was US $ 529.2 in 2010 - increased to US $ 650.9 in 2014. This income value is similar to that observed in the state of Moquegua, which in Peru is synonymous with mineral power and high-income concentration. Specifically, Peru is considered one of the largest producers of gold, silver and copper in the world; reserves that are mainly concentrated in the southern-coastal regions of the country.

Overall, there are several changes due to physical integration. In addition to income and population growth, there has also been an increase in the number of companies in these states. Namely, building and paving roads around the highway has done more than any other measure to reduce poverty in Peru in recent years.

3.2. Brazilian Context

The process of physical integration in the Brazilian scenario - especially in the border states - was seen as an opportunity to strengthen bilateral relations. At the same time, this venture has been touted as an opportunity for faster and more cost-effective shipment of exports to the Asian market, mainly China.

Consequently, the venture was expected to stimulate integration between both countries. In addition, it provided the largest flow of trade, which was hampered due to the precarious conditions of the old dirt road and also the lack of a border link (bridge), as the border is divided by the Acre river. In the three Brazilian states near the border (where the highway passes) with Peru - Acre,

Rondônia and Mato Grosso -, the expectation with the highway has always been positive, since besides providing Brazil with an exit to the Pacific Ocean, the purpose was to help to increase the flow of trade between border regions.

And it was so, that with the culmination of the works and use of the interoceanic highway, the increase of the trade flow via the highway modal was noticeable (Figure 3). In such a way that the logistical problem that seemed to limit trade and services is being eased. In addition, the promotion of the circulation and migration of people in these regions (Table 2) - until then - difficult to access, is being favored and even stimulating local tourism.

Still with respect to Table 2, in the state of Acre, between 2000 and 2010, the population growth rate was 31% higher compared to the other two states, however, there was a drop in the creation of new companies. In the state of Rondônia, there was a population growth between 2010 and 2014, with 12%, to the detriment of the other two states, and a decrease in the creation of new companies.

Already in the state of Mato Grosso, there was a smaller population growth, compared to the other two states between 2010 and 2014, and growth with regard to the creation of new companies. On the income side, there is an increase in the three states from 2010 to 2014, which is accompanied by increases in the minimum wage, even if the national currency has devalued (for comparison purposes the value in US $ of the minimum wage).

4. APPROACH, METHODOLOGICAL ANALYSIS AND DATA SOURCE

For the estimation of the equations mentioned below, the approach of several methods was used, aiming to overcome susceptible criticisms to the pooled method. By different methods, in addition to pooled, it is understood the fixed effects, random effects and PPML method. Specifically, the fixed and random methods and PPML present more accurate results, which are corroborated through the tests and coefficients presented in the results.

Table 1: States of Peru near the highway: population, average income and companies

| Estados	2010			2016		
	Var. pop.1%	Renda	Empresas	Var. pop.2%	Renda	Empresas
Apurimac	6	224,4	7.955	2	290,7	14.157
Arequipa	12	373,5	69.297	5	457,8	95.651
Ayacucho	14	228,2	12.655	5	284,2	20.848
Cusco	9	274,5	41.688	3	322,2	69.134
Ica	14	327,4	29.337	4	401,4	41.984
Madre de Dios	36	529,2	6.592	11	520,0	11.718
Moquegua	13	537,4	8.858	4	562,6	11.138
Puno	11	208,2	22.653	4	251,1	35.987
Tacna	19	398,2	20.549	5	415,6	27.132

Source: Prepared from INEI and PRODUCE (2019). Var. Pop.1: Percentage change in population from 2000 to 2010, Var. Pop.2: Percentage change in population from 2010 to 2016, Income: Average monthly income of employed persons in 2010 and 2016

Table 2: States of Brazil near the interoceanic highway. Main features

Estados	2010			2016		
	Var. Pop.1%	Renda	Empresas	Var. Pop.2%	Renda	Empresas
Acre	31	898,3	9.230	8	699,1	8.426
Rondônia	13	869,3	31.221	12	652,2	30.673
Mato grosso	21	811,4	78.284	6	685,4	86.225

Source: IBGE (2019). Var. Pop.1: Percentage change in population from 2000 to 2010, Var. Pop.2: Percentage change in population from 2010 to 2016, Income: Average monthly income of employed persons in 2010 and 2015

Figure 3: Evolution of the use of road modal for exports from Brazil to Peru. Period 2011 to 2017
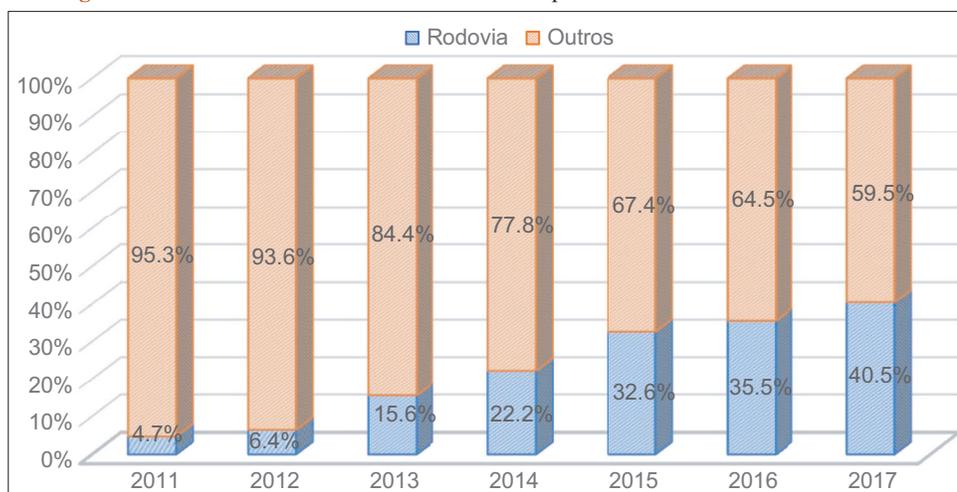
Source: MDIC (2019)

Several methods:

Brazil

$$\ln(Y_{ijt}) = \beta_0 + \beta_1 ln(\text{gdp1}_{it}) + \beta_2 ln(\text{dist1}_{ij}) + \beta_3 ln(\text{TC1}_{jt}) + \beta_4(\text{Rodov1}_{ij}) + \mu_{ijt} \quad (1)$$

Peru

$$ln(Y_{ijt}) = \beta_0 + \beta_1 ln(\text{gdp2}_{it}) + \beta_2 ln(\text{dist2}_{ij}) + \beta_3 ln(\text{TC2}_{jt}) + \beta_4(\text{Rodov2}_{ij}) + \mu_{ijt} \quad (2)$$

Where:
Y = corresponds to the trade flow between the States of Brazil and Peru. Export from State i of country j in year t = 2000 to 2018.

gdp1_{it} = corresponds to the GDP of the States of origin, exporting country, Brazil in this case;

gdp2_{it} = corresponds to the GDP of the States of origin, exporting country, Peru in this case;

dist1_{ij} = corresponds to the distances between the States of Brazil and Peru. Bilateral distances to the highest concentration of income in the country are considered. This methodology was established by CEPII, which is widely used in research of a similar nature;

dist2_{ij} = corresponds to the distances between the states of Peru and Brazil.

tc1_{it} = Brazilian real / nuevo sol exchange rate;

tc2_{it} = nuevo sol / Brazilian real exchange rate;

$Rodov1_{ij}$ = the percentage exported by road from Brazil to Peru is considered;

$Rodov2ij$ = the percentage exported by road from Peru to Brazil is considered;

μijt = é o termo do erro aleatório.

The two equations have variables in common, differing only by the numeral (1) for Brazil and the numeral (2) for Peru. It is important to mention that when estimating the models, in the case of Peru, 6 states are considered, namely: Arequipa, Ica, Moquegua, Tacna, Cusco and Madre de Dios - which have the greatest export performance to Brazil, the data collected are annual. In the case of Brazil, three states are considered for estimation: Acre, Rondônia and Matro Grosso.

The equations defined in the study are supported by discussions of the gravitational model for trade (Santos and Tenreyro, 2006; 2010 and 2011). On the basis of which, the flow of trade between economies has a direct and proportional relationship with the size of GDP and, inversely proportional to distances. In the study in question, the "distances" between capital cities of each exporting state was taken as a factor until the highest concentration of income in the exporting country, this methodology being defined by CEPII (2006).

Given the reality of both countries, it is claimed that trade in the road-bound states between the two countries is facilitated by infrastructure conditions. Thus, the question was to determine to what extent the road modal drives trade, in this way, the "modal" variable that is the result of the percentage proportion exported via road modal aims to explain this relationship.

With regard to the exchange rate, it is emphasized that the appreciation / devaluation of the exchange rate of an economy affects commercial and financial transactions carried out with the rest of the world. In the case of Brazil and Peru, the policies and economic stability of these countries can be considered one of the causes of the variability of macroeconomic variables, such as, for example, the exchange rate. In recent years the Brazilian real has lost purchasing power in relation to other currencies, such as the case of the Peruvian nuevo sol (UNCTAD, 2019). In view of this scenario, it is expected - for the Peruvian case - an inverse relationship between the exchange rate and the flow of trade, even though the Brazilian market is attractive.

Some studies related to the theme and the Latin American scenario were carried out by Rojas (2013), in which the author maintains that the problems that plague people located in border regions have been minimized due to the application and execution of cooperation agreements between the countries of America Central. Huerta (2006), when analyzing the bilateral relations between Mexico with the USA and the EU from the perspective of the new regionalism, observed that regionalism allowed barriers to trade to be eliminated in the US-Mexico exchange, this reality being contrary to the agreement with the EU.

In support of this issue of physical integration, ECLAC (2009) reinforces the importance of infrastructure in trade relations between countries in the region. And yet, it emphasizes that the infrastructure conditions for transport that condition competitiveness and future development. As a result, Lima (2010) highlights that the greater flow of trade, mainly in border regions, is directly related to the improvement of the structure. In view of this, IIRSA projects (in South America) are important contributions in facilitating trade.

4.1. Source of Data

The data used in the research were collected from the following institutions described in the Table 3 below:

5. EMPIRICAL RESULTS

Tables 4 and 5 show the results of equations 1 and 2. In these tables, attention is drawn to the magnitude of the coefficients of each of the variables of the PPML method in relation to the other estimated methods. It is observed that the elasticity of each of the variables estimated by the PPML method was below the average of the coefficients of the other estimates. In general, the PPML method has a lesser effect than that suggested by the average of the other estimated methods. In view of this, the explanation of the results is limited only to those obtained by the PPML method, since it presents more accurate results and that diverge from other methods.

Specifically, the discussion that revolves around the appropriate method, converges with the results obtained by Santos and Tenreyro (2006; 2010 and 2011). For these authors, PPML is said to be the most appropriate method for estimating the gravitational model (for sample types using values with zeros and nulls), in their analysis of international trade.

When analyzing the coefficients - primarily the GDP variable - it appears that the flow of trade is positively accompanied by increases in the income of exporting states. This result is expected whenever it can be theoretically justified, given that the increase in exports causes an increase in the income of the exporting country. In the specific case of the PPML method, for Brazil, for example, an increase of 10% in income, would cause an increase in trade of approximately 2.47%.

The positive result of the coefficient of the variable "Dist" is not expected from the theoretical point of view - by theory, it is

Table 3: Source of collected data

Institution	Initials	Description
1) Ministério de Desenvolvimento Indústria e Comércio Exterior	MDIC	Export data
2) Ministério de Comércio Exterior y Turismo	MINCETUR	Siicex system
3) Instituto Brasileiro de Geografia e Estatística	IBGE	GDP
4) Instituto Nacional de Estadística e Informática	INEI	GDP
5) Centre D´Estudes Prospectives et d´Informations Internationales	CEPII	Geographical distance
6) United Nations conference on trade and development	UNCTAD	exchange rate

understood that the greater the distances, the exchanges of trade tend to decrease. In the Brazilian case, the result can be justified given that the states of Rondônia and Mato Groso, being the most distant, export in greater volume, when compared to the state of Acre, thus discarding the possibility of influencing distances as a negative factor. In the case of Peru (Table 5), it appears that the states with the highest export performance in Peru are located in the coastal region and, therefore, farther in comparison to the other states that export to Brazil; namely, the states located in the coastal region of Peru are the most developed in that country, which justifies the positive value of this coefficient. Thus, through this result, it appears that trade facilitation has been positive for these states, thus reinforcing the expected, that is, that trade strengthens when there is proximity or when trade conditions are favored; such as: adequate infrastructure for transport, cost and time of transport, among others.

Positive results for the distance variable were also found by Zeynalov (2016) when analyzing Azerbaijan's trade with its main partners and; Bergstrand et al. (2015) when analyzing the effect of borders and distances as determinants on the flow of trade in the world and its effect on economic integration agreements.

The negative result of the coefficient of the variable "TC" indicates that given the increase in the exchange rate (real/nuevo sol), the effect is a decrease in the export offer from Brazil to Peru, considering that less money in foreign currency (nuevo sol) would be received; a fact that denotes not being attractive to Brazil. In general, this result is expected, since analyzing it in reverse, the Brazilian market is attractive to Peru.

Historically the Brazilian real has remained appreciated in relation to the nuevo sol, and this behavior has changed slightly in recent

Table 4: Result of the estimation of equation 1 by several methods

Variables	Pooled	Fixed effect	Random effect	PPML
GDP1	2.90360***	3.0638***	2.90507***	0.24703***
	(0.837998)	(0.8513)	(0.83196)	(0.08195)
Dist1	8.761407	- . -	8.77459*	0.95406*
	(5.44395)	- . -	(0.4171)	(0.54392)
TC1	−6.40256**	−5.11306**	−5.08364**	−0.51764**
	(3.14959)	(2.42349)	(0.41919)	(0.23819)
Rodov1	5.57019***	5.1770***	5.58487***	0.6003***
	(1.4420)	(1.5084)	(1.43842)	(0.15079)
Constante	−102.0365***	−41.8849***	−108.5251***	−9.53149***
	(32.5045)	(14.2674)	(31.78258)	(3.2746)
Observações	54	54	54	54
Grupos		3	3	3
R^2	0.665	0.531	0.5301	19.62
Test F	24.29***			
Teste Chow		1.72		
Test of Hausman		0.81		
Teste LM			7.29**	
Log likelihood	−133.0745			−157.81161

Source: prepared by the authors. Standard errors in parentheses. For EF and EA methods, the R-squared "within groups" is reported, for PPML, Pseudo R2. *** Significance at 1%; ** Significance at 5%; * 10% significance

Table 5: Result of the estimation of equation 2 by several methods

Variables	Pooled	Fixed effect	Random effect	PPML
GDP2	4.0123***	3.0271***	3.1183***	0.33509***
	(0.5074)	(0.5619)	(0.5463)	(0.03069)
Dist2	9.8589	- . -	6.7635	0.60121**
	(6.4851)	- . -	(30.0872)	(0.34251)
TC2	−0.7253	−1.2469	−1.1875	−0.01940
	(1.9661)	(1.4209)	(1.4109)	(0.107278)
Rodov2	1.5392	5.5885***	5.3379***	0.19145**
	(1.7286)	(1.5954)	(1.5638)	(0.09973)
Constante	−125.2412**	−29.9529***	−86.6798	−7.2818***
	(53.55)	(8.9829)	(246.5026)	(2.82309)
Observations	108	108	108	108
Groups		6	6	6
R^2	0.411	0.4042	0.4039	0.1517
Test F	17.98***			
Teste Chow		22.67***		
Test of Hausman		0.64		
Teste LM			206.24***	
Log likelihood	−326.2967			−412.75657

Source: prepared by the authors. Standard errors in parentheses. For EF and EA methods, the R-squared "within groups" is reported, for PPML, Pseudo R2. *** Significance at 1%; ** Significance at 5%; * 10% significance

years, thus, the nuevo sol has appreciated in relation to the real. In view of this, a positive behavior of the variable TC2 was expected, whenever when the Brazilian real appreciated more in relation to the new sun, Peru's export offer would tend to increase, however, the coefficient found for the variable TC2 is not expected. Furthermore, this result differs from that observed by Arevalo (2017) when studying the flow of trade between Brazil and Peru including all states that export/import between these countries. The result found by this author for the variable TC2 was positive, which supports the premise that the Brazilian market is attractive to Peru in terms of trade.

The positive result of the coefficient of the variable "Rodov" highlights the strengthening of trade between both countries via the road modal. Thus, the flow of trade has gradually grown, linked to several factors, with physical integration being important in this behavior. The effect of the coefficients for this variable are different in terms of intensity; there is a greater impact on trade exchanges carried out by the Brazilian states analyzed.

By the principle of parsimony, it is considered that the estimation of the equation by the PPML method shows more accurate statistical coefficients, in addition, by this method, the possibilities of heteroscedasticity existing in the model are eliminated. It was concluded that the flow of trade in these regions is positively influenced by the level of income, infrastructure and distance, linked to these last two factors the issue of the highway; and negatively by the exchange rate.

6. CONCLUSIONS

The main objective of the study was to evaluate the effects of physical integration, caused by the construction of the interoceanic highway. The study reflected on the consequences that this undertaking implied in increasing the flow of trade and, consequently, on the export basket of products sold in the linked regions, that is, where the highway passes. The central idea with the construction of the highway was to serve as a means of boosting the flow of trade between both countries, and especially in the regions through which the Interoceanic Highway passes.

The linked regions, where the highway goes, have for a long time faced problems that affect trade, such as the precarious infrastructure. These regions, being far from the main markets of their respective countries (be it Lima in Peru or São Paulo in Brazil), face logistical systems that are poorly developed. This affects the export performance through transportation costs, since, in general, exports - mainly of food - have low added value and high logistics costs, so its viability is confirmed mainly with gains scale obtained with large volumes. From an economic point of view, it is desirable that resources be directed towards improving infrastructure conditions (considered a bottleneck in trade in these states) through which the return to society would be obtained by the benefits that it could imply in the flow of trade.

With this study, we intend to contribute to the theory of international trade, specifically to the new regionalism, the same that becomes relevant in the current conditions where the search for new ways of strengthening bilateral and trade relations can serve as impellers (and serve as a debate) for the growth of underdeveloped regions in both countries.

In the study in question, the effects were evaluated: income, distance, exchange rate and highway, considered as determinants for the flow of trade to take place. In addition, through this work, it is possible to attribute a tangible value to the benefits of physical integration on the flow of trade, especially for the states through which the Highway passes, given the observed improvement in the flow of trade in them (Figures 2 and 3).

The empirical result through the application of the gravitational econometric model revealed that the estimates were adequate to assess the flow of trade according to the variables mentioned in the study. In this context, the importance of the PPML method stands out, which was considered the most appropriate for the type of sample used in the study (with zero and zero values).

In general terms, trade intensified after 2011, the year in which the highway began to operate in its entirety. This reality reinforces the positive value of the "highway" variable, whenever changes in the trade agenda can be expected when conditions are favored, in this case, infrastructure conditions. Thus, there is a positive effect for both countries, which is maintained that physical integration turns out to be relevant for the linked regions.

Therefore, the results of this work indicate that the strategies promoted by these countries aiming at solving these problems - of little border relation for the states - can be solved through joint efforts. No less fail to mention other factors, which through the common effort of both countries, and linked to the adoption of policies, facilitated the increase in the flow of trade, that is, through the elimination of customs duties and or promotion of prospects potential, which caused trade and population movement to grow.

7. ACKNOWLEDGMENTS

REFERENCES

Agur, I. (2008), The US trade deficit, the decline of the WTO and the rise of regionalism. Global Economy Journal, 8(3), 1-34.

Almeida, C.A., Seleme, R., Neto, J.C. (2013), Rodovia Transoceânica: Uma alternativa logística para o escoamento das exportações da soja brasileira com destino à China. Revista de Economia e Sociologia Rural, 51(2), 351-368.

Alschner, W. (2014), Regionalism and overlap in investment treaty law: Towards consolidation or contradiction? Journal of International Economic Law, 17(2), 271-298.

Arevalo, J.L.S., Merlo, E.M. (2017), Analysis of competitiveness in trade between Brazil and Peru: An approach considering the effect of physical Integration. Journal Globalization, Competitiveness and Governability, 11(2), 80-97.

Balvin, D., Patrón, P. (2008), Carretera Interoceánica Sur: Consideraciones

Para su Aprovechamiento Sostenible. Lima: Amigos de la Tierra, Asociación Civil Labor. p129.

Barrientos, F.P. (2012), Efecto de la carretera Interoceánica en el comercio internacional de Perú y Brasil. Revista Finanzas y Política Económica, 4(2), 21-50.

Bergstrand, J., Larch, M., Yotov, Y. (2015), Economic integration agreements, border effects, and distance elasticities in the gravity equation. European Economic Review, 78(C), 307-327.

Bicalho, A. (2013), Estrada do pacífico na integração Sul-Americana e o Acre. Espaço Aberto, 3(2), 185-208.

Bonifaz, J.L., Urrunaga, R., Astorne, C. Estimación de Los Beneficios Económicos de la Carretera Interoceánica. 1st ed. Peru: Centro de Investigación de la Universidad del Pacífico.

Bouzas, R. (2005), The new regionalism and the Free Trade Area of the Américas: A less benevolent view. Revista de la Cepal, 85, 7-18.

Brasil. Ministério de Desenvolvimento Indústria e Comércio Exterior. Dados do Comércio Exterior-MDIC. Plataforma Alice Web. Available from: http://www.alice web.desenvolvimento.gov.br.

CEPII. (2006), Centre d'Estudes Prospectives et d'Informations Internationales. Metodologia de Distância. Available from: http://www.cepii.fr/distance/noticedist_en.pdf.

Cihelkova, E., Frolova, E.D. (2014), The impact of regionalism on regional development under the conditions of a globalized economy. Economy of Region, 4, 45-57.

ECLAC. (1994), Economic commission for Latin America. In: El Regionalismo Abierto en América Latina y el Caribe: La Integración Económica al Servicio de la Transformación Productiva Con Equidad. Santiago de Chile: ECLAC. p109.

ECLAC. (2009), Economic commission for Latin America. In: Infraestructura Física e Integración Regional. 280th ed. Santiago: ECLAC.

Embperu. (2015), Embaixada do Peru. Relaciones Bilaterales-Reseña Histórica. Available from: http://www.embperu.org.br/index.php?option=com_content&view=article&id=138:rel-bil.

Gómez-Mera, L., Barrett, B. (2012), The political economy of preferential trade agreements: Latin America and beyond. Latin American Politics and Society, 54, 181-196.

Herrero, O.S. (2016), El proceso de regionalización latinoamericano ¿Aceptar que la cooperación es la única manera? Regional and Sectorial Economic Studies, 16(1), 171-186.

Herz, B., Wagner, M. (2011), Regionalism as a building block for multilateralism. Global Economy Journal, 11(1), 3.

Huerta, A.M.U. (2006), Nuevo Regionalismo en América del Norte. Cooperación y Competencia en las Relaciones de México con Estados Unidos de América y la Unión Europea. Tesis de Doctorado-Programa de Doctorado "Relaciones Internacionales, Unión Europea y Globalización". Facultad de Ciencias Políticas y Sociología. Madrid: Universidad Complutense de Madrid.

IBGE. (2019), Instituto Brasileiro de Geografia e Estatística. Banco de Dados. Available from: http://www.ibge.gov.br/home/estatística/economía/contasnacionais/2013/default.shtm.

IIRSA. (2019), Iniciativa Para la Integración de la Infraestructura Regional Suramericana. Dados e Informações. Available from: http://www.iirsa.org/document?menuitemid=5.

INEI. (2019), Instituto Nacional de Estadística e Informática. Banco de Dados. Available from: https://www.inei.gob.pe/estadisticas/indice-tematico/economia.

Kohli, H.A., Basil, P. (2011), Requirements for infrastructure investment in Latin America under alternate growth scenarios: 2011-2040. Global Journal of Emerging Market Economies. 3(1), 59-110.

Krugman, P., Obstfeld, M. (2010), Economía Internacional. 8th ed. São Paulo: Pearson Prentice Hall.

Lobos, D., Frey, K. (2015), Aproximaciones al rol de los planificadores regionales de la iniciativa para la integración de la infraestructura regional suramericana (IIRSA). EURE (Santiago), 41(124), 247-265.

MDIC. (2019), Ministério de Desenvolvimento Indústria e Comércio Exterior. Dados do Comércio Exterior-MDIC. Plataforma Alice Web. Available from: http://www.aliceweb.desenvolvimento.gov.br.

MINCETUR. , Ministerio de Comercio Exterior y Turismo. Mincetur Capacita a Exportadores de los Departamentos de Tacna y Madre de Dios Para Exportar a Brasil a Través de la Carretera Interoceánica Sur. Available from: http://www.ww2.mincetur.gob.pe/mincetur-capacita-a-exportadores-de-tacna-para-exportar-a-brasil-a-traves-de-la-carretera-interoceanica-sur.

MINCETUR. (2019), Ministro de Comercio Exterior y Turismo. Sistema Integrado de Información de Comércio Exterior-SIICEX. Dados de Exportação do Peru. Available from: http://www.siicex.gob.pe/siicex/portal5ES.asp?_page_=193.19100&_portletid_=sfichapaisinit&scriptdo=cc_fpa_init&ppais=29.

Okabe, M., Urata, S. (2014), The impact of AFTA on intra-AFTA trade. Journal of Asian Economics, 35, 12-31.

Palestini, S. (2017), La gobernanza regional del desarrollo en América del Sur (2000-2015). Revista de Estudios Políticos, 176, 191-222.

PRODUCE. (2019), Ministerio de la Producción. Banco de Datos. Available from: http://www.produce.gob.pe/index.php/features/anuario-estadistico.

Riggirozzi, P. (2014), Regionalism through social policy: Collective action and health diplomacy in South América. Economy and Society, 43(3), 432-454.

Rojas, J.B. (2013), Integración Centro Américana: El Caso de Panamá (1980-1999). Tesis de Doctorado. Departamento de Derecho Internacional Público y Relaciones Internacionales (Estudios Internacionales). Facultad de Ciencias Políticas y Sociología. Madrid: Universidad Complutense de Madrid.

Santos, J.M.C., Tenreyro, S. (2006), The log of gravity. The Review of Economics and Statistics, 88(4), 641-658.

Santos, J.M.C., Tenreyro, S. (2010), On the existence of the maximum likelihood estimates in Poisson regression. Economics Letters, 107, 310-312.

Santos, J.M.C., Tenreyro, S. (2011), Further simulation evidence on the performance of the poisson pseudo-maximum likelihood estimator. Economics Letters, 112(2), 220-222.

UNCTAD. (2019), Conferência Das Nações Unidas Sobre Comércio e Desenvolvimento. Reports-Currency Exchange Rates. Available from: http://www.unctadstat.unctad.org/wds/tableviewer/tableview.aspx?reportid=117.

Vicente, G.V. (2011), Integración Económica y Apertura Comercial en Centroamérica en el Período 1990-2005. Tesis de Doctorado. Departamento de Economía Aplicada I. Facultad de Ciencias Económicas y Empresariales. Madrid: Universidad Complutense de Madrid.

Zeynalov, A. (2016), The gravity of institutions in a resource-rich country: The case of Azerbaijan. International Economics and Economic Policy, 14(2), 1-23.