EfilJournal CİLT/VOLUME: 1
SAYI/ISSUE: 4

Latin American Neoextractivismo: Split or Deepening of the Liberal Model of the Economy?

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Abstract

This paper explores the economic effects of extractivism in Chile, Colombia, Mexico and Peru, applying the Dutch Disease model. A Johansen cointegration test finds a strong negative relationship between the appreciation of the real exchange rate due to increased government spending, and a decreasing participation of manufactures both at the national level and in exports. Other weaker, yet still significant, economic effects are also suggested. As the model of growth based on natural resources continues in Latin America, its economic effects must be discerned in order to guarantee a more fair inclusion in global trade and stronger national economic growth.

Keywords: *Extractivism, Dutch Disease, Latin America, Natural Resource Curse, Johansen Cointegration Test*

JEL Classification: *O13, C1, F41, O54, Q32*

Latin Amerikan Neo-Ekstraktivizm: Liberal Ekonomik Modelin Parçalanması mı Derinleşmesi mi?

Özet

Bu makale, Hollanda Sendromu modelini kullanarak Şili, Kolombiya, Meksika ve Peru'da çıkarıcılığın (extractivism) ekonomik etkilerini incelemektedir. Johansen eş bütünleme testi, artan kamu harcamaları nedeniyle, reel döviz kuru ile üreticilerin ulusal düzeydeki ve ihracattaki azalan katkıları arasında güçlü bir negatif ilişki bulunduğunu göstermektedir. Zayıf ancak önemli diğer etkiler de meydana gelmiştir. Latin Amerika'daki, doğal kaynaklara bağlı büyüme modeli devam ettikçe, küresel ticarete dahil olunması ve güçlü bir ulusal ekonomik büyümenin sağlanması için bu modelin ekonomik etkileri anlaşılmalıdır.

Anahtar Kelimeler: *Ekstraktivizm, Hollandalı Sendromu, Latin Amerika, Doğal Kaynak Laneti, Johansen Eş Bütünleme Testi*

JEL Sınıflandırması: *O13, C1, F41, O54, Q32*

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1. Introduction

This paper explores some effects of extractivism on the structure of the economy of four countries in Latin America: Chile, Colombia, Mexico and Peru.[1] The Dutch Disease (DD) model contains the most explanatory power of the relationship between international specialization in raw materials and total domestic product and the respective productive sectors, especially agriculture and manufacturing.

Extractivism is the hallmark of the liberal economic model established during the region´s structural reforms, beginning with the liberalization of foreign trade in the 1970s in Chile and Argentina, and in the rest of the countries of Latin America in the 1980s and 1990s. We suggest that the dynamics of Gross Domestic Product (GDP), productivity, employment and income recorded since then continue, given that the goal of the liberalization of the economies was to promote the movement of capital and labor towards productive activities with comparative advantages, by closely linking domestic prices with external ones.

Furthermore, the impact of extractivism in the productive structure would be in line with the assumptions of the Dutch Disease model: premature decline of manufactures and agriculture in the generation of gross national product and employment, an approach that contradicts the fundamentals of foreign trade based on comparative advantages, the intense use of abundant resources and relative costs of production.

To achieve its objective, this document is organized as follows. Section two presents basic definitions of extractivism, as well as the theoretical, classical and contemporary elements of structuralism. The third section establishes if, for the four countries, the

1 These four countries are members of the Pacific Alliance, which was created on April 28th, 2011 after the signing of the Lima Declaration, with one of its objectives being the promotion of industrialization. Ironically, the present article suggests that the continued specialization in raw materials of these four countries goes against such objective.

hypothesis of the Dutch Disease model is verified. The analysis focuses on the decades from 1960 to the present (or the most recent year for which there is comparable data for the region and the four countries studied), a period that has seen the adjustment of Latin American economies to liberalization, structural reforms and the crisis of 2008. The last section concludes.

2. What is Extractivism and What are its Objectives, Background and Theoretical Elements?

2.1. Extractivism, Objectives and Background

Extractivism is a model of economic growth in Latin America based on the specialization of exports on natural resources that are only slightly (if at all) transformed, whether of agricultural, mining or fossil origin (Myint, 1965: 15; Prebisch, 1949; Furtado, 1982; Cardoso and Faleto, 1969). The concept of extractivism also emphasizes the main forces that promote it, such as high international prices (Grigera and Alvarez, 2013; Gudynas, 2013), and points out to the continuity between the extractivism of the late nineteenth and the more recent one, since the first decades of the twentieth century.

In the colonial period, the Spanish government imposed the *quinto real*, a rate of 20% for mining concessions and selling or renting of agricultural land. In the post-independence period, until the first two to three decades of the twentieth century, exports of raw materials provided resources essential for nation building. The private sector was allowed to accumulate capital and increase their investments, to expand the existing production capacity and to diversify its activities. Nineteenth century extractivism did not trigger the expected economic effects, since the growth of the exported volume did not generate gains in productivity due to technological improvements, but due to the intensification of labor and the transfer of low productivity labor to less dynamic activities, such as mining and plantations (Acosta, 2011; Svampa, 2013).

Therefore, to activate development towards activities with greater technological change, economies of scale, positive externalities and export dynamism, industrialization Latin America launched a complex system in was later promoted in the region as a necessary way to overcome underdevelopment (Rosestein-Rodan, 1943; Nurkse, 1959; Kaldor, 2007; Prebisch, 1949). Exports were consider a powerful catalytic of economic growth (Ul Haque et al., 1995; Haussman et al., 2007; Rodrik, 2007). During this period, external sales of commodities provided the necessary investment resources to cover imports of capital goods and the inputs demanded by industrialization. Import tariffs protected activities that competed with imports, promoting their growth, with fiscal sacrifice for the cost of the incentives to industrialization. Circa the end of the sixties, last century, problems emerging from the industrialization model, imposed the elimination of some of the incentives used to promote the unbalanced growth pattern. Additionally, governments launched programs to promote exports of manufactures taking advantage of the regional integration

programs. So, the region adopted Linder trade model combinig south-north exchange of commodities with a south-south trade exporting manufactures to a market integrated by less industrialized economies, see Linder (1961).

The debt crisis was the justification for ending the substitution model and the promotion of industrialization as the engine of growth. It gave rise to the export model of growth, established in the 1980s and 1990s, and currently in force in all the countries of the region. This model resumes specialization based on static comparative advantages and thus promotes exports of raw materials, more for tax purposes than for employment generation. In the structural reforms, both in energy and mining during Mexico's Peña Nieto government, as well as the mining sector reforms of the Colombian presidents Uribe and Santos and in Argentina, it is possible to identify truncated versions of the "vent of surplus theory" developed by Lewis. The programmes in these three countries implicitly assume full employment, rely on external investment, are capital intensive and do not seek to absorb labor with low marginal productivity that is found, to a large extent, in informal urban employment, services and construction and, to a lesser extent, in the rural sector. For these reasons, these policies will not increase overall economic productivity.

The theoretical elements of actual extractivism in Latin America are the same classical and neoclassical principles argued to explain the export specialization in early XX century but adapted to the economic, social and political conditions existing since the last three decades and targeting to different ends. It aims to raise the rent from the abundant resource and to distribute it with a view to rising capital accumulation in the public sector and social development, to generate employment, to raise labor income and to reduce inequality and poverty. The main problem with this model is the volatility of prices of raw materials in the global market: When the prices are high, expectations of increasing economic growth and social policies scale up. When prices go down, or even worse, crash in a very reduced time, the governments have to face the challenges to adjust the economy to the new and in general they cut expenditure and implement austerity programs that worsen the crisis. The price bonanza that began during the 1990s ended abruptly in 2011. Up to day there are not , with no signs of recovery due to the state of the world economy, closed an upward price cycle and posing doubts about the permanence of economic and social policies, previous governments were replaced by neoliberal governments at the right of the political spectrum in all these countries but Bolivia and Venezuela.

In the economic dynamics outlined above, the reduction of inequality or poverty are not explicitly mentioned as central political goals. For Smith (1776), poverty was indeed the disturbing factor, since it prevented the confidence and respect necessary for the functioning of the market and for savings to become investments, which, in pursuing growth, would reduce poverty. In accordance with the postulates of classical and neo classical economics, it was assumed that growth would address this goal in a gradual and automatic way (Kuznets (1966), Kaldor (2007) (1957), Solow (1956), Lucas). To distribute, as Lucas (2004) asserted, is a *poisonous* idea (sic) that only damages the economy and impedes its expansion. Inequality between countries would also be reduced as free trade

increased, due to higher growth rates in less developed countries, stimulating convergence (Solow, 1956). Prebisch and the dependency analysts (1949) coincide with these ideas and blame the brakes on development on the dependence of economies on external capital. Industrialization, based on national capital, would severe this umbilical cord and, by accelerating growth, would change economic and political structures, while reducing inequality and poverty (Puyana, 2015a).

Identifying the rents from extractivism in the national budget is a difficult task as Burchardt & Dietz (2014) suggest. The authors identify three group of countries according to the extractive rent model: the Andean states with high "pure" commodity rent, South American countries with a small but rising extractivism, and Mexico and Central America with very low and rising mining sector, but moving towards higher fiscal dependency on rents. The rents provided by extractive activities create the so called "elevator effect", as they provide resources for poverty alleviation programs allowing thousands of people to move a higher income level while preserving the ancient societal structure (Burchardt & Dietz, 2014). Inequality persists because the distribution of rents is a political economy issue which depends on how different social groups accede the government and influence the decision making processes.

The distributive effects of extractivism are seen in the structure of fiscal policy instrumented in resource rich Latin America countries. In general, taxation is regressive or neutral and fiscal expenditure does not affect in a significant degree the market income concentration. Due to commodity rents[2], other sources of fiscal revenue are low and total effective tax revenue as proportion of GDP is rather low, in Mexico being only 13%, according to OCDE. In Mexico and in Colombia, the costs of rebates, exemptions and tax reductions granted to capital nears the oil rent government take. Mexican oil rent represented near 38% of total fiscal income in average, for the entire 21st century (Peters, 2016).

2.2. Theoretical Background for Extractivism

The theoretical conceptualization of the international division of labor based on abundant factors goes back to classical economy authors -Smith, Ricardo and Mills- and extends well into the twentieth century within the models of trade flows and factor endowment (Heckscher-Ohlin and Stolper-Samuelson models, as well as Rybczynski's theorem), applying two analytical approaches: the theory of relative costs and productivity. Under the theory of relative costs, specialization implies a reversible movement through the static curve of production possibilities assuming the full employment production factors and considering the available technologies (Myint, 1965: 15). On the other hand, in the doctrine of productivity, there is no full use of factors because the size of the domestic

2 Here we refer to rent as to the government take from oil and mining industries in the form of royalties and taxes. We do not ignore the classical economics definition of extractive rents (absolute and relative rent) or the Marx concept of it.

market does not allow the full exploitation of a relatively abundant resource (mining, land, labor), so that total effective labor productivity is lower than the potential one. In this context, international trade, by expanding the market and deepening specialization, encourages technological change, raises labor productivity and generates benefits of growth and development, but the productive structure of countries rich in natural resources, forged according to external demand, is hardly reversible (Mill, 1848, quoted in Myint, 1958: 318 and 319). Therefore, expanding production to export abundant resources does not imply reducing production for the domestic market, nor does it generate inflationary pressures, as in the theory of relative costs, while it does increase productivity as labor is transferred, from subsistence agriculture with very low marginal labor productivity, to more productive activities. Hence, a country that specializes in the international market is vulnerable to external shocks and movements of terms of trade, to a greater degree than that accepted by the theory of relative costs (Myint, 1965: 320). This insight is presented in the analysis of Latin American development in Furtado (1982) and in Cardoso and Faleto (1969).

The concern about intra-country inequality because of international specialization is relatively new and the DD model does not integrate the distributional effects of resource bonuses, beyond changes in the structure of employment. Some recent studies attempt to complement this model with some relevant theoretical elements. They allowed, in the models that analyze this linkage, to solve the problem of the endogeneity of growth and inequality. This endogeneity suggests the existence of a non-included and exogenous variable. In effect, "... a country's wealth in, or dependence on, natural resources can be considered as an exogenous variable to the growth model and of those explaining the impact of inequality on growth" (Gylfason and Zoega, 2002: 21). These authors found that wealth in natural resources affects inequality and GDP growth, through an inverse relationship, and suggest why: "the wealth in natural resources is a cause of inequality and low growth, by diverting resources, labor and capital towards primary activities and inhibiting investment in education, constraining the development of manufactures, the main source of human capital" (Gylfason and Zoega, 2002: 10), an argument consistent with the factor movement of DD models.

2.3. Recent Developments on the Effects of Extractivism on the Productive Structure: The Natural Resource Curse, and the Dutch Disease (DD) Model

The specialization in the exports of raw materials is a theme that re-emerged after the revaluation of crude oil by the Organization of the Petroleum Exporting Countries in 1973. Since then, although oil exporting countries grew, they developed less than those lacking fossil resources (Puyana, 2015b), although there are various exceptions (Humphreys et al., 2007). For these oil rich countries, institutional development could be weaker and there

could be a tendency for higher levels of corruption and political conflicts between the different levels of government as well as social confrontations, which sometimes erupted into violence (Karl, 2007; Acemoglu et al., 2011).

The 1973 oil price spikes stimulated research on the economic and political impact of commodity bonanzas, under the concept of "natural resource curse" in developing countries (Gelb, 1988; Auty 1993; Puyana, 2015b), in which the importance of these exports grew (Will, 2005; Krugman, 1987). Under the natural resource curse, that the negative effects of price booms of raw materials are: 1) the tendency to worsening terms of trade (according to the Prebisch-Singer hypothesis); 2) the instability of the prices of primary goods; 3) the low value of export returns; and 4) the losses in employment, income and exports of tradable sectors and products that are not in boom. These phenomena are themselves results from a slower pace of technological change in primary activities, when compared to that from manufacturing or service. Another source of conflict are the struggles to capture the rents leading to corruption and social conflicts, even of violent character (Sachs and Warner, 1995; Collier and Hoeffler, 2000).

The DD model was then proposed as an explanation of the natural resource curse, and is linked to the determinants of structural change, as analyzed by Chenery and Syrquin (1986), as well as Prebisch (1949), Furtado (1982) Cardoso and Faleto (1969). On the breadth of natural resource wealth and the intensity of price booms depend structural changes in the economy and their reversibility, as suggested by various contemporary studies of the structural problems of resource specialization (Bair, 2015; Buccellato and Alessandrini, 2009; Fleming and Measham, 2013). The DD model could explain the lower product and productivity growth of oil economies, due to the decline of tradable sectors, agriculture and manufactures as a source of GDP and employment, associated to the revaluation of the real exchange rate. Such unwanted economic results stem from an effect of the increase in foreign exchange due to the exploitation and exports of raw materials and the following expansion of public spending.

The DD model includes elements of neoclassical economic theory: a) the law of single price; b) full employment and perfect mobility of all productive factors; and c) perfect adjustment of wages and prices, with which it rejects all measures to prevent their effects on productive and employment structures or on the real exchange rate. The optimal alternative under this approach is to allow the economy to automatically adjust to the new price conditions (Corden, 1984), in contrast to proposals that promote the need to avoid appreciation of the real exchange rate and to protect tradable sectors that are not in boom (Gelb, 1988; Auty 1993; Puyana and Romero, 2009). The theoretical assumptions of the DD model, full employment of all factors of production, mainly labor and capital, seldom occur in particular countries and even less in the economies of Latin America, where there is urban and rural unemployment and underemployment, a shortage of savings and concentration of income and poverty, all of which reduce the capacity of the

domestic market and intensifies the negative effects of specialization on natural resources (Puyana and Costantino, 2015; Kojo, 2015). In this way, the present study does not follow the common methodologies of the natural resource curse and the DD, analyzing multiple countries in one major comparison, but instead focuses on analyzing separate countries at a time, proposing specific interpretations of extractivism and its economic consequences for each country.

3. Do Chile, Colombia, Mexico and Peru suffer from Dutch Disease? Testing the Model's Hypotheses

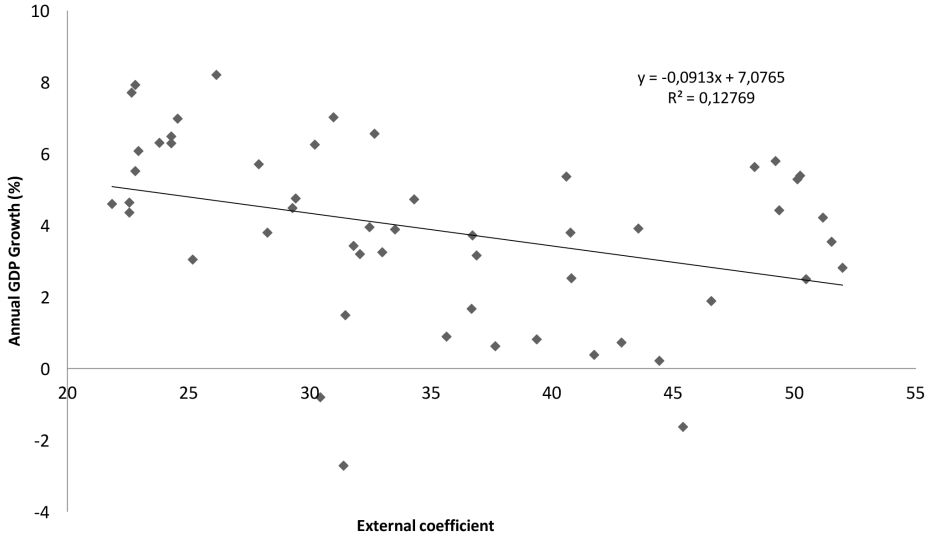
3.1. A General Analysis of the Region

As a preliminary step to verify if the economies of Chile, Colombia, Mexico and Peru show the symptoms of DD, we present here the trajectory of the most relevant economic variables of these countries and the region, to illustrate the context of Latin American development in the post-reform period, from 1980 to the present. Such variables are: economic growth, trade liberalization and its impact on growth, and the evolution of exports of raw materials during price booms, especially those which conform a greater weight in exports. We consider these features distinguish these 4 countries from Norway, Botswana and Indonesia that avoided DD symptoms (Gulbanov et al, 2010; Collier et al 2009, Thorp et al 2012). Depending on the type of instrumented policies, both the Dutch Disease and the Natural Resource Curse, can be avoided, a task troublesome not only for less developed countries, even the United Kingdom did not manage to fully prevent it (Krugman 1987).

It is noteworthy that the external coefficient[3] of the whole region hiked from a lower 33 per cent of GDP in 1980, to 54 per cent in 2015, with greater momentum along the 1990s, mainly due to the push of demand from developed economies and China and India. The opening to global trade is unbalanced, suggesting increasing pressure on domestic production competing with imports, which is why trade liberalization and the advance of primary exports have not stimulated economic growth. Meanwhile, between 1980 and 2015, the external coefficient of the economy expanded by 28%, while the Latin American GDP rose to 3.1%, suggesting a weaker relationship between export growth and GDP, as well as an intensification of the income elasticity of imports. The indirect relationship of the external coefficient and GDP growth for all the countries in the region is shown in Figure 1.

3 External coefficient of an economy expresses the degree of its liberalization and it is measured as the division of the sum of imports and exports with GDP. External Coefficient = Imports+exports/ GDP

Figure 1: Relationship Between Annual GDP Growth and the External Coefficient (Average 1960-2013)



Source: Authors´ creation with data from WDI (2016).

Such relationship varies in intensity according to periods with booms. The growth rate of exports between 1983 and 2017 was higher than the one recorded in the period 1960-1982, while GDP had the opposite trajectory. Real export revenues fell due to deteriorating terms of trade, as the price of primary goods declined in real terms to the lowest levels recorded and only recovered a few years before the crisis of 2007-8, only to descend again. The instability in prices is partly due to the liberalization of international markets, the entry of more bidders and the speculation in futures markets.

Table 1: Latin American Exports of Raw Materials, Food and Non-technology-intensive Manufactures. Percentages Over Total Exports, 1962-2012

Country	1962	1990	2000	2012	2012*
Venezuela	93.9	93.6	93.8	ND	100
Paraguay	88.6	90.3	83.8	98	99.8
Nicaragua	ND	91.6	92.1	94.6	95.1
Ecuador	98.2	97.6	90.1	91	97.5
Peru	99.1	81.6	84.1	88.8	99.9
Chile	96.3	87.4	81.4	85.8	95.3

Uruguay	0	60.9	60.3	84.6	99.3
Colombia	96.3	74.2	67.5	82.4	94.8
Argentina	96.5	70.8	66.2	65.3	89.7
Brasil	96.8	46.9	39.6	62.6	87.2
Mexico	85.5	64.9	38.9	40.8	82.4
Costa Rica	0	65.6	34.4	38.8	60.4

Source: Authors´ creation with data from WDI (2016).

This trajectory was coupled with the re-primarization of exports illustrated in Table 1. In 2012 the weight of raw materials was high, even in Argentina and Brazil, countries with large domestic markets and significant manufacturing sectors, while Mexico, Costa Rica and Salvador witnessed extensive external sales of final consumption manufactures, which are labor-intensive and low in technological content, some of which are embedded in global value chains. Due to the low contribution of these manufactures, the value added of the sectors and the growth of total GDP and price formation, the behavior of the latter is like that found with raw materials (Puyana and Romero, 2009).

The weight of these manufactures in total exports is calculated as the difference in the values of the indicated columns 2012 and 2012* of Table 1. The growth of total Mexican exports is revealing, at an average annual rate of 8.6%, explained mainly due to manufactures that account for about 80% of the total, which in 2014 amounted to US $ 327 billion dollars, in 2005 values. Of that total, exports of maquila manufactures accounted for 75% which, due to their highly imported content (around 60 percent of total exports value), has a net contribution to total GDP that does not exceed 4%. The import-intensive Mexican export model has increased the external constraints of the economy by raising the propensity to import to 4.5%, as forecasted by Prebisch (1949: 18-20) in commenting the effect of exports of raw materials. With varying intensity, this pattern is repeated throughout Latin America (Puyana, 2015a).

3.2. Are There Symptoms of DD?

Of the various effects implicit in the DD models, this article will focus on four principal hypotheses: a) a positive relationship between export revenues and state income; which results in b) and appreciation of the real exchange rate or increase of the relative prices of non-tradables, a result of monetary expansion and public expenditure; c) declining national production of tradable goods, agriculture and manufactures not in high demand, induced by the real exchange rate revaluation; and d) a reduction of exports of tradable goods that are not booming, such as manufactures, due to the exchange rate appreciation.

The variables considered in the DD model are listed below (with the respective codification in parenthesis)[4]:

- Oil exports (LPX)
- Exports of minerals and metals (LOMX)
- Exports of raw materials (LMPX)
- Public expenditure (LG)
- The share of public expenditure in total GDP (LG_PIB)
- The real exchange rate index (Lrxr)
- The money supply (LM) (The monetary aggregate M2 was considered)
- GDP per capita (LPIBp)
- The share of manufacturing production in total GDP (Lmanuf_PIB)
- The share of manufacturing exports in total exports (Lmanuf_X)
- The share of manufacturing production in total US GDP (Lmanuf_PIBus)

To avoid problems of multicollinearity[5], such economic effects were separated according to the specification of the following five central equations, which indicate the sequential impacts derived from the inflow of capital flows into a country that exports natural resources.

Central equations:

I. LG = f (LPX, LOMX, LMPX)

II. Lrxr = f (LG, LM)

III. Lmanuf_PIB = f (LG_PIB, LM, PIBp, LManuf_PIBus)

IV. Lmanuf_PIB = f (Lrxr, LM, PIBp, LManuf_PIBus)

V. Lmanuf_X = f (Lrxr)

Equation I suggests that there is a medium and long-term positive relationship between public spending and the revenues generated by exports of goods in boom for each country. For equation II, most of the empirical DD analysis assume that an increase in public expenditure and in money supply would stimulate domestic demand beyond the internal productive capacity. The resulting excess in the demand of goods is mitigated only through a price increase, and the increase in domestic prices in turn ends up appreciating the real exchange rate[6]. Therefore, a negative relation is expected between the real exchange rate, public expenditure and money supply.

4 All variables are converted to their natural logarithm to facilitate comparison.

5 Multicollinearity exists when in a multiple regression model, several of the independent variables are closely correlated to one another.

6 In this paper, an increase in the real exchange rate means an appreciation and a reduction of the exchange rate means a depreciation of the real exchange rate (rxr = e (P * / P)).

An increase in government expenditure, which triggers a price increase and an appreciation of the real exchange rate, could increase manufacturing imports due to high global competition and lower domestic manufacturing output. These effects are measured by equations III, IV and V. Equation III shows that the weight of manufacturing production in total GDP depends on public expenditure in relation to GDP, money supply, GDP per capita of the country in question and, for Mexico alone, also of the United States manufacturing production in relation to its GDP, because of the close link between the manufacturing structures of the two countries.

Equation IV is similar to equation III, except that, in order to avoid a multicollinearity problem by simultaneously incorporating public expenditure in relation to GDP and the real exchange rate, the effect of each variable was estimated separately. For this equation, a positive relationship is predicted between manufacturing output in relation to GDP and the real exchange rate. Lastly, Equation V indicates that an increase in the share of public spending as a proportion of GDP, which is manifested as a bonanza effect, generates an appreciation of the real exchange rate, which decreases the share of manufacturing exports in relation to the total.

The variables mentioned above are obtained in time series, reason for which it became necessary to firstly carry out a unit root analysis in order to assess stationarity and the integration of each variable. The following unit root tests were used: Augmented Dickey Fuller (ADF), Phillips Perron (PP) and Kwiatkowsky, Phillips, Schmidt and Shin (KPSS). The results of the tests for the variables of the four countries studied conclude that all variables present in the study show an integration order I (1), given that most values indicated the acceptance of the stationarity of the variables in the first difference[7]. The model A is without trend or intercept, the model B includes intercept and the C includes trend and intercept.

Since the economic series of all the countries follow a process of integration of order I (1), it was decided to use Johansen's cointegration methodology (1988), in order to estimate if the economic relations indicated in the five central equations have a long-run equilibrium relationship. The first step to estimate such econometric models was to estimate an autoregressive vector model (VAR) with the proposed macroeconomic variables in each of the five equations, according to the following specification with p lags:

$$y_1 = \mu + A_1 y_{t-1} + A_2 y_{t-2} + ... + A_p y_{t-p} + v_t$$

where y_t is a vector that includes all the main variables; μ includes the constant, the trend or the respective dummy variables, and v_t is the error term that is distributed normally with the mean on zero and constant variance. If there is a linear relationship

7 In the cases of the unit root tests ADF and PP, the null hypothesis raises the existence of a unit root and, therefore, the non-stationarity of the variable. The alternative hypothesis in these two tests indicates that the variable in question is stationary. On the other hand, in the KPSS test, the null hypothesis implies the stationarity of the variable with respect to the trend, while the alternative hypothesis indicates the non-compliance with stationarity.

between these endogenous variables, according to Granger's representation theorem (1987), the above equation can be represented as an error correction mechanism (ECM):

$$\Delta y_t = \mu + \Gamma_1 \Delta y_{t-1} + \Gamma_2 \Delta y_{t-2} + ... + \Gamma_p \Delta y_{t-p} + \phi y_{t-p} + e_t$$

$$\text{Where, } \Gamma_1 = -I + A_1 + A_2 + ... + A_i,$$

$$\text{For } i = 1, 2, ..., p_{-1} y \emptyset_0 = I - A_1 - A_2 ... - A_p$$

If initially the variables included in the vector y_t are of an order of integration I (1) and the vector v_t is of order of integration I (0), then it is said that the series co-integrate and an ECM exists.

Each of the five equations listed above was adapted for each of the countries, taking into account the relationship between the variables according to the country structure and the respective statistical significance. The following Table 2 summarizes the functional relationships for each country.

Table 2: Functional Relationships, Dutch Disease Model for the Countries of the Pacific Alliance

Equation	Chile	Colombia	Mexico	Peru
I	LG = f (LOMX, LMPX)	LG = f (LPX, LMPX)	LG = f (LPX, LMPX)	LG = f (LOMX,)
II	Lrxr = f (LG)	Lrxr = f (LG)	Lrxr = f (LG)	Lrxr = f (LG)
III	Lmanuf_PIB = f (LG_PIB, LM, PIBp,)	Lmanuf_PIB = f (LG_PIB, PIBp,)	Lmanuf_PIB = f (LG_PIB, PIBp, LManuf_PIBus)	Lmanuf_PIB = f (LG_PIB, PIBp)
IV	Lmanuf_PIB = f (Lxrx, LM, PIBp,)	Lmanuf_PIB = f (Lxrx, PIBp,)	Lmanuf_PIB = f (Lxrx PIBp, LManuf_PIBus)	Lmanuf_PIB = f (Lxrx, PIBp)
V	Lmanuf_X = f (Lrxr)	Lmanuf_X = f (Lrxr)	Lmanuf_X = f (Lrxr)	Lmanuf_X = f (Lrxr)

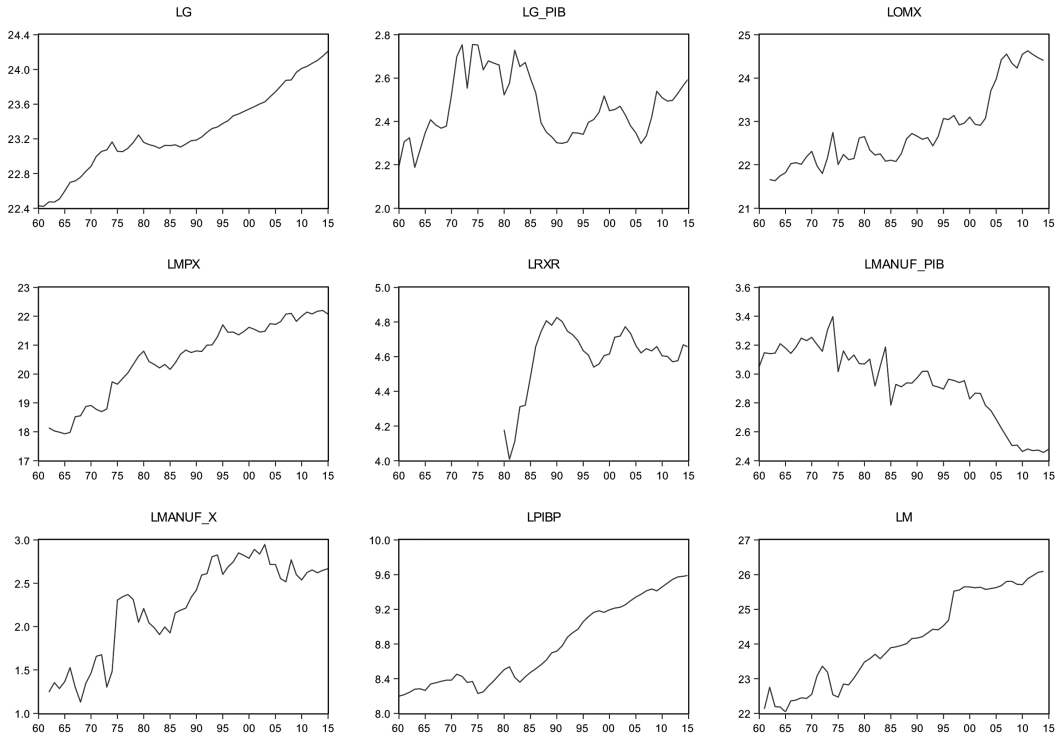
Source: Authors´ creation.

The results of the application of the methodology of Johansen (1988) for all the proposed relations are presented in the following sections, separated by country.

3.2.1. Chile

Figure 2 shows the trajectories for the variables used in the study for Chile, while Table 3 shows its final results.

Figure 2: Trajectories of Economic Variables for Chile, 1960-2015



Source: Authors´ creation with data from WDI (2016).

Table 3: Results of Econometric Analysis for Chile

(I)	LG	LOMX	LMPX	C		CointEq1	VC	R2 adj.	Lags	Period	Obs
	1	0.258	0.394	9.475		-0.114731	1	0.334	1	1985-2014	30
t-test		[-3.24896]	[-3.42571]	[-8.20324]		[-6.31710]					
(II)	LRXR	LG	C			CointEq1	VC#	R2 adj.	Lags	Period	Obs
	1	-0.553	17.196			-0.200768	1	0.241	2	1990-2011	22
t-test		[8.04357]	[-10.8990]			[-2.42199]					
(III)	LMAN_PIB	LG_PIB	LPIBP	LM	C	CointEq1	VC#	R2 adj.	Lags	Period	Obs
	1	-0.958	-0.934	0.120	10.637	-0.331463	2	0.830	3	1965-2014	50
t-test		[5.35549]	[4.12638]	[-1.55704]	[-15.5776]	[-5.85008]					
IV	LMAN_PIB	LRXR	LM	LPIBP	C	CointEq1	VC#	R2 adj.	Lags	Period	Obs
	1	-0.552856	0.337082	-1.886282	13.97621	-0.38203	2	0.494	1	1994-201	21
t-test		[2.18884]	[-3.77285]	[8.42614]	[-8.67523]	[-5.36357]					
V	LMANUF_X	LRXR				CointEq1	VC#	R2 adj.	Lags	Period	Obs
	1	0.585767				-0.432379	1	0.217	1	1991-2015	25
t-test		[-81.0703]				[-2.76597]					

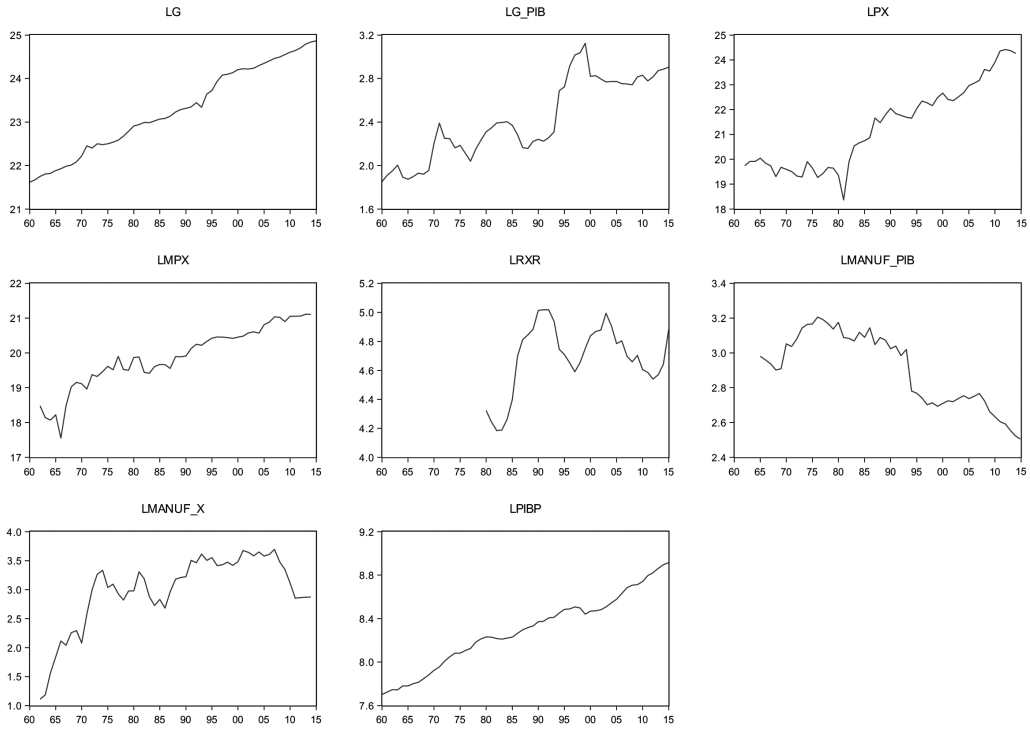
Source: Authors´ creation with data from WDI (2016).

The most important results seen in the previous table are those of Equation III and IV, a negative relationship where an increase in government spending and in the exchange rate is associated with a decrease in the participation of manufactures in total exports. The other equations also receive appropriate regression coefficients from the hypothesis expected, but with a less predictable value.

3.2.2. Colombia

Figure 3 shows the trajectories for the variables utilized in the study for Colombia, while Table 4 shows its final results.

Figure 3: Trajectories of Economic Variables for Colombia



Source: Authors´ creation with data from WDI (2016).

Table 4: Results of Econometric Study for Colombia

(I)	LG	LPX	LMPX	C	CointEq1	VC#	R2 adj.	Lags	Period	Obs
	1	0.209345	0.304155	13.35966	-0.401417	1	0.865407	1	1994-2014	21
t-test		[-3.74524]	[-1.86046]	[-6.08605]	[-14.5164]					
(II)	LRXR	LG	C		CointEq1	VC#	R2 adj.	Lags	Period	Obs
	1	-0.23709	10.65737		-0.267087	1	0.36721	1	1988-2014	27
t-test		[4.14516]	[-7.65161]		[-2.61715]					
(III)	LMAN_PIB	LG_PIB	LPIBP	C	CointEq1	VC#	R2 adj.	Lags	Period	Obs
	1	-0.356703	-0.580792	8.672623	-0.317923	2	0.719464	2	1970-2015	46
t-test		[4.99049]	[6.02359]	[-13.3943]	[-6.81580]					
(IV)	LMAN_PIB	LRXR	LPIBP	C	CointEq1	VC#	R2 adj.	Lags	Period	Obs
	1	0.601566	-0.75402	6.200785	-0.184558	1	0.774908	1	1987 2015	29
t-test		[-2.97128]	[4.23597]	[-2.75222]	[-4.76626]					
V	LMANUF_X	LRXR	C		CointEq1	VC#	R2 adj.	Lags	Period	Obs
t-test	1	0.184782	4.146138		-0.424822	1	0.479784	1	1986 2014	29
		[-1.99754]			[-3.97863]					

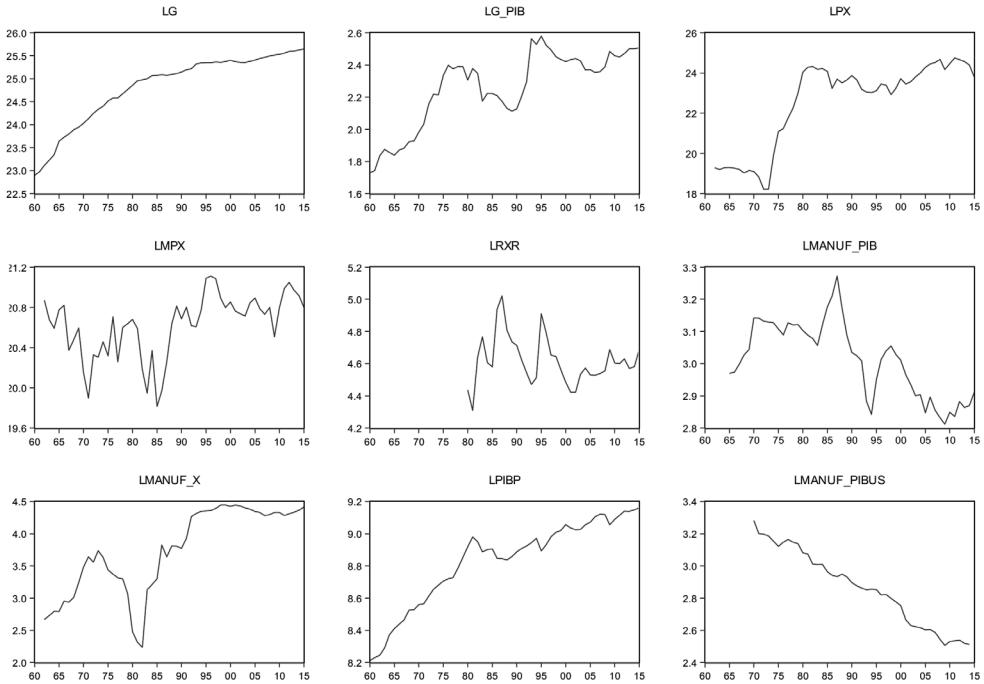
Source: Authors´ creation with data from WDI (2016).

Similar to Chile, the results of Colombia are stronger for equations III and IV, suggesting an inverse relationship between government spending and the exchange rate, and the participation in manufactures in GDP. However, differently from Chile, Colombia´s strongest relationship is between the income from the sale of oil (LPX) and other commodities (LMPX) to government spending (LG). As can be seen in Figure 3, one of the reasons of this strong relationship is because all three variables increase throughout the entire period of study, in a similar fashion. The differences could be explained by the early introduction of the Chilean Stabilization Fund aiming at mitigating the impact of price bonanzas by freezing part of the windfall investing abroad and monetizing only the amount needed to keep the economy growing at a long term rate that will preserve price stability.

3.2.3. Mexico

Figure 4 shows the trajectories for the variables utilized in the study for Mexico, while Table 5 shows its final results.

Figure 4: Trajectories of Variables for Mexico



Source: Authors´ creation with data from WDI (2016).

Table 5: Results of Econometric Analysis for Mexico

(I)	LG	LPX	LMPX	C		CointEq1	VC#	R2 adj.	Lags	Period	Obs
	1	0.2562	0.6505	5.8246		-0.110006	1	0.623	2	1990-2015	26
t-test		[-10.4506]	[-5.65500]	[-2.34881]		[-3.48839]					
(II)	LRXR	LG	C			CointEq1	VC#	R2 adj.	Lags	Period	Obs
	1	-0.2687	11.4073			-0.641724	1	0.370	1	1982-2015	34
t-test		[1.76563]	[-2.95711]			[-4.36667]					
(III)	LMAN_PIB	LG_PIB	LPIBP	LMAN_ PIBUS	C	CointEq1	VC#	R2 adj.	Lags	Period	Obs
	1	-0.1263	0.8043	1.0626	-6.8341	-0.645709	3	0.436	2	1985-2014	30
t-test		[1.71210]	[-2.71818]	[-6.54114]	[2.24603]	[-4.31032]					
(IV)	LMAN_PIB	LRXR	LMAN_ PIBUS	LPIBP	C	CointEq1	VC#	R2 adj.	Lags	Period	Obs
	1	0.323755	0.69739	0.812143	7.899646	-0.229421	3	0.345	1	1990-2014	25
t-test		[-2.10973]	[-2.85290]	[-1.87389]	[1.62240]	[-1.97262]					
(V)	LMANUF_X	LRXR				CointEq1	VC#	R2 adj.	Lags	Period	Obs
	1	0.953138				-0.107122	2	0.781	3	1990-2105	22
t-test		[-61.7474]				[-3.32084]					

Source: Authors´ creation with data from WDI (2016).

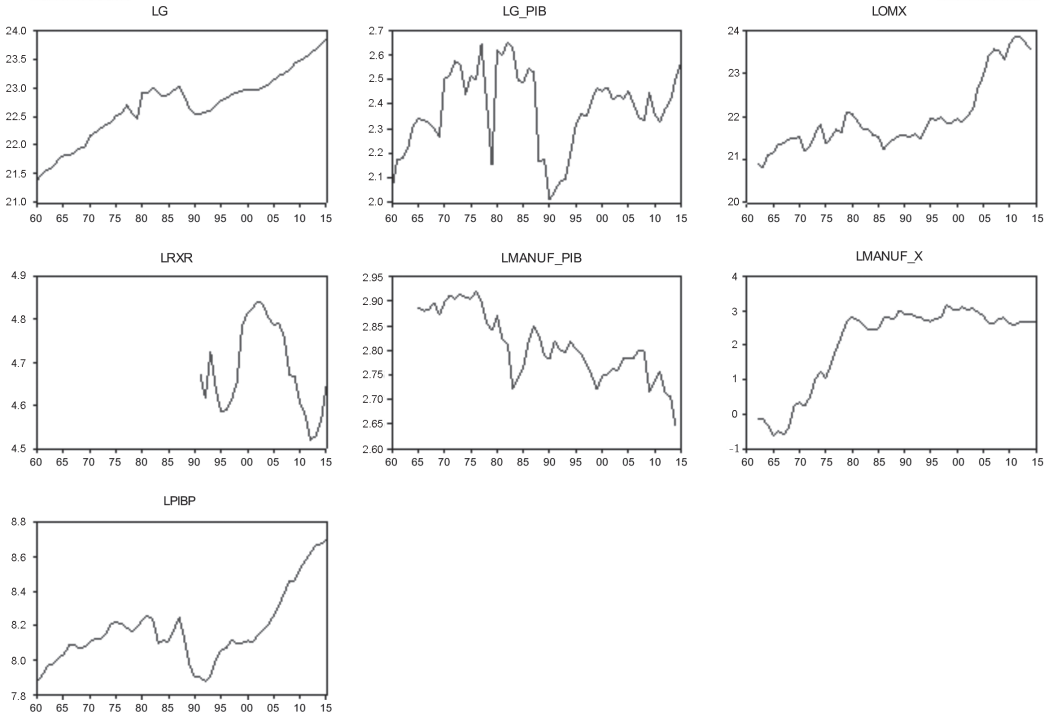
For Mexico the most important relationships found are those of Equation V, where the appreciation of the exchange rate has a positive relationship with the participation of the manufactures in exports, due to the fact that the Mexican Peso revaluation reduces the price of imported inputs on which Mexican manufactures and its exports are highly intensive. In other words, only for Mexico can one make the strongest case of an appreciation of the real exchange rate leading to an increase of manufactures in exports, especially in the period 1990-2015.

Amongst middle income large developing countries, Mexican manufactures are one of the most integrated in the low value, labour intensive segments of the production process of the global value chains. This fact explains the apparent contradictory results of Equation V and constitutes another topic worth of further attention in the context of the extractivism literature, since Mexico shows intensive decline of manufactures in total GDP, despite the formidable growth of exports of manufactures revealing similar structural economic impacts as the specialization in raw materials.

3.2.4. Peru

Figure 5 shows the trajectories for the variables utilized in the study for Peru, while Table 6 shows its final results.

Figure 5: Trajectories of Economic Variables for Peru



Source: Authors´ creation with data from WDI (2016).

Table 6: Results of Econometric Analysis for Peru

(I)	LG	LOM	C		CointEq1	VC#	R2 adj.	Lags	Period	Obs
	1	0.5586	10.6813		-0.179728	1	0.592	1	1970-2014	45
t-test		[-7.57998]	[-6.59376]		[-4.66221]					
(II)	LRXR	LG	C		CointEq1	VC#	R2 adj.	Lags	Period	Obs
	1	-0.191643	9.051119		-0.264765	1	0.264	3	1996-2015	22
t-test		[2.73025]	[-5.62317]		[-2.48128]					
(III)	LMAN_PIB	LG_PIB	LPIBP	C	CointEq1	VC#	R2 adj.	Lags	Period	Obs
	1	-0.1376	-0.1624	4.4011	-0.302996	1	0.324	1	1990-2014	25
t-test		[5.24996]	[9.12057]	[-34.2142]	[-1.94666]					
(IV)	LMAN_PIB	LRXRP	LPIBP	C	CointEq1	VC#	R2 adj.	Lags	Period	Obs
	1	0.3688	-0.2070	2.7263	-0.552633	1	0.567	2	1994-2014	21
t-test		[-4.06759]	[6.52411]	[-6.12749]	[-3.26798]					
V	LMANUF_X	LRXR	C		CointEq1	VC#	R2 adj.	Lags	Period	Obs
	1	0.840535	-1.11491		-0.52571	1	0.486	2	1994-2015	22
t-test		[-2.52397]			[-1.83206]					

Source: Authors´ creation with data from WDI (2016).

The most significant results for Peru lie in Equation I and IV, where the exports of mineral products are positively related to government spending, and the resulting appreciation of the exchange rate results in a diminishing participation of manufactures in national GDP. Although these are the most significant and strong results, the econometric exercise suggests many other weaker effects of Dutch Disease for the countries of the Pacific Alliance, as well as effects that vary according to the period under study.

In the period 1985-2014, in the Chilean economy, the rise in exports of minerals and metals stimulated the increase of public spending by approximately 26%, while the upsurge in exports of raw materials stimulated it by approximately 39% annually. For the Chilean economy, the upturn in exports of minerals and metals stimulated the growth of public spending by approximately 56% annual average in the period 1970-2014[8].

In the case of Mexico and Colombia, countries with periods of oil bonanza, the dependence of public expenditure on the income generated by oil exports and on exports of raw materials was considered. The results point to a strong relationship since the 1990s. In the case of Colombia, in the period 1994-2014, the increase in oil exports stimulated the increase in public spending by approximately 21% a year, while the exports of raw materials stimulated the increase in public spending by approximately 30%, by its annual average. For Mexico, during the period 1990-2015, oil exports stimulated public spending by 26%, while exports of raw materials did so by an annual average of 65%.

The results of Specification II indicate that for the four countries here considered, there is a long-run equilibrium relationship between the logarithm of the real exchange rate and the logarithm of public expenditure. The increase in public spending stimulated the appreciation of the real exchange rate by approximately 55% in Chile (1982-2105), 24% in Colombia (1988-2015), 26% in Mexico (1982-2015) and 19% in Peru (1996-2015)[9].

The increase in fiscal revenues - as a result of the increase in the foreign exchange generated by the bonanzas - through the appreciation of the exchange rate, leads to the reduction of the production of the sectors that are not in export boom, such is the case of manufacturing production. This effect, which is measured in equation III, indicates that for the four nations considered, as discussed above, there seems to be an inverse relationship between the logarithm of manufacturing production in total production and the logarithm of the share of public expenditure in total GDP.

8 For the case of Peru, the calculated cointegration vector refers to a longer period of time, in contrast to the other three countries.

9 For all countries except Peru, an equilibrium relationship has been established between the variables from the 1980s to 2015. In the case of Peru, it was possible to make this specification since 1991, that is to say from the entry into circulation of the new Sun. However, from 1991 to 1995, the relationship between public expenditure and the real exchange rate was not significant, so the model had to be considered from 1996.

Equation III also indicates that per capita GDP and the share of US manufacturing production in total GDP have a direct effect on the weight of manufacturing production in total production. In the case of Chile, Colombia, and Peru, the decline in manufacturing's share of total production has been more pronounced than in Mexico, so the results indicate an inverse relationship with their GDP per capita[10]. The results of the specification IV measure the effect of the appreciation of the real exchange rate on manufacturing production: with the exception of Chile[11], there is a direct equilibrium relationship between both variables. Likewise, the effect of GDP per capita on the percentage of manufacturing production in total GDP is measured, which indicates the same type of relationship obtained with equation III, direct for the case of Mexico and indirect for the rest of the countries. Only in the case of Chile is a long-run equilibrium relationship present between manufacturing production and the money supply.

Finally, the effect of the decline in the real exchange rate on exports of non-bonanza goods, in this case on the weight of manufacturing exports in total exports, is measured. For the four countries, a direct long-term equilibrium relationship is indicated. The results indicate that the Mexican economy is the most affected by the exchange appreciation derived from the good assets that were considered[12].

4. Conclusions

The present article corroborated the presence of various symptoms of the Dutch Disease in the four countries. Only four main symptoms were studied: (a) a positive relationship between export revenues and state income; which results in b) and appreciation of the real exchange rate or increase of the relative prices of non-tradables, a result of monetary expansion and public expenditure; c) declining national production of tradable goods not in boom, induced by the real revaluation, such as manufactures; and d) a reduction of exports of tradable goods that are not booming, such as manufactures, due to the exchange rate appreciation. More specifically, the results point to strong negative relations between government spending and the participation of manufactures in GDP, as well as between these latter and the appreciation of the real exchange rate. Other symptoms of the Dutch Disease are present in the four countries, however at a less significant strength.

10 The results obtained by Alicia (2015b) also point out to a direct relationship between the share of manufacturing in total production with respect to GDP per capita for Mexico, which is indirect for Colombia.

11 In the case of Chile, the type of relationship varies, considering all the years for which there is information of both variables (1980-2015), the model indicates a direct relationship although this is not statistically significant (does not comply with all tests of correct specification) but if the model is made from 1986 onwards, the relation is inverse.

12 Such calculations can be obtained by personal request to the authors. Since it was considered more of a good in good condition, the effect of DD is greater compared to that indicated in Puyana (2015b), although in the case of Chile, a greater effect is expected.

The results presented here suggest that trade liberalization and the expansion of natural resource exports are insufficient to accelerate growth and guarantee labor absorption rates adequate to the growth of the economically active population, as well as to achieve the growth of the total labor productivity necessary for steady increases in revenues. In this context, to propose a pattern of production based on the undervaluation of labor and the depredation of natural resources, would entail several economic effects raised in this article, which would in turn deepen the structural problems of the region and lead the region farther away from economic, political, social and environmentally sustainable development. The present study must be complemented by taking into account important economic variables such as income disparities, poverty employment and productivity.

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