

Economic growth, international trade and debt: A model to understand developed and non-developed countries

Ariel Bernardo Ibañez Choque*

* PhD. (c) in Economic Sciences at *Universidad Autónoma Metropolitana de México* and Specialist in Economic History by *Universidad Nacional Autónoma de México*. Bachelor's Degree in economics and Master in Economic Development at *Universidad Mayor de San Andrés* of Bolivia. (e-mail: aibanez@comunidad.unam.mx)

This paper is a result of a visiting research period in Latin and Latinx American Studies Program (LLaS) and Economic Department of University of Missouri-Kansas City (UMKC) during Spring Semester 2018.

Disclaimer: The contents of this document is responsibility of the author and does not compromise the opinion of the Central Bank of Bolivia.

ABSTRACT

This paper has the objective to show the external performance of the relationship between developed and non-developed countries in the international trade. Particularly, it focusses on the effects of external debt and rate of interest payments on the rate of economic growth. Previous papers have not deepened enough on certain net surplus trade balance economies and their trade relationship with net deficit economies. So, our innovation is a new analytical system to explain the rate of economic growth in a hypothetical world economy with two asymmetric countries in their balance of payments and economic structures. This system shows four mechanisms of dependency between developed and non-developed countries in the international trade: “terms of trade”, “trade exchange ratio”, “debt and interest”, and “economic structure”. Usually, these mechanisms favor long-term performance of developed economies, but punish non-developed economies. Then, contrary to what mainstream proposed, trade liberalization is not enough to guarantee the economic development of non-industrialized economies.

JEL Classification: *B59, C22, E12, F43, O11*

Keywords: *Economic growth, international trade, external debt, dependency, industrialization*

Crecimiento económico, comercio internacional y deuda externa: Un modelo para entender la relación entre países desarrollados y no desarrollados

Ariel Bernardo Ibañez Choque**

** Candidato a Doctor en Ciencias Económicas por la Universidad Autónoma Metropolitana de México y Especialista en Historia Económica por la Universidad Nacional Autónoma de México. Licenciado en Economía y Maestro en Desarrollo Económico por la Universidad Mayor de San Andrés de Bolivia. (correo: aibanez@comunidad.unam.mx)

Este artículo es resultado de un periodo de investigación en el Departamento de Estudios Latinoamericanos y el Departamento de Economía de la Universidad de Missouri-Kansas City durante el semestre de primavera del año 2018.

El contenido del presente documento es responsabilidad del autor y no compromete la opinión del Banco Central de Bolivia.

RESUMEN

Este artículo tiene el objetivo de mostrar el desempeño externo de la relación entre países desarrollados y no desarrollados en el comercio internacional. En particular, se enfoca en los efectos de la deuda externa y la tasa de interés en la tasa de crecimiento económico. Anteriores investigaciones no han estudiado suficientemente ciertas economías superavitarias netas en balanza comercial y su relación comercial con las economías deficitarias. La innovación de este artículo es un nuevo sistema analítico para explicar la tasa de crecimiento económico en una economía mundial hipotética con dos países asimétricos en su balanza de pagos y en sus estructuras económicas. Los resultados de este sistema muestran cuatro mecanismos de dependencia entre países desarrollados y no desarrollados en el comercio internacional: “términos de intercambio”, “relación de intercambio”, “deuda e intereses” y “estructura económica”. Por lo general, estos mecanismos favorecen el desempeño de largo plazo de las economías desarrolladas, pero castigan a las economías no desarrolladas. Luego, la liberalización del comercio, contrariamente al consenso dominante, no es suficiente para garantizar el crecimiento económico de las economías no industrializadas.

Clasificación JEL: B59, C22, E12, F43, O11

Palabras clave: Crecimiento económico, comercio internacional, deuda externa, dependencia, industrialización

I. Introduction

The currently mainstream theory argues the universal benefits of free and international trade. The “comparative advantages” of each economy through market mechanism produce the best possible result. It means that economic specialization and labor international division will produce a joint prosperity (Helpman, 2014).

Also, the orthodox neoclassical theory of economic growth proposes an “absolute convergence” process of income and wealth between different economies. The decreasing returns to scale by each production factor in more developed countries, produces higher rates of economic growth of low-income countries than high-income countries. This process stops when their levels of income are equal (Barro and Sala-i-Martin, 2009). Then, the low capital per capita in non-developed countries¹ will generate an absolute convergent process with the rest of the world.

However, the universal benefits of free and international trade are questioned by the reality of world market. In fact, the “comparative advantages” in the international trade could be more beneficial in industrialized economies than non-industrialized economies. Moreover, most of economies abundant in natural resources have “comparative disadvantage” in the world market because of the “resource curse”. Their specialization in natural resources has caused economic enclaves, extractive activities, capital outflows, rent seeking behavior and corruption structures.

Similarly, the absolute convergence process is a criticized result of orthodox theory. Actually, from XIX Century until the present, there is a constantly “absolute divergence” process on income and wealth between industrialized and non-industrialized economies. Since then, the exclusive club of developed countries has remained almost unchanged. The scarce cases of convergence, as “Asian tigers” cases, seem to be more a result of an industrial policy than a result of market

1 In this paper the term “non-developed” countries or economies is used, instead of “developing” countries or economies because, according to the fifth section, a developing country or economy implies a “structural change” into a process of industrialization and diversification of its economic structure.

mechanism. Likewise, foreign capital and external debt for investments in low-income countries have resulted in a double-edged weapon. Frequently, external debt has generated external crises and deep economic recessions over non-developed countries. In effect, Latin America countries suffered its last external debt crisis on the beginning of 1980' and it produced a 10 years recession period called "the lost decade".

Then, the objective of this paper is to show the external performance of the relationship between developed and non-developed countries in the international trade. The proposed model could be superior to neoclassical model because it is more consistent with the reality, particularly with non-industrialized countries. In that sense, the model provides an original and alternative explanation to divergence economic growth process into international trade. The model's results show four mechanisms of "dependency" in the world market that determine the long-term economic performances: "terms of trade", "trade exchange ratio", "debt and interest", and "economic structure". Usually, these dependency relations work against non-industrialized economies and generate vicious circles of economic growth.²

II. A hypothetical world economy

In relation to the purpose of this paper, it begins from an abstract world with the following characteristics:

- The world is a whole within two different economies: D (developed) and ND (non-developed).
- D and ND exchange commodities, services and capital.
- Prices in the world market are given.
- The aggregate demand is the center of activity, then production factors are elastic to the aggregate demand.

2 Fortunately, a half of these results were discussed previously by the Latin American Structuralism and Latin American Dependency theories (Rodríguez, 2006). Then, additionally this paper tries a first dialogue between these theories and the heterodox theory of economic growth.

- The long-term is an historical sequence of production events.
- Only exports are the autonomous component of the aggregate demand.

At the same time, the model of international trade between D and ND will be as following:

$$\text{- Export demand} \quad X_t = A \left(\frac{P_{X_t}}{P_{M_t} E_t} \right)^\eta Z_t^\varepsilon \quad (1)$$

$$\text{- Import demand} \quad M_t = B \left(\frac{P_{M_t} E_t}{P_{X_t}} \right)^\psi Y_t^\pi \quad (2)$$

$$\text{- Balance of payments} \quad P_{X_t} X_t + C_t = P_{M_t} E_t M_t + D_t \quad (3)$$

The exports demand (X_t) is a constant elasticity (A) function of internal prices of exports (P_{X_t}), external prices of imports (P_{M_t}), nominal exchange rate (E_t), and the external income (Z_t), where $\eta < 0$ is the price elasticity of exports and $\varepsilon > 0$ is the income elasticity of exports. The import demand (M_t) is a constant elasticity (B) function of internal prices of exports (P_{X_t}), external prices of imports (P_{M_t}), nominal exchange rate (E_t), and the internal income (Y_t), where $\psi < 0$ is the price elasticity of imports and $\pi > 0$ is the income elasticity of imports. The capital inflows (C_t) represents capital incomes, preferably from external source, and capital outflows (D_t) represent payments of external debt service.

III. General model of balance-of-payments-constrained economic growth

Thirlwall (1979, 2002, 2011) proposed the seminal model of economic growth restricted by balance of trade. His model was original and empirically robust in predict the rate of economic growth of a set of countries. So currently, his equation of economic growth is known as Thirlwall's Law. Subsequently, Thirlwall and Hussain (1982) incorporated net capital flows in the model. They found that if an economy wants to compensate the effect of a disequilibrium in its current account over its rate of economic growth, then it should have a growth rate of capital inflows equal to the sum of growth rate of exports and domestic prices.

After, Elliott and Rhodd (1999) expanded the model including the debt service. Their model shows the negative impact of rate of debt service growth over rate of economic growth. Following, it presents the general model of an open economy with capital inflows and capital outflows.

Applying logarithms and deriving over time on (1), (2) and (3), it results the next system:

$$x = \eta(p_X - p_M - e) + \varepsilon z \quad (4)$$

$$m = \psi(p_M + e - p_X) + \pi y \quad (5)$$

$$\lambda(x + p_X) + (1 - \lambda)c = \theta(p_M + e + m) + (1 - \theta)d \quad (6)$$

The lowercase letters represent the growth rate of each variable³. Also,

$$\lambda = \frac{P_{Xt} X_t}{P_{Xt} X_t + C_t}, \quad 1 - \lambda = \frac{C_t}{P_{Xt} X_t + C_t}, \quad \theta = \frac{P_{Mt} E_t M_t}{P_{Mt} E_t M_t + D_t} \quad \text{and} \quad 1 - \theta = \frac{D_t}{P_{Mt} E_t M_t + D_t}.$$

It means that balance of payments growth rate depends of relative weight of its terms.

Solving the system (4), (5) and (6) for the rate of economic growth:

$$y = \frac{1}{\pi} \left[\left(\frac{\lambda}{\theta} - 1 \right) p_X + \left(1 + \frac{\lambda}{\theta} \eta + \psi \right) (p_X - p_M - e) + \frac{\lambda}{\theta} \varepsilon z + \left(\frac{1 - \lambda}{\theta} \right) c - \left(\frac{1 - \theta}{\theta} \right) d \right] \quad (7)$$

According to (7), the elasticity income of import demand is inversely related with the rate of economic growth (π). The external income growth (z) weighted by the elasticity income of exports has a positive impact over the rate of economic growth. The growth of capital income (c) affects positively the rate of economic growth. In contrast, the growth of capital outflows, like the debt (d), impact negatively on the rate of economic growth. Additionally, as $\eta < 0$ and $\psi < 0$, the effect of terms of trade over the economic growth rate depends on:

- i. $\frac{\lambda}{\theta} \eta + \psi \leq -1$, in this case the effect will be direct or zero;

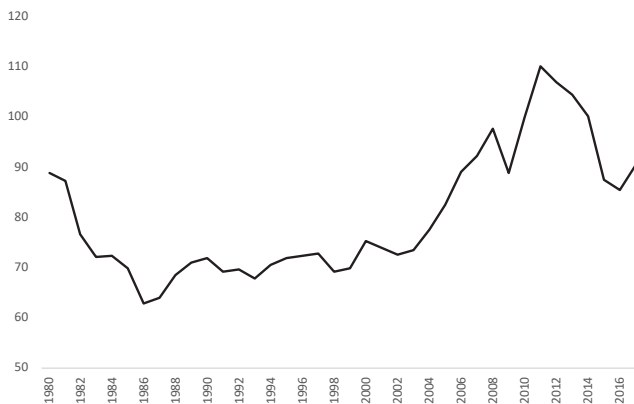
3 For example, in the case of the growth rate of product or income: $y = \frac{Y_t'}{Y_t} = \frac{\partial Y_t}{Y_t}$.

- ii. $\frac{\lambda}{\theta} \eta + \psi > -1$, in this case the effect will be inverse; it's the dynamic equivalent of Marshall-Lerner condition about a positive impact of a depreciation of exchange rate (e) over the economic growth rate (Thirlwall, 2011).

Then, in absence of Marshall-Lerner condition, a “deterioration of terms of trade” ($p_X - (p_M + e) < 0$) or an “improvement of terms of trade” ($p_X - (p_M + e) > 0$) negatively or positively affects the rate of economic growth, respectively.

Indeed, in the fifties Prebisch (1950) showed the process of “deterioration of terms of trade” for Latin American countries in the international trade. He argued that technological change into developed countries factories -center-, and its absence into Latin American countries industrial structures -periphery-, was the main reason that explains the process of “deterioration of terms of trade”. At the same time, he supported the necessity of industrialization, protection and promotion of technological change processes in Latin American countries in order to improve their terms of trade and their economic growth.

Figure 1: LATIN AMERICA & THE CARIBBEAN TERMS OF TRADE, 1980-2017 (Index 2010=100)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), CEPALSTAT 2017 (<https://estadisticas.cepal.org/cepalstat/Portada.html>).

Currently, Figure 1 shows continued periods of deterioration of Latin American terms of trade. In the 80's, this region suffered a radical contraction of its terms of trade. Then, in the 90's Latin America could not overcome the contraction effect of previous decade. From 2004 to 2011, this region begun a process of improvement of its terms of trade, but with a short contraction in 2009 as an effect of financial crisis. Finally, over the last six years Latin America is into a new process of deterioration of its terms of trade, in fact, the index of its terms of trade in 2017 is similar to that of 1980.

The terms of trade depend on international division of labor, industrial and socioeconomic structures, technological development, and the prevailing grade of monopoly into the global market (Prebisch, 1950; Ibañez et al., 2016). Therefore, this is the first relationship of dependency that arises in the international trade: the relationship of "terms of trade". In absence of Marshall-Lerner condition, the deterioration of terms of trade for some economies implies the improvement of terms of trade for others. This is one of the determinants that makes that as growth rate is higher in technological countries, it is lower in non-technological countries. Then, terms of trade relationship could imply the dependency between developed and non-developed countries.

Now, as Thirlwall (1979, 2002) proposed exclusively for simplicity, this paper assumes that $p_x = p_M + e$.⁴ It means that in the long-term the growth rate of prices both of exports and imports are constant. So, the non-price competition is more important for economic growth over the long-term (McCombie and Roberts, 2005)⁵. Thus, equation (4) becomes $x = \varepsilon z$, and equation (7) turns into:

$$y = \frac{1}{\pi} \left[\left(\frac{\lambda}{\theta} - 1 \right) p_x + \frac{\lambda}{\theta} x + \left(\frac{1-\lambda}{\theta} \right) c - \left(\frac{1-\theta}{\theta} \right) d \right] \quad (8)$$

4 Apparently, Figure 1 contradicts this assumption, but the assumption of constant terms of trade is a simplifying assumption. In fact, equation (7) shows that terms of trade and trade exchange ratio have simultaneously effects over the economic growth rate.

5 Price competition in the international trade is known as "currency war". It implies a career of depreciation of nominal exchange rate with the purpose of improve the international competitiveness. The price competition implies constant depreciation of nominal exchange rate and it doesn't have effect in the long run because it would be anticipated by the market. (Ibañez, 2012; Ibañez et al., 2016; McCombie and Roberts, 2005).

Giving (8) with constants terms of trade, the effect of growth rate of prices ($p_X = p_M + e$) over the rate of economic growth depends on the ratio $\frac{\lambda}{\theta}$. And this fraction represents the ratio between the value of exports and the value of imports:

$$\frac{\lambda}{\theta} = \frac{P_{Xt} X_t}{P_{Mt} E_t M_t} \quad (9)$$

The ratio $\frac{\lambda}{\theta}$ can be greater, lesser or equal to one, i.e., it expresses if an economy has surplus, deficit or evenness in its balance of trade. Let's analyze these three cases:

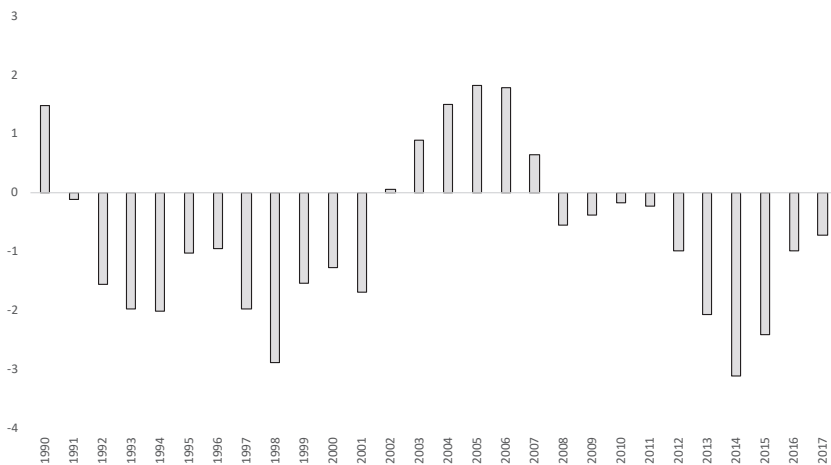
- i. Surplus: If $\frac{\lambda}{\theta} > 1 \rightarrow P_{Xt} X_t > P_{Mt} E_t M_t$, then the rate of price growth p_X or $p_M + e$ will be a positive effect over the rate of economic growth.
- ii. Deficit: If $0 < \frac{\lambda}{\theta} < 1 \rightarrow P_{Xt} X_t < P_{Mt} E_t M_t$, then the rate of price growth p_X or $p_M + e$ will be a negative effect over the rate of economic growth.
- iii. Equality: If $\frac{\lambda}{\theta} = 1 \rightarrow P_{Xt} X_t = P_{Mt} E_t M_t$, then the rate of price growth doesn't have any effect over the rate of economic growth.

Moreover, the equation of economic growth becomes: $y = \frac{x}{\pi}$.

This expression corresponds to the seminal model and it is known as "Thirlwall's Law".

Then, this result shows the second relationship of dependency in the international trade: "trade exchange ratio" relationship. If an economy has not equality in the balance of trade, then it will affect its rate of economic growth. Surplus economies will win a positive additional effect over their rate of economic growth, but, at the same time, deficit economies will lose the same effect over their rate of economic growth.

**Figure 2: LATIN AMERICA & THE CARIBBEAN TRADE BALANCE,
1990-2017
(% of GDP)**



Source: Economic Commission for Latin America and the Caribbean (ECLAC), CEPALSTAT 2017 (<https://estadisticas.cepal.org/cepalstat/Portada.html>).

Indeed, according to Figure 2 Latin America and the Caribbean has a structural deficit in trade balance, i.e., a negative trade exchange ratio relation with the rest of the world. From the 90's to 2001, this region was absolutely in deficit with a lowest pick in 1998, period that was into the context of Tequila crisis in Mexico and the Samba Crisis in Brazil. Then, during the next six years, Latin America and the Caribbean had surplus in its trade balance with a highest peak in 2005. Finally, from 2008 and with the beginning of the financial crisis, Latin America and the Caribbean returned to deficit in balance of trade. Then, according to equation (8) this deficit trade exchange ratio relation might explain the low performance of Latin America and the Caribbean's economic growth.

Therefore, there is a perverse incentive in the world market to produce trade exchange ratio dependency. That was the principle of colonialism in the first globalization process in America between XVI-XVIII centuries: "*all benefits for the metropolis*" [Marx, 1867 (2005); Dussel, 1992; Semo, 2016]. Moreover, in the currently new age of globalization this

principle of dependency in the world market becomes “*the imperialism in the twenty-first century*” (Smith, 2016). Indeed, the “trade exchange ratio” relationship is not only an economic issue, it is also a geopolitical issue that expresses the background of world market powers.

IV. Model of two economies with interest rate on debt

Elliott & Rhodd (1999) were the first to incorporate debt servicing in the balance of payments. Ferreira & Canuto (2003) added net payments of interest, dividends and profits. They found a negative effect of debt payments or net capital payments over the income growth rate. Moreno-Brid (2003) explicitly added into the general model net interest payments separated from capital flows. He showed the negative impact of interest payments over the rate of economic growth. Alleyne & Francis (2008) incorporated interest payments and net transfers and found countervailing effects between both of them. Vera (2006) did a north-south model -this model is the precedent of this section- incorporating net capital flows and inflows between two asymmetric economies. He identified the positive impact of the growth rate of net capital surplus by a North region which represents developed countries, and the negative effect of net capital debt by the South region or developing countries, over their rates of economic growth. But, unfortunately, all of them did not study the specific role of interest rate, in terms of a price, in the long-term economic growth. Then, in this section the innovation is to introduce, explicitly, the interest rate on debt (i_t) through the capital market.

This paper assumes that a developed economy (D) has a net surplus in balance of trade (C_t), then a non-developed economy (ND) will be a net debtor ($(1+i_t)D_{t-1}$). Thus, their balance of payments will be:

- D's balance of payments⁶

$$P_{D,t} X_{Dt} + (1+i_t)D_{t-1} = P_{D,t} E_{Dt} M_{Dt} + C_t \quad (10)$$

6 The sub index “D” denotes Developed economy.

- ND's balance of payments⁷

$$P_{ND,X_t} X_{NDt} + C_t = P_{ND,M_t} E_{ND,t} M_{ND,t} + (1+i_t) D_{t-1} \quad (11)$$

D_{t-1} is a constant and represents the previous capital surplus in the world market. At the same time, D_{t-1} is an income as returns of capital for D and an outflow for ND as debt and interest payments.

Solving (10) and (11) with their respect exports demand (1) and imports demand (2)⁸:

$$y_D = \frac{1}{\pi_D} \left[\left(\frac{\tau}{\sigma} - 1 \right) p_{D,X} + \left(1 + \frac{\tau}{\sigma} \eta_D + \psi_D \right) (p_{D,X} - p_{D,M} - e_D) + \frac{\tau}{\sigma} \varepsilon_D z + \frac{\beta}{\sigma} r - \left(\frac{1-\sigma}{\sigma} \right) c \right] \quad (12)$$

$$y_{ND} = \frac{1}{\pi_{ND}} \left[\left(\frac{\alpha}{\theta} - 1 \right) p_{ND,X} + \left(1 + \frac{\alpha}{\theta} \eta_{ND} + \psi_{ND} \right) (p_{ND,X} - p_{ND,M} - e_{ND}) + \frac{\alpha}{\theta} \varepsilon_{ND} z - \frac{\gamma}{\theta} r + \left(\frac{1-\alpha}{\theta} \right) c \right] \quad (13)$$

where, r is the growth rate of the interest rate on debt⁹,

$$\beta = \left(\frac{i_t D_{t-1}}{P_{D,X_t} X_{Dt} + (1+i_t) D_{t-1}} \right) \text{ and } \gamma = \left(\frac{i_t D_{t-1}}{P_{ND,M_t} E_{NDt} M_{NDt} + (1+i_t) D_{t-1}} \right).$$

Maintaining as a purpose focusing over the role of debt and interests payments over the rate of economic growth, let's introduce the assumption that $p_X = p_M + e = 0$ (as Elliott & Rhodd, 1999). It represents the assumption that relative prices of international trade will be constant in the long-term. Then,

$$y_D = \frac{1}{\pi_D} \left[\frac{\tau}{\sigma} x_D + \frac{\beta}{\sigma} r - \left(\frac{1-\sigma}{\sigma} \right) c \right] \quad (14)$$

$$y_{ND} = \frac{1}{\pi_{ND}} \left[\frac{\alpha}{\theta} x_{ND} - \frac{\gamma}{\theta} r + \left(\frac{1-\alpha}{\theta} \right) c \right] \quad (15)$$

7 The sub index "ND" denotes Non-developed economy.

8 Appendix contains the analytical model and its solution.

9 $r = \frac{\dot{i}_t}{i_t} = \frac{\partial i_t}{i_t}$

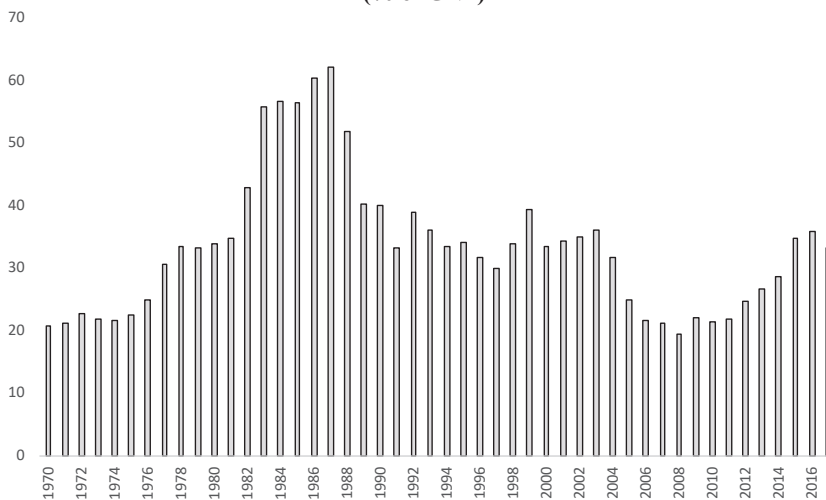
The system (14)-(15) is a new proposal to this paper to understand the dynamic growth relation between developed and non-developed countries. Therefore, giving (14) and (15), these results show the third relationship of dependency in the world market: the “debt and interest” relationship. The first one, the growth rate of capital surplus imposes an incentive over developed economy to reduce its capital outflows or foreign investments because it inversely impacts on its rate of economic growth. For a non-developed economy, that incentive becomes negative for its financing needs because it reduces the capital supply in the world market and increases interest rate on debt. According to this, the increases of interest rate on debt impose a punishment to non-developed economy’s rate of economic growth, and a reward to developed economy’s rate of economic growth.

As a result, there is a perverse mechanism of “debt and interest” dependency in the capital market regarding an arbitrary manage because of an advantageous position of developed economies to control the interest rate on debt from the capital supply side. This position is widely favorable for surplus developed economies because they can use part of their capital surplus into their domestic economies and they can improve their rate of economic growth through increase of interest rates on debt. By contrast, non-developed economies must accept certain interest rates on debt and allocate internal savings as shocks absorber against negative impact on its rate of economic growth.

Indeed, Latin American countries, usually deficit trade economies, have suffered recurring external debt crises since they became independent states¹⁰. Volatility of foreign capital flows generates external vulnerability in the economic performance of Latin America countries (Bértola and Ocampo, 2013)

10 Historically, England (XIX century) and United States (XX century) financial systems were the source of capital surplus in Latin America international trade (Bértola and Ocampo, 2013).

Figure 3: LATIN AMERICA AND THE CARIBBEAN EXTERNAL DEBT STOCK, 1970-2017
(% of GNP)



Source: World Bank Data Base 2018 (<https://www.data.worldbank.org/>). These series exclude Latin American high-income countries¹¹: Chile, Uruguay, Panamá, Bahamas, etc.

According to Figure 3, Latin America and the Caribbean's external debt stock have cyclical dynamics. In the last fifty years, the high peaks show periods of debt crisis some deeper than others. That was the case of Latin America "external debt crisis" in the '80s. Ten years before, the United States unilaterally left the Bretton Woods agreements and dollar parity in 1971. Also, in 1973 the Organization of the Petroleum Exporting Countries (OPEC) duplicated the oil price and stopped exporting oil to the United States¹². Then developed countries became in a stagflation crisis and, at the same time, the world market was plenty of petrodollars. During '70s, Latin American countries used those foreign capital inflows to sustain their economic growth. As a result, the Latin America debt rose from 68 billion dollars in 1975 to 318

11 To see the list of countries: <https://datos.bancomundial.org/indicador/DT.DOD.DECT.GN.ZS?locations=XJ>.

12 This was a geopolitical policy of OPEC, because the United States supported to Israel in its previous war against Egypt and Syria (Marichal, 2010).

billion dollars in 1982, an exponential increase of 368% in only seven years. But, between 1980 – 1982, the United States implemented a restrictive monetary policy to reduce inflation and increase its domestic interest rate. So, at the beginning of the '80s the supply of capital in the world market fell suddenly and debt-service payments increased radically. The debt-service payments for non-developed countries grew from 20 billion dollars in 1981 to 100 billion dollars in 1982. In August^{20th}, 1982, Mexico led an “international crisis” of external debt by announcing the suspension of debt payments. Quickly the rest of Latin American countries followed it. (Marichal, 2010)

After the collapse of Latin America debt payments, the mechanism of “debt and interest” dependency relationship operated through the debt renegotiation. The multilateral financial organisms and private financial banks of developed countries imposed to Latin American countries several recessive policies: openness trade, privatizations, exchange rate devaluation, reduction of government budget, and use of revenues from natural resources for debt-service payments. During 80's those policies generated recession and hyperinflation in Latin America, period that was called the “lost decade”. Currently, the external debt and its interest rate are still determinants of development and economic growth of Latin American countries.

V. Economic structure and structural change

The objective of this section is to analyze the dynamics of economic structure, then it assumes evenness in balance of trade ($P_{X_i} X_i = P_{M_i} E_i M_i$). It is the third case of general model of balance-of-payments-constrained economic growth¹³. Therefore, (14) and (15) becomes¹⁴:

$$- \quad D's \text{ rate of economic growth} \quad y_D = \frac{1}{\pi_D} x_D = \frac{\varepsilon_D}{\pi_D} y_{ND} \quad (16)$$

$$- \quad ND's \text{ rate of economic growth} \quad y_{ND} = \frac{1}{\pi_{ND}} x_{ND} = \frac{\varepsilon_{ND}}{\pi_{ND}} y_D \quad (17)$$

13 See the third section of this paper.

14 If $P_{X_i} X_i = P_{M_i} E_i M_i$, then $c = 0$, $r = 0$, $\frac{\tau}{\sigma} = 1$ and $\frac{\alpha}{\theta} = 1$, because there is no capital surplus and debt in the balance of payments of developed and non-developed countries, respectively.

These equations, (16) and (17), show the interrelationship of rates of economic growth of a developed economy (D) and a non-developed economy (ND). Therefore, the difference or equality between these rates of economic growth depends on structural parameters of each economy. Depending on structural relationship between income elasticity of exports and income elasticity of imports, there are three possible cases:

Table 1: TYPES OF ECONOMIC STRUCTURE

	<i>Structural Relationship</i>	<i>Income elasticity of imports</i>	<i>Rate of economic growth</i>
Developed and industrialized economy (D)	$\pi_D < \varepsilon_D$	$\pi_D < 1$	$y_D > (x_D = y_{ND})$
Balanced structure economy	$\pi_{D,ND} = \varepsilon_{D,ND}$	$\pi_{D,ND} = 1$	$y_D = x_{D,ND} = y_{ND}$
Non-developed economy (ND)	$\pi_{ND} > \varepsilon_{ND}$	$\pi_{ND} > 1$	$y_{ND} < (x_{ND} = y_D)$

Source: Ibañez et al. (2016) p. 60

The first case of Table 1 is an economy with income elasticity of imports less than income elasticity of exports. It expresses an industrialized economic structure enough to respond to increases of domestic and external incomes. In other words, its production system is capable to provide goods and services to domestic and world markets when the wealth grows. Usually an economy like this exports final goods and imports commodities -energy and raw material-. As a result, its rate of economic growth will be greater than the rest of the world. Then, this economy will increasingly become in a developed and industrialized economy (D).

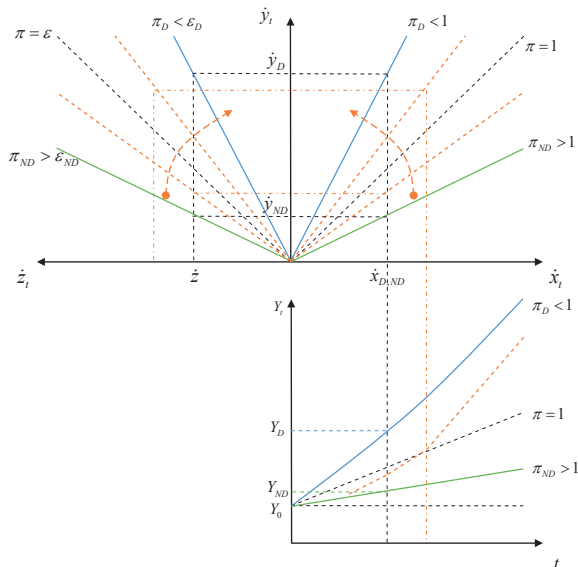
In contrast, the third case of Table 1 is an economy with income elasticity of imports greater than income elasticity of exports. Such an economy has problems to assimilate its own income increases into its production system. Then, it gets goods and services that cannot produce by itself from the world market. Typically, this economy exports exhaustible natural resources which are used in the production system of developed and industrialized economy (D). Likewise it has problems of export diversification. So, its rate of economic growth will be less than

D's rate of economic growth. Consequently, this economy will become an extractive and an increasingly non-developed economy (ND).

Finally, the second case of Table 1 is a balanced structure economy. This has the same rate of economic growth than the rest of the world. It is a result of the parity of income elasticity of exports and income elasticity of imports. It doesn't mean an equalization or homogenization of its production system with the world market. Moreover, there are different economic structures in the world market. But in this case there is a complementary and cooperative behavior between its economic structure and the rest of the world in front of increases of wealth.

In these three cases, the economic dynamics in the long-term will be different. To focus on it, we will assume these economies begin to exchange in the world market with the same income level and growth rate of exports, as shown below:

Figure 4: GENERAL DYNAMIC MODEL AND STRUCTURAL CHANGE



Source: Ibañez et al. (2016) p. 59

Note: In this graph we assume that developed economy (D) in blue color and non-developed economy (ND) in green color have the same export growth rate and the same initial level of income (Y_0). Orange lines represent the process of structural change.

According to Figure 4, economies that open to international trade, even with the same income level and the same growth rate of exports at the beginning, could have different economic performances just for having different economic structures. In the first period, the industrialized economy (blue line) will be ahead to balanced economy (black line) and non-industrialized economy (green line). If everything remains constant, this gap between them will grow in each period. Then, the industrialized economy will become in an increasingly developed economy, but balanced economy and non-industrialized economy will become in non-developed economies. In other words, against what mainstream proclaims, external openness and international trade are not enough to generate a convergent economic growth in the world market.

In that sense, the “structural relationship” is the fourth relationship of dependency in the world market. A non-industrialized economy has a vicious circle of development: $\pi_{ND} > \varepsilon_{ND} \leftrightarrow y_{ND} < y_D$. It means that this ND economy which exports exhaustible natural resources will be constantly in a worse condition than the developed economy. It also develops an extractive and sparsely diversified economy with socioeconomic pathologies known in Economics literature as “resource curse”. In contrast, industrialized economy has a virtuous circle of development: $\pi_D < \varepsilon_D \leftrightarrow y_D > y_{ND}$. It permits to this economy D strengthens its industrialized economic structure. Then, there is not a world market mechanism to convergence between different economies.

In fact, resource curse is a denomination of natural resource abundant and scarcely industrialized economies which tends to grow slower than industrialized and developed economies (Saravia, 2009). An economy that has such a curse has “Dutch disease” symptoms: appreciated real exchange rate because of natural resources abundance (Ellman, 1981; Bresser-Pereira, 2008). Moreover, it implies a deindustrialization process as result of a non-competitive exchange rate, reduction of investments, increase of intermediate goods imports, and contraction of industrial sector (Bresser-Pereira, 2008). At the same time, abundance of natural resources produces investments instability in the long run through

volatility of commodity prices (Gylfason et al., 1999), and external debt problems by requesting excessive loans (Mansoorian, 1991). In addition, rents from natural resources without strong institutions usually generate “extractive institutions” that promote rent seeking behavior punishing economic development (Acemoglu and Robins, 2012).

In Latin America, that is the case of Bolivia. Bolivia is a mineral and oil export country. Its exports of exhaustible natural resources represent more than 80% of its total exports. Since the beginning of XXI century, Bolivian exports has been exponentially concentrated in natural gas. Currently, its good imports value is fifteen times its good exports value. At the same time, Bolivia’s imports quantity double its exports quantity. Bolivian exports don’t innovate in new goods neither in new markets, but its imports increase in goods and markets. It means that Bolivia’s economic structure is weak and insufficient in front of world market. Therefore, Bolivia has experimented a lousy export diversification and a reverse process of import substitution. Rents from natural resources has potentiated extractive institutions like economic power concentration and rent seeking behavior. (Ibañez et al., 2016; Gavincha, 2015; Ibañez, 2018, 2012, 2014; Arevilca and Risso, 2007) Thus, Bolivia is an example of non-developed economy into a vicious circle of development in Latin America.

Returning to the model, a convergent dynamic model needs non-developed economy changes its structural relationship parameters to reach developed economy. In Figure 1, this process is represented by orange line. It is the process of “structural change” and implies the transformation process from a non-industrialized economy to a diversified and industrialized one. Then, the condition of convergence in the long-term is:

$$(Y_{ND} = Y_D) \leftrightarrow (y_{ND} = y_D) \leftrightarrow \left(\frac{\varepsilon_{ND}}{\pi_{ND}} = \frac{\varepsilon_D}{\pi_D} \right)$$

This condition expresses that if a non-developed economy ($\pi > \varepsilon$) tends to export more than to import ($\pi < \varepsilon$) it will achieve the income and wealth level of a developed economy.

The purpose of structural change process is to close the technological gap between non-developed and developed countries in the world market. For a non-developed economy, the means to achieve it and to accomplish high rates of economic growth is the reallocation of rents from natural resources to “knowledge intensive” and “dynamic demand” sectors. The “efficient dynamic of productive structure” implies technological innovation, creation of investment opportunities, new technological sectors, productivity and employment increases, export diversification, internal and external demand expansion, and industrialization (CEPAL, 2014; Cimoli et al., 2015). In the case of non-developed economies, it is to return to discussions about industrial policies, efficient protectionism policies and import substitution policies (Thirlwall, 2002).

The best examples of structural change processes are some Asian countries called “Asian tigers”. In contrast, outcomes from periods of high rates of economic growth in Latin America were strongly used in social politics, but weakly or insufficiently used in industrial policies. As a result, between 1980 - 2010, productivity and employment in Latin America have constantly decreased (CEPAL, 2014). In fact, between 1975 –2010, technological gap has benefited developed countries productivity more than non-developed countries. Particularly, the technological gap weighted by primary education has negatively affected factors productivity in non-developed countries (Velasquez and Quispe, 2017).

VI. Conclusions

In the absence of structural change, free trade and liberalization an economy is not enough to provide a convergent process of economic growth in the world market. This paper provides four mechanisms of dependency relationships in the international trade. These mechanisms systematically improve the economic development of industrialized economies, but reduce the economic development of non-industrialized economies. Indeed, from classical Latin American structuralists to current ECLAC propositions, the absence of industrialized economic structures is the key problem to achieve a convergent and sustainable economic development in non-industrialized economies.

The general model of balance-of-payments-constrained economic growth shows the “terms of trade” and “trade exchange ratio” dependency relations in the world market. A deterioration of terms of trade could impact negatively over the rate of economic growth, but an improvement of terms of trade could affect positively over the rate of economic growth. Unfortunately, non-developed countries had been frequently involved into deterioration of terms of trade processes. Also, a surplus in balance of trade produces a positive impact of prices on the rate of economic growth, but a deficit in balance of trade generates a negative impact over the economic growth. Historically, non-developed countries have experimented long periods of deficit in current account and their geopolitical implications. So, terms of trade and trade exchange ratio have benefited the rate of economic growth in developed countries at the expense of decreasing the rate of economic growth in non-developed countries.

The system presented in this paper is a new and innovative extended model with interest rate on debt and shows the “debt and interest” dependency relationship in the international trade. The growth of capital surplus in the world market positively impacts on the rate of economic growth in deficit and non-developed economies, but negatively on the rate of economic growth of surplus and developed economies. At the same time, changes of interest rates on debt affects negatively the rate of economic growth in non-developed economies, but positively the rate of economic growth of developed economies. There is a perverse mechanism in developed economies to arbitrary reduce capital supply in the world market in order to increase interest rate on debt and thus improve their rate of economic growth. Indeed, only developed countries and their financial sectors has sufficient power to control capital supply and interest on debt. Frequently, in front of their financial needs, non-developed countries don't have other options but to accept these unfavorable conditions. This perverse mechanism of dependency can generate deep economic crisis in non-developed economies like the debt crisis in Latin America during the 'lost decade'.

The analysis of economic structure and structural change shows the “structural relation” of dependency in the world market. The structural ratio of income elasticity of exports over income elasticity of imports

reflects a type of economic structure and determines the rate of economic growth. Non-industrialized economies are immersed in a vicious circle of development: structural ratios less than the unit produce rates of economic growth less than the rates of economic growth in industrialized economies. In contrast, industrialized economies are immersed in virtuous circle of development: structural ratios higher than the unit produce rates of economic growth higher than the rates of economic growth in non-industrialized economies. Then, this paper shows that there is not a world market mechanism to convergence between industrialized and non-industrialized economies. In fact, the mechanism of convergence is an extra-market means: the process of structural change. It implies the transformation process from non-industrialized economies to diversified and industrialized economies to overcome the structural relation of dependency in the international trade.

This paper suggests that future researches should focus on the role of trade exchange rate over the rate of economic growth. It implies to leave the assumption of non-price competition in the model. It will provide a better explanation of long-term economic growth and a fertile dialogue with theories of Dutch Disease for non-industrialized and abundant resource economies. Also, future researches should deepen the discussion between structuralist and dependency theories and the heterodox theory of economic growth. It will be an academic success because, as this paper showed, there are important number of coincidences to complement and to enrich the theory of economic development. Finally, empirical estimations of the four-dependency mechanism between developed and non-developed countries will be determinant to improve the system proposed in this paper.

References

- ACEMOGLU, D. and J. ROBINSON (2012). *Why nations fail: The origins of power, prosperity, and poverty*, Profile Books Ltd., London
- ALLEYNE, D. and A. A. FRANCIS (2008). "Balance of Payments-Constrained Growth in Developing Countries: A Theoretical Perspective" *Metroeconomica*, 59 (2), pp. 189 - 202
- AREVILCA, B. and W. A. RISSO (2007). "The balance of payments constrained growth model: empirical evidence for Bolivia, 1953-2002", *Revista de Humanidades y Ciencias Sociales*, 3 (edición especial), pp. 187 – 219
- BANCO MUNDIAL (2018). "Datos de libre acceso del Banco Mundial". Disponible en <https://www.datos.bancomundial.org>
- BARRO, R., J. and X. SALA-I-MARTIN (2009). *Crecimiento económico*, segunda edición, Editorial Reverté S.A., Barcelona, España
- BÉRTOLA, L. y J. A. OCAMPO (2013). *El desarrollo económico de América Latina desde la Independencia*, primera edición, Fondo de Cultura Económica, México
- BRESSER-PEREIRA, L. (2008). "The Dutch disease and its neutralization: A Ricardian approach", *Brazilian Journal of Political Economy*, 28 (1) (109), pp. 47 - 71
- CIMOLI, M., J. B. PEREIRA, G. PORCILE (2015). "Cambio estructural y crecimiento" Comisión Económica para América Latina y el Caribe, Serie Desarrollo Productivo No. 197, enero
- COMISIÓN ECONÓMICA PARA AMÉRICA LATINA Y EL CARIBE - CEPAL (2014). *Cambio estructural para la igualdad. Una visión integrada del desarrollo*, Naciones Unidas, Santiago de Chile
- COMISIÓN ECONÓMICA PARA AMÉRICA LATINA Y EL CARIBE - CEPAL (2017). "CEPALSTAT Bases de Datos y Publicaciones Estadísticas". Disponible en <https://estadisticas.cepal.org/cepalstat/Portada.html>

DUSSEL, E. (2008). 1492: *El encubrimiento del Otro. Hacia el origen del "Mito de la modernidad"* versión corregida y aumentada, Biblioteca Indígena – Colección: Pensamiento Crítico, Vicepresidencia del Estado Plurinacional de Bolivia, La Paz, Bolivia

ELLIOTT, D. R. and R. RHODD (1999). "Explaining growth rate differences in highly indebted countries: An extension to Thirlwall and Hussain" *Applied Economics*, 31, pp. 1145 - 1148

ELLMAN, M. "Natural Gas, Restructuring and Re-industrialisation: The Dutch Experience of Industrial Policy in BARKER, T. and V. BRAILOVSKY (Eds.) (1981) *Oil or industry?: Energy, Industrialization and Economic Policy in Canada, Mexico, the Netherlands, Norway and the United Kingdom*, Academic Press, London, pp. 149 - 166

FERREIRA, A. L. and O. CANUTO (2003). "Thirlwall's Law and Foreign Capital in Brazil" *Momento Económico*, 125, pp. 18 - 29

GAVINCHA, M. (2015). *Diversificación de las exportaciones manufactureras de Bolivia*, tesis de grado de Maestría en Ciencias Económicas en la Universidad Autónoma Metropolitana, México

GYLFASON, T., T. T. HERBERTSON, G. ZOEGA (1999). "A Mixed Blessing: Natural Resources and Economic Growth" *Macroeconomic Dynamics*, 3 (2), pp. 204 - 225

HELPMAN, E. (2014). *El comercio internacional*, Fondo de Cultura Económica, México

IBAÑEZ, A. (2018). *Desarrollo sostenible y desempeño institucional: Hacia los determinantes del extractivismo de Bolivia*, Editorial Académica Española

IBAÑEZ, A. (2014). *Bolivia: Determinantes del ahorro neto ajustado y desempeño institucional*, tesis de grado para la Maestría en Desarrollo Económico, Universidad Mayor de San Andrés – Postgrado en Ciencias del Desarrollo, La Paz Bolivia

IBAÑEZ, A. (2012). *Crecimiento económico de Bolivia: Un enfoque heterodoxo*, tesis de grado, Universidad Mayor de San Andrés, Facultad de Ciencias Económicas y Financieras, carrera de Economía, La Paz, Bolivia

IBAÑEZ, A., M. GAVINCHA, M. LLAPACO (2016). "Crecimiento económico, cambio estructural y diversificación: el caso de Bolivia" Banco Central de Bolivia, *Revista de Análisis*, 24, pp. 49 - 114

MANSOORIAN, A. (1991). "Resource Discoveries and 'Excessive' External Borrowing" *The Economic Journal*, 101 (409), pp. 1497 - 1509

MARICHAL, C. (2010). *Nueva historia de las grandes crisis financieras. Una perspectiva global, 1873-2008*, Random House Mondadori, Buenos Aires, Argentina

MARX, K. (1867). *Das capital kritik der politischen ökonomie*, editado por SCARON, P., traducido al español por SCARON, P. (2005) *El Capital. Crítica de la economía política: El proceso de producción de capital*, tomo I, volumen 3, Siglo veintiuno Editores, México

McCOMBIE, J. S. L. y M. ROBERTS . "El papel de la balanza de pagos en el crecimiento económico" en SETTERFIELD, M. (Ed.) (2005) *La economía del crecimiento dirigido por la demanda. Cambiando la visión desde el lado de la oferta en el largo plazo*, Ediciones Akal S.A., Madrid, España, pp. 93 - 120

MORENO-BRID, J. C. (2003). "Capital Flows, Interest Payments and The Balance-of-Payments Constrained Growth Model: A Theoretical and Empirical Analysis", *Metroeconomica*, 54 (2-3) pp. 346 - 365

PREBISCH, R. (1950). "The Economic Development of Latin America and Its Principal Problems", United Nations, Economic Commission for Latin America, New York

RODRÍGUEZ, O. (2006). *El estructuralismo latinoamericano*, Ediciones Siglo XXI, México

SARAVIA, A. (2011). “La maldición de los RRNN en Bolivia, RRNN, instituciones y comercio internacional”, Universidad Mayor de San Simón, Facultad de Ciencias Económicas, Instituto de Estudios Sociales y Económicos, Serie de documentos de investigación No. 12, noviembre

SEMO, E. (2016). *México: Del antiguo régimen a la modernidad. Reforma y revolución*, segunda edición, Universidad Nacional Autónoma de México, México

SMITH, J. (2016). *Imperialism in the Twenty-First Century. Globalization, Super-Exploitation, and Capitalism's Final Crisis*, Monthly Review Press, New York

THIRLWALL, A. (2011). “Balance of payments constrained growth models: history and overview”, *PSL Quarterly Review*, 64 (259), pp. 307 - 351

THIRLWALL, A. (2002). *The Nature of Economic Growth: An Alternative Framework for Understanding the Performance of Nations*, Edward Elgar Publishing Limited, United Kingdom

THIRLWALL, A. (1979). “The Balance of Payments Constraint as an Explanation of International Growth Rate Differences”, Banca Nazionale del Lavoro, *PSL Quarterly Review*, 32 (128), pp. 45 - 53

THIRLWALL, A. and M. N. HUSSAIN (1982). “The Balance of Payments Constraint, Capital Flows and Growth Rate Differences between Developing Countries”, *Oxford Economic Papers*, 34 (3), pp. 498 - 510

VELASQUEZ, F. and S. R. QUISPE (2017). “Distancia a la frontera tecnológica y educación: Alternativas de crecimiento económico para países en desarrollo” Banco Central de Bolivia, *Revista de Análisis*, 27, pp. 9 - 36

VERA, L. (2006). “The balance-of-payments–constrained growth model: a north-south approach”, *Journal of Post Keynesian Economics*, 29 (1), pp. 67 - 92

Appendix

Model of balance-of-payments-constrained economic growth for two economies with debt and interest rate

1. Developed Economy

i. Hypothetical system: An economy constrained by balance of payments

$$- \text{Export demand } X_{Dt} = A \left(\frac{P_{D,Xt}}{P_{D,Mt} E_{Dt}} \right)^{\eta_D} Z_t^{\varepsilon_D}; \eta_D < 0 \wedge \varepsilon_D > 0 \quad (\text{A1})$$

$$- \text{Import demand } M_{Dt} = B \left(\frac{P_{D,Mt} E_{Dt}}{P_{D,Xt}} \right)^{\psi_D} Y_t^{\pi_D}; \psi_D < 0 \wedge \pi_D > 0 \quad (\text{A2})$$

$$- \text{Balance of payments } P_{D,Xt} X_{Dt} + (1+i_t)D_{t-1} = P_{D,Mt} E_{Dt} M_{Dt} + C_t \quad (\text{A3})$$

ii. Solving the system

- Applying logarithms and differentiating with respect the time (A1), (A2) and (A3):

$$x_D = \eta_D (p_{D,X} - p_{D,M} - e_D) + \varepsilon_D z \quad (\text{A4})$$

$$m_D = \psi_D (p_{D,M} + e_D - p_{D,X}) + \pi_D y_D \quad (\text{A5})$$

$$\tau (p_{D,X} + x_D) + \beta r = \sigma (p_{D,M} + e_D + m_D) + (1 - \sigma) c \quad (\text{A6})$$

$$\text{where, } \tau = \left(\frac{P_{D,Xt} X_{Dt}}{P_{D,Xt} X_{Dt} + (1+i_t)D_{t-1}} \right), \beta = \left(\frac{i_t D_{t-1}}{P_{D,Xt} X_{Dt} + (1+i_t)D_{t-1}} \right),$$

$$\sigma = \left(\frac{P_{D,Mt} E_{Dt} M_{Dt}}{P_{D,Mt} E_{Dt} M_{Dt} + C_t} \right) \text{ and } 1 - \sigma = \left(\frac{C_t}{P_{D,Mt} E_{Dt} M_{Dt} + C_t} \right).$$

- Replacing (A4) and (A5) in (A6):

$$y_D = \frac{1}{\pi_D} \left[\left(\frac{\tau}{\sigma} - 1 \right) p_{D,X} + \left(1 + \frac{\tau}{\sigma} \eta_D + \psi_D \right) (p_{D,X} - p_{D,M} - e_D) + \frac{\tau}{\sigma} \varepsilon_D z + \frac{\beta}{\sigma} r - \left(\frac{1 - \sigma}{\sigma} \right) c \right] \quad (\text{A7})$$

- Assuming $p_X = p_M + e = 0$, then:

$$y_D = \frac{1}{\pi_D} \left[\frac{\tau}{\sigma} x_D + \frac{\beta}{\sigma} r - \left(\frac{1-\sigma}{\sigma} \right) c \right] \quad (\text{A8})$$

2. Non-Developed Economy

i. Hypothetical system: A constrained economy by balance of payments

- Export demand

$$X_{NDt} = A \left(\frac{P_{ND,Xt} E_{NDt}}{P_{ND,Mt} E_{NDt}} \right)^{\eta_{ND}} Z_t^{\varepsilon_{ND}}; \eta_{ND} < 0 \wedge \varepsilon_{ND} > 0 \quad (\text{A9})$$

- Import demand

$$M_{NDt} = B \left(\frac{P_{ND,Mt} E_{NDt}}{P_{ND,Xt}} \right)^{\psi_{ND}} Y_t^{\pi_{ND}}; \psi_{ND} < 0 \wedge \pi_{ND} > 0 \quad (\text{A10})$$

- Balance of payments

$$P_{ND,Xt} X_{NDt} + C_t = P_{ND,Mt} E_{NDt} M_{NDt} + (1+i_t) D_{t-1} \quad (\text{A11})$$

ii. Solving the system

- Applying logarithms and differentiating with respect the time (A9), (A10) and (A11):

$$x_{ND} = \eta_{ND} (p_{ND,X} - p_{ND,M} - e_{ND}) + \varepsilon_{ND} z \quad (\text{A12})$$

$$m_{ND} = \psi_{ND} (p_{ND,M} + e_{ND} - p_{ND,X}) + \pi_{ND} y_{ND} \quad (\text{A13})$$

$$\alpha (p_{ND,X} + x_{ND}) + (1-\alpha) c = \theta (p_{ND,M} + e_{ND} + m_{ND}) + \gamma r \quad (\text{A14})$$

where, $\alpha = \left(\frac{P_{ND,Xt} X_{NDt}}{P_{ND,Xt} X_{NDt} + C_t} \right)$, $1-\alpha = \left(\frac{C_t}{P_{ND,Xt} X_{NDt} + C_t} \right)$,

$$\theta = \left(\frac{P_{ND,Mt} E_{NDt} M_{NDt}}{P_{ND,Mt} E_{NDt} M_{NDt} + (1+i_t) D_{t-1}} \right) \text{ and } \gamma = \left(\frac{i_t D_{t-1}}{P_{ND,Mt} E_{NDt} M_{NDt} + (1+i_t) D_{t-1}} \right).$$

- Replacing (A12) and (A13) in (A14):

$$y_{ND} = \frac{1}{\pi_{ND}} \left[\left(\frac{\alpha}{\theta} - 1 \right) p_{ND,x} + \left(1 + \frac{\alpha}{\theta} \eta_{ND} + \psi \right) (p_{ND,x} - p_{ND,M} - e_{ND}) + \frac{\alpha}{\theta} \varepsilon_{ND} z - \frac{\gamma}{\theta} r + \left(\frac{1-\alpha}{\theta} \right) c \right] \quad (\text{A15})$$

- Assuming $p_X = p_M + e = 0$, then:

$$y_{ND} = \frac{1}{\pi_{ND}} \left[\frac{\alpha}{\theta} x_{ND} - \frac{\gamma}{\theta} r + \left(\frac{1-\alpha}{\theta} \right) c \right] \quad (\text{A16})$$

3. The dynamic growth system to developed and non-developed countries

- Economic growth for a developed country:

$$y_D = \frac{1}{\pi_D} \left[\frac{\tau}{\sigma} x_D + \frac{\beta}{\sigma} r - \left(\frac{1-\sigma}{\sigma} \right) c \right] \quad (\text{A17})$$

- Economic growth for a non-developed country:

$$y_{ND} = \frac{1}{\pi} \left[\frac{\alpha}{\theta} x_{ND} - \frac{\gamma}{\theta} r + \left(\frac{1-\alpha}{\theta} \right) c \right] \quad (\text{A18})$$