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BALANCE OF PAYMENTS CONSTRAINED, STRUCTURAL CHANGE AND NATIONAL INNOVATION SYSTEM

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A linha editorial dos **Cadernos CEPEC** recepciona textos de diferentes matizes teóricas das ciências econômicas e sociais, que busquem tratar, preferencialmente, das inter-relações entre as sociedades e economias amazônicas com a brasileira e mundial, seja se utilizando de instrumentais históricos, sociológicos, estatísticos ou econométricos. A linha editorial privilegia artigos que tratem de Desenvolvimento social, econômico e ambiental, preferencialmente focados no mosaico que constitui as diferentes "Amazônias", aceitando, porém, contribuições que, sob enfoque inovador, problematize e seja propositivo acerca do desenvolvimento brasileiro e, ou mesmo, mundial e suas implicações.

Nosso enfoque central, portanto, refere-se ao tratamento multidisciplinar dos temas referentes ao Desenvolvimento das sociedades Amazônicas, considerando que não há uma restrição dessa temática geral, na medida em que diversos temas conexos se integram. Vale observar que a Amazônia Legal Brasileira ocupa aproximadamente 5,2 milhões de Km2, o que corresponde a aproximadamente 60% do território brasileiro. Por outro lado, somente a Amazônia brasileira detém, segundo o último censo, uma população de aproximadamente 23 milhões de brasileiros e constitui frente importante da expansão da acumulação capitalista não somente no Brasil, como em outros seis países da América do Sul (Colômbia, Peru, Bolívia, Guiana, Suriname, Venezuela), o que a torna uma questão central para o debate da integração sul-americana.

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SUMÁRIO

BALANCE OF PAYMENTS CONSTRAINED, STRUCTURAL CHANGE AND NATIONAL INNOVATION SYSTEM

Douglas Alencar[1]

1. INTRODUCTION

There is one major criticism about balance of payment constrained growth models, which states that the long run growth is determined by the average rate of exports in relation with the ratio of income elasticity of imports. If the income elasticity of imports is bigger than the average rate of exports, economic growth will be constrained. The empirical evidence about this approach, known as Thirlwall's Law, can be found in several papers as Thirlwall and Hussain (1982), McCombie (1989), Moreno-Brid (2003), Lima and Carvalho (2009), and Britto and McCombie (2009). However, the approach does not have a complete consistent explanation about why the external constraint occurs. Some authors have tried to explain why the countries have their growth constrained using the Systems of Innovation approach, as Silveira, Romero and Britto (2010), Missio and Jayme Jr (2011), Jayme Jr and Resende (2009), and Silva and Hasenclever (2010). In their point of view, the main determinant of the deterioration of the terms of trade in an economy lies in the lack of maturity of its National Innovation System.

2. BALANCE OF PAYMENTS CONSTRAINED

The theory that discusses the issues of balance of payments constrained growth was first elaborated by Thirlwall (1979). Its main idea is that economic growth could be constrained by the external sector if the income elasticity of imports is higher than the income elasticity of exports. Araújo and Lima (2007) developed an approach which have the model formalised by Thirlwall (1979) as its basis, combined with a Pasinettian multi-sectorial macrodynamic analisis. This approach states that the income per capital growth rate in developing countries is directly proportional to the growth rate of their exports and inversely related to the income elasticity of demand for imports. These elasticities, in turn, are weighted by coefficients that measure the share of each sector in total exports and imports. The interesting implication of Thirlwall's Law is that multi-sectoral changes in the composition of demand or in the production structure – which can or not be reflected in changes in income elasticities – can also be reflected in the share of each sector of exports or imports (Gouvea and Lima, 2010) .

In this work was seached of models of growth restriction derived from the original model of Thirlwall. The model of the balance of payments constrained, created by Thirlwall (1979) that

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defones rate of growth consistent with the balance of the Balance of Payments of each country is a direct relationship between income elasticity of foreign demand for exports and income elasticity for imports.This section reviews the externally constrained growth models derived from Thirlwall's original model. The balance of payments constrained growth model developed by Thirlwall says that the growth rate compatible with balance of payments equilibrium for any country is a direct relation between the income elasticity of external demand for its exports and the income elasticity of demand for imports. In equilibrium:

$$\frac{Yd}{Yw} = \frac{\xi}{\pi} \qquad (1)$$

where:

Yd = domestic income growth rate

Yw = foreign income growth rate

ξ = income elasticity of demand for exports

π = income elasticity of demand for imports

In the original formulation Thirlwall (1979) specifies the external equilibrium condition as follows:

$$P_d X_t = P_f M_t E_t \qquad (2)$$

where X is export volume, Pd is the domestic price of exports, M is import volume, Pf is the foreign price of imports, and E is the nominal exchange rate. Equation (2) expressed in terms of growth rates is:

$$p_d + x = p_f + m + e \qquad (3)$$

Because external demand for exports, as well as internal demand for imports, depends on relative prices, price and income elasticities, and domestic and foreign income (Y and Z respectively), it follows that:

$$M = a \left(\frac{P_f E}{P_d}\right)^{\psi} Y^{\pi} \qquad (4)$$

$$X = b \left(\frac{P_d}{P_f E} \right)^{\eta} Z^{\varepsilon} \qquad (5)$$

where "a" and "b" are constant, ψ is the price elasticity of imports, π is the income elasticity of demand for imports, η is the price elasticity of exports, and ε is the income elasticity of demand for exports. Equations (4) and (5) expressed in terms of growth rates are as follows:

$$x = \eta \, (p_d - e - p_f) + \varepsilon z \qquad (6)$$
$$m = \psi \, (p_f + e - p_d) + \pi y \qquad (7)$$

Substituting (6) and (7) into (3) and solving for y gives the solution for the economic growth rate consistent with balance of payments growth Y_{BP}:

$$Y_{BP} = \frac{(1 + \eta + \psi) \, (p_d - p_f - e) + \varepsilon z}{\pi} \qquad (8)$$

If the terms of trade or the real exchange rate are constant (*e=0*), and if it is also assumed that external inflation is equal to domestic inflation (*pd-pf=0*), then equation (8) is simplified to the expression known as Thirlwall's Law:[2]

$$Y_{BP} = \frac{x}{\pi} \qquad (9)$$

Thus the long-run expansion of a country's real domestic income is given by the ratio of export growth to the income elasticity of imports (Moreno-Brid & Pérez, 2003).

The constant terms of trade assumption has been criticized, mainly by neoclassical economists, since it means that the BOP is adjusted via income rather than prices, a highly important factor for neoclassicists. Thirlwall (1979) argues that BOP adjustment through prices is not supported by the empirical evidence.

Moreno-Brid (2003) reformulates Thirlwall's conventional model to capture the impact of the constraint created by capital flows, explicitly including interest payments, which are missing from his 1998-99 model.

> "The first is to present a version of the BPC model that explicitly takes interest payments into account and — though not necessarily imposing as a long-run condition the constancy of the interest rate — guarantees a sustainable path of

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[2] In which $x = \varepsilon z$, by definition.

external debt accumulation (Moreno-Brid, 2003, p. 347)."

Starting from the export and import demand functions (6) and (7), he suggests an alternative form for these, adding to the original model's equations for exports and imports another condition for BOP equilibrium, expressed as follows:

$$e + p_f + m = \theta_1(pd + x) - \theta_2 (p_a + r) + (1 - \theta_1 + \theta_2)(p_a + f) \quad (10)$$

where r is the change in net interest, and θ_1 and θ_2 are the ratios measured in the initial period:

$$\theta_1 = \frac{P_d X}{P_f\, E\, M} \quad (11)$$

$$\theta_2 = \frac{P_d R}{P_f\, M\, E} \quad (12)$$

He also introduces into these export and import demand functions a sustainable debt accumulation condition determined by the ratio of the current account to GDP:

$$\frac{F}{Y} = k \quad (13)$$

In terms of variation rates, this equation yields:

$$f + p_d = y + p_d \quad (14)$$

Substituting this debt constraint (14) into (10) and solving for y the system of equations (6), (7), (10), (11) and (12) obtains the economic growth rate consistent with balance of payments equilibrium, now explicitly including interest payments and imposing a constraint on external indebtedness:

$$y_{ca} = \frac{\theta_1\, \varepsilon z - \theta_2\, r + (1 + \theta\eta + \psi)\, (p_a - e - p_f)}{\pi - (1 - \theta_1 + \theta_2)} \quad (15)$$

Moreover, if $pd = e + p_f$, i.e. assuming the external and internal rates of inflation are the same and the nominal exchange rate has no influence in the long run, then:

$$y_{ca} = \frac{\theta_1 x - \theta_2 r}{\pi - (1 - \theta_1 + \theta_2)} \qquad (16)$$

It is evident from the BOP equilibrium equation, therefore, that the long-term equilibrium rate can be completely changed by the inflow and outflow of capital, plus interest payments and debt repayments.

3. NATIONAL INNOVATION SYSTEMS AND BALANCE OF PAYMENTS CONSTRAINED

In this paper, we will work with an idea that the growth of value and quantity of export has relationship with national innovation system (NIS). For intense, if the NIS is mature, the degree of value of export is bigger than the value of imports. In other words, the growth of economic, which has a relationship with external sector, can be determined by NIS. For the neo-Schumpeterian economic the process of innovation can be connect with NIS. In turn, this system shows us the importance of institutional configuration which supported to creation of innovation and our incorporation on the system economic. To Freeman (2004) the economic growth is determined by the diffusion capacity efficient in productive system. If the innovation is introduction in system, it can generate opportunity to extraordinary profits.

There is no consensus about the definition of competitiveness in an economy. In this research, we assume a relation between the competitiveness and the income elasticity of imports. It is reasonable to consider the hypothesis that the macroeconomic policies define at least a part of the competitiveness of the economies. These policies can be, for instance, directed to monetary or fiscal issues, or to the exchange rates. For example, there are some empirical examples of countries that maintain their real exchange rates appreciated notwithstanding without incurring in a lack of competitiveness, like Italy, Sweden and Canada. More than that, some countries have fiscal deficits, like England and the USA (JAYME JR; RESENDE, 2009).

Jayme Jr and Resende (2009) define competitiveness as the possibility of an economy to experience surpluses in its trade balances. For them, a country has to be able to compete both internally and externally. However, the amount exported keeps a positive relationship with the characteristics and volume of technologic content used to produce them. Therefore, in an economy, the performance of trade balance depends on the degree of competitiveness, which in turn depends of the relationship between technological processes, exports and imports. The exported value depends on three features of the exports market as follow:

i)   Market structure of the exported goods: if their market structure is close to a

monopolistic or oligopolistic situation, the export capacity will be bigger than in a situation of competitive markets and the exporting companies can fix prices;

ii) Market dynamism: if the demand growth rate is high, the value of exports tend to be bigger;

iii) Market protection: if the market has no protectionist practices, the value of exports to this market tends to be bigger.

There is one more important feature that keeps a relationship with the value of exports: the processes of technological change and their diffusion in the economy. These processes can be captured through the National Innovation Systems (NIS) development analysis. (FREEMAN, 2004; NELSON,1993; FAGERBERG, 1994; BERNARDES; ALBUQUERQUE, 2003; JAYME JR; RESENDE, 2009). In this research, we considered that the value of exports is influenced by the System of Innovation (SI) development.

Abramovitz (1986) argued that there is a lag between the creations of innovation on central countries and incorporation of this innovation by development countries. This author development the hypothesis of catch-up, this hypothesis says that the growth rates of productivity across countries tend to be inversely related to the initial level of productivity. The central idea is that when leading country changed the technologic, the follower country will use the old technologic and the productivity this last country will raise, and the long run the follower can have a similar technologic. However followers tend to catch-up faster if they are initially more backward.

Silveira, Romero and Britto (2010) created a proxy to measure the maturity of a NIS. This proxy is constructed dividing the total number of patents of a country by the total number of patents of other countries. The implicit idea is that if a NIS is mature, the country would be able to export products with high aggregated value. On the contrary, if the country has an immature NIS, it would export products with low aggregated value. They conclude that the higher the technological content of national production, the greater the elasticity income of exports and the lower the elasticity income of imports.

3.1 BALANCE OF PAYMENTS CONSTRAINED GROWTH AND STRUCTURAL CHANGE

The theory that discusses the issues of balance of payments constrained growth was first elaborated by Thirlwall (1979). Its main idea is that economic growth could be constrained by the external sector if the income elasticity of imports is higher than the income elasticity of exports. Araújo and Lima (2007) developed an approach which have the model formalised by Thirlwall (1979) as its basis, combined with a Pasinettian multi-sectorial macrodynamic analisis. This

approach states that the income per capital growth rate in developing countries is directly proportional to the growth rate of their exports and inversely related to the income elasticity of demand for imports. These elasticities, in turn, are weighted by coefficients that measure the share of each sector in total exports and imports. The interesting implication of Thirlwall's Law is that multi-sectoral changes in the composition of demand or in the production structure – which can or not be reflected in changes in income elasticities – can also be reflected in the share of each sector of exports or imports (Gouvea and Lima, 2010) .

The Balance of Payment Constrained in a Mult-sectorial abroch was inspered by the multi-sector framework of Pasinetti (1981, 1993). Araujo and Lima (2007) develop a mult-sector BPCG model. This abroch can be demostred how following:

$$M = \sum_{J=1}^{k} \lambda_{mj} P_f M_j \quad (17)$$

$$X = \sum_{i=1}^{l} \theta_{xi} P_d X_i \quad (18)$$

We assume that there are k imported goods and l exported goods in this economy. Where P_f is the price to imports in foreing currency, P_d is the price to exports in local currency, X and M is the volume of exports and imports, λ_I and θ_I represent the level of development of NIS and the trade balance, respectively. If we assume which the relative prices of exports and imports are constant in the long run, and we will assume the tax rate to variables:

$$m = \sum_{J=1}^{k} \lambda_{mj} m_j \quad (19)$$

$$x = \sum_{i=1}^{l} \theta_{xi} x_i \quad (20)$$

Folling Araujo and Lima (2007), we can write the demand functions for each imported and exported good how:

$$M_j = a_j \left(\frac{P_{fj}E}{P_{dj}}\right)^{\psi_j} Y^{\pi_j} \quad (21)$$

$$X_i = b_i \left(\frac{P_{di}}{P_{fi}E}\right)^{\eta_i} Z^{\varepsilon_i} \quad (22)$$

From that it follows, we have:

$$m_j = \pi_j y \quad (23)$$

$$x_i = \varepsilon_i z \quad (24)$$

Substituting the equation (23) and (24) in equation (19) and (20), we obteded:

$$m = y \sum_{J=1}^{k} \lambda_{mj} \pi_j \quad (25)$$

$$x = z \sum_{i=1}^{l} \theta_{xi} \, \varepsilon_i \qquad (26)$$

If m and x are equal, and solving this equation to y we have:

$$y = \frac{\sum_{i=1}^{n-1} \lambda_i \varepsilon_i}{\sum_{i=1}^{n-1} \theta_i \pi_i} \cdot z \qquad (27)$$

Where y is the domestic income growth rate; z is the foreign income growth rate; ε_i is the income elasticity of exports produced by sector i, which have in its estimation the real exchange rate; π_i is the income elasticity of imports from sector i; and λ_i and θ_i represent the level of development of NIS and the trade balance, respectively.

4. FINAL CONSIDERATIONS

The balance of payment constrained growth models does not have a complete consistent explanation about why the external constraint occurs. Some authors have tried to explain why the countries have their growth constrained using the Systems of Innovation approach, as Silveira, Romero and Britto (2010), Missio and Jayme Jr (2011), Jayme Jr and Resende (2009), and Silva and Hasenclever (2010). In their point of view, the main determinant of the deterioration of the terms of trade in an economy lies in the lack of maturity of its National Innovation System.

This approach related the NIS with the growth rate of an economy, in the long run. We have analyzed the NIS in section two, and in the third section we presented the theory on income growth in the long run constrained by the Balance of Payments, through a development of Thirlwall's (1979) seminal theory. Thus, our hypothesis is that the income growth rate in the long run is constrained by the relationship of the income elasticities of exports and imports and by the level of development of the National Innovation System. Our research tries to elucidate why some countries experiment a constrained economic growth in the long run, due to the immaturity of their NIS.

BIBLIOGRAPHY

ALONSO, J. A. Growth and the external constraint: lessons from the Spanish case. Applied Economics,   31(2), 245-253, 1999.
ARAUJO, R.A.; LIMA, G.T. A Structural Economic Dynamics Approach to Balance-of-Payments-Constrained Growth. Cambridge Journal of Economics, v. 31, p. 755-774, 2007.
BRITTO, G.; MCCOMBIE, J.S.L. Thirlwall's law and the long-term equilibrium growth rate: an application to Brazil. Journal of Post Keynesian Economics, v. 32, p. 115-136, 2009.
FREEMAN, C. The National System of innovation in historical perspective. Revista Brasileira de Inovação, v.3, n. 1, 2004.
GOUVÊA, R.R.; LIMA, G.T. Structural change, balance-of-payments constraint, and economic

growth: evidence from the multisectoral Thirlwall's law. Journal of Post Keynesian Economics, v. 33, p. 169-204, 2010.

JAYME Jr., F.G. Balance-of-Payments-Constrained Economic Growth in Brazil. Brazilian Journal of Political Economy, v. 23, n. 1 (89), Jan.-Mar. 2003.

JAYME JR., F. G.; RESENDE, M. F. C. Crescimento econômico e restrição externa: teoria e a experiência brasileira, In: MICHEL, R.; CARVALHO, L. (Org) Crescimento econômico: setor externo e inflação, Rio de Janeiro: IPEA, 2009.

LALL, S. (2000). The Technological Structure and Performance of Developing Country Manufactured Exports, 1985-1998. QEH Working Paper Series, n. 44.

LIMA, G.T; CARVALHO, V.R. Estrutura Produtiva, Restrição Externa e Crescimento Econômico: A Experiência Brasileira. Economia e Sociedade (UNICAMP. Impresso), v. 18, p. 31-60, 2009.

McCOMBIE, J.S.L. 'Thirlwall's Law' and balance of payments constrained growth–a comment on the debate. Applied Economics, 21(5), 611-629, 1989.

MISSIO, F; JAYME Jr. F.G. Structural Heterogeneity, and Endogeneity of Elasticites on the Balance-of-Payments Constrained Growth Model. Texto para Discussão No 425. UFMG-CEDEPLAR. 2011.

MORENO-BRID, J.C. Capital flows, interest payments and the balance-of-payments constrained growth model: a theoretical and empirical analysis. Metroeconomica, v. 54, n. 2-3, p. 346-365, may 2003.

NELSON, R. R. National innovation systems: A comparative analysis. Oxford: Oxford U. Press, 1993.

SILVEIRA, F.; ROMERO, J.P.; BRITTO, G. Mudança estrutural, sistema nacional de inovações e restrição do balanço de pagamentos: análise teórica e empírica do caso brasileiro. Encontro Nacional de Economia da ANPEC, 2010.

THIRLWALL, A. The balance of payments constraint as an explanation of international growth rates differences, Banca Nazionale del Lavoro Quarterly Review, Vol. 128, 1979.

_____; HUSSAIN, M.N. The balance of payments constraint, capital flows and growth rate differences between developing countries. Oxford Economic Papers, New Series, v. 34, n. 3, p. 498-510, nov. 1982.