

Commodity-dependence and growth: South America 1962-2017

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Abstract:

In this paper I propose a bridge between post-Keynesian and Structuralist traditions in the form of a growth model that considers the specificities of commodity dependent countries. To that end, in line with the Balance of Payments Constrained Growth models and based on the extensive evidence of their adequacy for South American economies, the requirement for balanced international trade, and so the relevance of international demand, is maintained. But, in the light of Structuralist literature, I highlight the importance of commodity dependence for the region, by including an additional export sector in the model, which is a price-taker of prices denominated in foreign currency and depends on limited natural resources. The research contributions are multiple. First, the model integrates theoretical perspectives and reproduces some long-lasting stylized facts in the region, like the crucial importance of commodity prices and exchange rates for growth. Second, several historical databases are articulated contributing with original insights of the development process in the region. Additionally, econometric tests validate the results based on historical data for the period 1962-2017. Finally, these results add on the current debate on the effect of some crucial macroeconomic variables in the economic growth and development path of South American countries.

1- Introduction

Balance of Payments Constrained Growth (BPCG) models have been widely applied to study Latin American countries long run growth trajectories, because of their historical tendency to fall on Balance of Payments crises, what is a central constraint to their growth (Thirlwall, 2019). Despite the very important insights about regional long-run growth challenges derived from these exercises, some specific features of these countries are not fully reflected in standard BPCG models. Specifically, their long-run dependence on primary commodities as a central source of dynamism and foreign currency, historically emphasized by Structuralist approaches, does not completely fit on standard BPCG models. The last super cycle of commodities 2002-2012 (or commodity-boom), showed once again the central importance of commodity prices for Latin American economic performance. This dependence was evident not only during the boom phase, but specially during the most recent bust. This is why any model designed to reflect the economic performance of this region must consider their implications (Ocampo, 2017; Bianchi et al, 2024).

Commodity-dependence is especially acute in South American countries. This region is considered one of the most strongly dependent on commodities exports in the world (de

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la Torre et al., 2017; UNCTAD, 2021), what implies relevant specificities in the operation of the economic gears of the region. First, many global commodity markets operate close to perfect competition conditions, what implies that individual exporters (companies or countries) are basically price-takers of prices set at global markets. Additionally, prices are set in international currencies, mostly dollars, so country-internal conditions, like devaluations can change dramatically the exporters' profitability conditions, but generally do not affect export prices. What is more, commodity production relies on natural resources (land, mineral deposits, etc.) which are heterogeneous and limited, subject to diminishing returns and supply constraints (Reinert 2019; Radetzky and Warrell, 2021). These conditions do not invalidate the crucial role played by demand, and specifically by export demand, as a central source for sustained growth, but they force to rethink the specific forms it takes.

What I propose in this paper is a modified BPCG model, specifically adapted to South American strong dependency in commodity exports. In this way, it bridges the Post-Keynesian thought with its focus on export demand as a central condition for growth, with the Structuralist tradition about the relevance of productive structure and international insertion of countries. Building on Thirlwall (1979, 2013) and Bianchi et al (2024), this model proposes a two export-sectors economy, one standard "industrial" sector, demand-constrained, and one commodity sector, supply-constrained, but nevertheless dependent on demand conditions through exogenous commodity prices. Balance of Payments, which in this version of the model with no capital movements is equivalent to Current Account, is still the central constraint to sustained growth, but it is affected not only by local and international dynamism through import and export elasticities, but also by commodity prices and supply conditions in primary sectors. In this way, price competition and exchange rates dynamic re-take a central role in overall economic performance of the countries, in contrast to canonical BPCG model (Thirlwall, 1979), but in a complementary way than postulated by Export Led Cumulative Causation models. It is not about cumulative causation on productivity growth, but about profitability in commodity production, import substitution and industrial export competitiveness (Blecker and Setterfield, 2019).

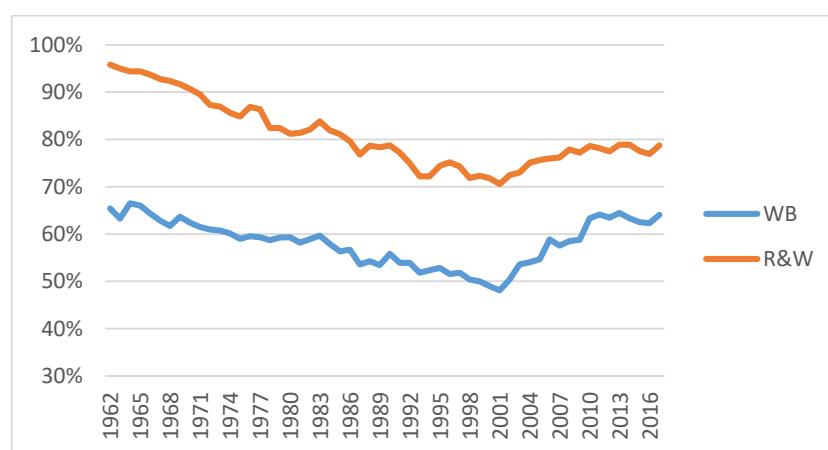
The rest of the paper is structured as follows. Chapter 2 develops the theoretical framework in the light of the historical evidence. Next, chapter 3 develops and analyses

the theoretical model proposed. Chapter 4 defines the empirical strategy and advances with the econometric tests. Finally, chapter 5 discuss the results.

2- Theoretical framework and historical evidence

South America has historically been one of most heavily commodity-dependent regions in the world. That condition can be traced back till colonial times when they were part of vast empires and their role was to provide precious metals and raw materials to their metropolises. Later, it was reinforced but also modified, during the period known as “first globalization” (1870-1913) during which these countries transformed their economies to meet the changing and increasing demand for food and new raw materials, from industrializing Europe, and later, United States. Despite important efforts to diversify the economies and change that pattern of international insertion during the decades that followed the 1930’s global crisis, since the 1980’s, and in the framework of policies inspired by the Washington Consensus, the region is facing a ‘reprimarization’ process (Bértola and Ocampo, 2013; Cimoli et al, 2019). Figure 1 shows the commodity share in total South American exports, considering two alternative definitions of commodities.

Figure 1 Commodity-share in South American merchandise exports according to two alternative definitions of commodities

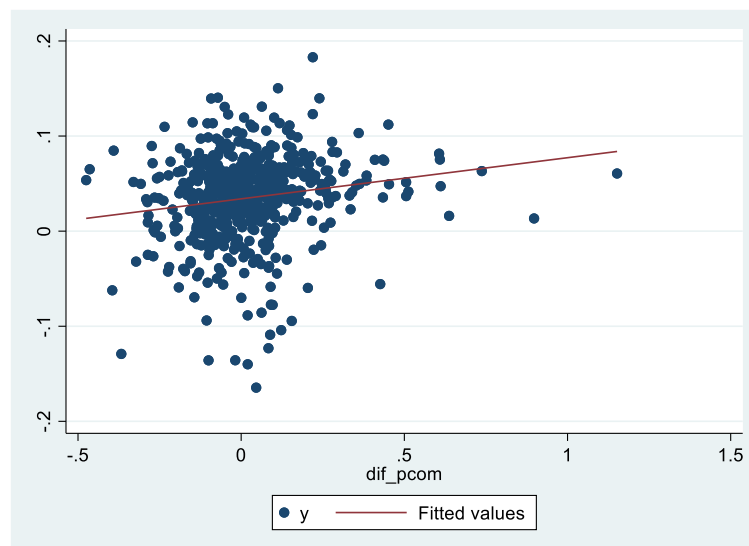


Source: Own elaboration, based on Atlas Economic Complexity Database, and two alternative definitions of commodities: Radetsky & Warrell (2021) (R&W) and World Bank “The Pink Sheet” (WB)

UNCTAD (2019) defines as "commodity dependent" to countries whose merchandise export basket are made up of at least 60% of commodities, threshold currently exceeded by all countries in the region. That situation implies direct consequences on the economic performance of these countries. As has been long studied, the trajectory and volatility of

commodity prices heavily affects South American economies (De la Torre et al., 2017; Ocampo, 2017). Figure 2 shows the correlation between commodity-prices accelerations and economic growth for South American countries in the period studied in this paper.

Figure 2: Commodity price accelerations and growth. South American Countries 1962-2017



Source: Own elaboration based on PWT 9.1, Atlas Economic Complexity Database and World Bank Commodity Price data “The Pink sheet”

Theoretically, this situation has been analyzed from different approaches. Structuralist tradition, since the mid of last century, developed a framework in which world economy is constituted by a center, rich, industrialized, technologically advanced and homogenous in terms of productivity; and a periphery, poor, specialized in raw materials, technologically laggard and heterogeneous in the internal distribution of productivity. Those regions interact through different market structures. On one hand, oligopolies in the advanced industrial markets allow central countries to set the prices of their exports, retaining the productivity growth through higher salaries and profits. On the other, highly competitive raw material markets, force countries to price-competition, transferring productivity growth to declining prices. Therefore, that systemic functioning tends to wide income gaps and reinforce specializations (Prebisch, 1949; Rodriguez, 2006). In this sense, the ideas of different market structures between industrial goods and commodities, and the prevalence of exogenous prices in the latter, as in the model developed in this paper, were already present in this theory, but they have been recently confirmed (Demir and Razmi, 2022).

In Post-Keynesian approach, there have also been proposed useful tools to interpret this reality. The focus is on demand as the main restriction to growth, not only in short, but

also in the long run. Thirlwall (1979) developed a model which is the canonical reference for BPCG analysis. His most famous equation, known as “Thirlwall law” states that the external equilibrium growth rate, equals the rate of growth of commercial partners (Z) multiplied by the ratio between exports and imports income-elasticities ($\frac{\varepsilon}{\pi}$):

$$y_B = \frac{\varepsilon}{\pi} Z$$

So, if the trade specialization of a country determines that its exports’ income-elasticity tends to be lower than its imports’, ($\frac{\varepsilon}{\pi} < 1$), that country will tend to grow slower than its commercial partners, leading to divergence. That has been widely interpreted, even by Thirlwall himself (Thirlwall 2013), as an explanation of the slow growth trajectory of commodity dependent countries. In this tradition there have been many contributions to enrich and expand these ideas (e.g. Dutt, 2002; Araujo and Lima, 2007; Gouvea and Lima, 2013). However, from this point of view, the important difference between goods is from the demand side, but there is no difference from the supply side. What is more, market structures are not differentiated and if the “elasticity pessimism” holds, as Thirlwall law implies, relative prices and exchange rates are not relevant for growth.

More recently, the Neo-Structuralist stream, has linked old Structuralist ideas with Post-Keynesian and also Neo-Schumpeterian contributions, in a general framework that articulate the supply side with demand side restrictions to growth, associated to commodity specialization, in new versions of Center – Periphery models (Cimoli and Porcile, 2011; Cimoli et al, 2019).

Also linked to Neo-Schumpeterian approach, Reinert (1996, 2019) has made relevant contributions to understand some specificities of commodity production. Particularly, the idea that goods whose production depends on natural resources present diminishing returns, since the natural resource stock is limited and quality-heterogeneous, so production increase will require either advance to exploit lesser quality resources or intensify the exploitation. Those ideas signal a very important difference from the supply side between industrial production on one hand, easily scalable to meet increasing demand and subject to scale economies and decreasing individual costs, and commodity production on the other, with diminishing returns and increasing costs.

In conclusion a new framework is necessary, which explicitly considers the strong commodity dependence of many developing countries, taking into account their specific production conditions and constraints and articulating them in a general BPCG model.

3- A two export-sectors Balance of Payments constrained growth model

3.1 – The model

The objective of this chapter is to postulate and assess a BPCG model which can reflect the specific conditions of commodity production and exports. For that goal, a two export-sectors model is proposed. One traditional “industrial sector” (following Thirlwall, 1979) only demand-restricted, so it can automatically react to a demand increase. The demand, in turn, is limited by price competition and by commercial partner’s income, assuming a positive income elasticity.

Additionally, a primary commodity productive and exporter sector, which does not face demand limitations. Instead, it is assumed an infinite price elasticity of the demand faced by each country. This implies the “small country assumption”, not in geographical terms, but in the sense that the country can sell all its production at market prices, which it cannot affect; countries are price-takers (Clavijo and Ros, 2015; Blecker, 2016; Razmi, 2016). Those prices are set in international currency (dollars), so exporter’s exchange rates do not affect prices, but they strongly affect the profitability conditions of countries and producers, since production costs are mainly set in national currency. However, this sector is limited by its supply capacity which has the technical characteristics already commented: it depends on quality-heterogeneous and quantity-limited natural resources what determines diminishing returns when advancing towards lower quality resources (the extensive margin), or towards the application of increasing quantities of capital (machinery, fertilizers, insecticides) and labor over the same resources (intensive margin), so as to increase production. So, this model is in line with Razmi (2016) in assuming export supply constraints, but the reasons and the variables that determines those constraints are completely different².

² Razmi (2016) also considers export supply constraints, but associated to capital accumulation as a condition for developing export capacity, while in this model the restrictions are associated to the fact that natural resources, the basic factor for commodity production, are essentially limited and quality-heterogeneous.

The following export equation (expressed in real or physical units) reflects the conditions described, where the first term reflects the commodity sector and the second the industrial sector:

$$(1) X = d \left(\frac{P_{com}E}{P} \right)^{\alpha} + g \left(\frac{P}{P^*E} \right)^{-\gamma} Y^* \varepsilon$$

In equation 1, **d** and **g** are constants, P_{com} represents commodity prices, E is the nominal exchange rate, P is the internal price level and Y^* is the rest of the world (commercial partners) income level. γ , and α , both positive, reflect, respectively, the relative price demand-elasticity of industrial exports, and the export-margin supply-elasticity of commodities (Bianchi et al, 2024). The industrial exports term ε is the income elasticity of exports, also positive.

Note that the numerator of the expression in parenthesis in the first term (mentioned as export-margin) is the unitary income of exporters expressed in national currency, while the denominator is a proxy of local production costs, so the quotient represents the profits margin of the exporter. In this way, the model assumes a positive reaction of commodity production and exports (commodity supply) to their profitability conditions, in line with Bianchi et al (2023) findings. But given the features mentioned of quality heterogeneity (lands and mineral deposits show variable productivity) and scarcity (they are not infinite) that reaction, captured by α , is not infinite. So production increase is only possible with a growing profit margin, to meet the increasing specific costs.

The second term, the industrial sector, is exactly the same as in Thirlwall's (1979) classical model, and expresses a price competition between a national and a foreign product which are imperfect substitutes and a demand restriction given by the income level of the importers (commercial partners), assuming a positive income elasticity (ε). This parameter is also frequently assumed as a quality indicator in the sense that higher quality products will show a higher income elasticity (Porcile and Yajima, 2021). So, this sector is only demand restricted assuming that supply can react to demand increases, because it is not dependent on fixed natural resources.

In this way, this is a three goods (and three prices) model: a commodity (whose price is P_{com} set in dollars, only for export), a local industrial good (both exported and consumed locally, as will be clarified later; whose price is P , set in local currency), and a foreign industrial good (whose price is P^* , set in dollars, both imported for internal consumption, and international competitor of local industrial good in third markets).

The import equation is exactly as in Thirlwall (1979):

$$(2) \mathbf{M} = \mathbf{a} \left(\frac{P^*E}{P} \right)^{-\psi} Y^\pi$$

Imports are assumed to depend, on one hand, on relative prices between the imported industrial product and the local one, where $-\psi$ expresses the imports price elasticity, which is negative ($\psi > 0$), and on the other, on local real income level (Y), where π is the imports income elasticity, assumed to be positive as usual.

The next step is to establish the balance of payments equilibrium (trade equilibrium in this case without capital movements), where real quantities of exports and imports are multiplied by their respective prices in the same currency and to proceed to time differentiation so as to find the equilibrium income growth rate:

$$(3) P_{\text{com}} \left[d \left(\frac{P_{\text{com}}E}{P} \right)^\alpha \right] + \frac{P}{E} \left[\left(g \left(\frac{P}{P^*E} \right)^{-\gamma} Y^{\varepsilon} \right) \right] = P^* \left[a \left(\frac{P^*E}{P} \right)^{-\psi} Y^\pi \right]$$

Log derivating:

$$(4) \theta \{ p_{\text{com}} + [\alpha(p_{\text{com}} + e - p)] \} + (1 - \theta) \{ (p - e) + [(-\gamma)(p - p^* - e) + \varepsilon y^*] \} = p^* - \psi(p^* + e - p) + \pi y$$

where lowercase letters are the rate of change of uppercase variables, and θ is the share of commodities in total exports ($0 \leq \theta \leq 1$), considered given in this version of the model.

Operating:

$$(5) y_B = \frac{1}{\pi} \{ \theta (1 + \alpha) p_{\text{com}} + [\theta \alpha + (1 - \theta) \gamma + \psi + \theta - 1](e - p) + [(1 - \theta) \gamma - (1 - \psi)] p^* + (1 - \theta) \varepsilon y^* \}$$

Where y_B is the balance-of-payments equilibrium growth rate. In this expression, the parameters have been ordered in relation to the exogenous variables, so as to focus on the marginal impact on equilibrium growth rate of a change in any of them. But before going deeper in the interpretation of the equation, one step more is needed.

In order to make a more real model of an open economy we must consider that internal prices in the economy are not exogenous, as they are affected by external ones. The equation that drives this is as follows:

$$(6) P = (P^*E)^\beta C^{1-\beta}$$

Where β is the weight of external prices, expressed in local currency, in the local price. It can be thought as the ponderation of tradable goods in the local consumption basket. C is a completely internal cost, that can be understood as non-tradable costs (e.g. salaries). So, as can be seen, commodities are only exported, (either completely as raw materials or

even with some industrial process), but they are a negligible part of the internal consumption basket in the economy (think on iron in Brazil or soybeans in Argentina). Consumption basket is constituted by the local “industrial” good and by the imported good.

In order to include this equation (6) in the equilibrium growth equation, we first log-differentiate it so as to get the rate of variation of prices:

$$(7) \quad p = \beta (p^* + e) + (1 - \beta)c$$

Combining this equation (7) with equation (5):

$$(8) \quad y_B = \frac{1}{\pi} \{ \theta (1 + \alpha) p_{com} + [\theta \alpha + (1 - \theta)Y + \psi + \theta - 1] (e - [\beta (p^* + e) + (1 - \beta)c]) + [(1 - \theta)Y - (1 - \psi)] p^* + (1 - \theta) \varepsilon y^* \}$$

Operating:

$$(9) \quad y_B = \frac{1}{\pi} \{ \underbrace{\theta(1+\alpha)p_{com}} + \underbrace{[\theta\alpha+\psi+(1-\theta)(Y-1)](1-\beta)(e-c)} + \underbrace{[1-\beta(1-\theta)+\beta\theta\alpha-(1-\beta)[(\psi)-Y(1-\theta)]p^*}_{(1-\theta)\varepsilon y^*} \}$$

This last equation (9) is the main expression of the model. It expresses the basic relationships we will proceed to interpret in next section. At a first glance, we can observe that, as well as equation (5), it expresses the BP equilibrium growth rate, where parameters have been ordered in relation to exogenous variables, and horizontal braces distinguish each variable marginal effect. But now, internal inflation (p) is not any more in the equation, because it is not an exogenous variable. Instead, it has been replaced by its explicative variables, international inflation (p^*), domestic currency devaluation (e) and the rate of change of internal non-tradable costs (c). The second brace, particularly, signals the impact on y_B of what can be understood as a real currency devaluation ($e-c$), because it is the difference between the nominal exchange rate devaluation (e), which may be considered as tradable prices rate of change, and c , the rate of change of non-tradable prices; that is to say, the *internal* exchange rate (Blecker, 2022a).

3.2 Marginal effects

For a better understanding of the model and its implications, the objective of this section is to interpret the marginal effects of exogenous variables in y_B . The first one, following the order of equation (9), is the marginal effect of a change in the price of commodities:

$$(10) \quad \frac{\partial y_B}{\partial p_{com}} = \frac{\theta(1+\alpha)}{\pi}$$

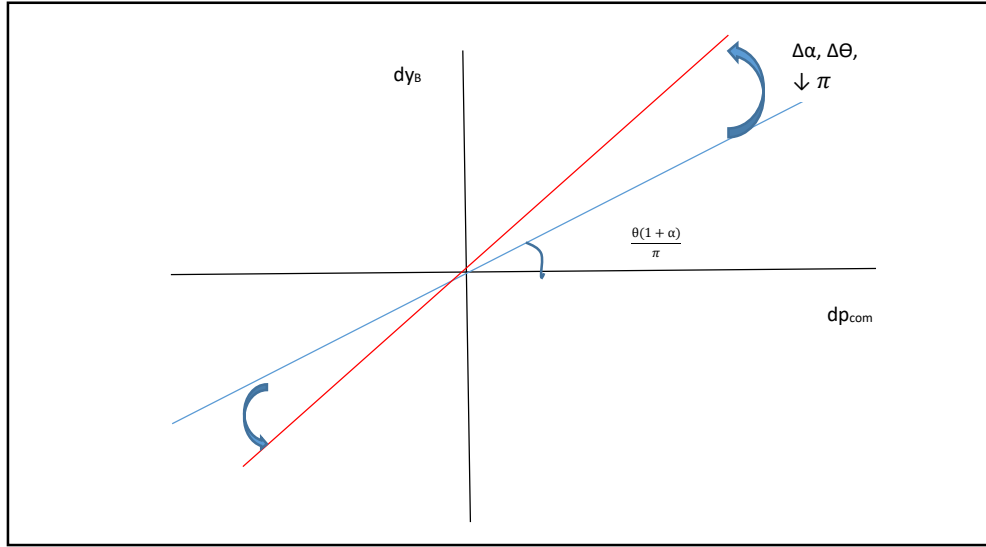
As can be seen in expression (11) an acceleration (deceleration) in commodity prices generates unequivocally an acceleration (deceleration) in equilibrium growth, because all the parameters in the expression on the right are positive. The amount of that impact depends on α , the sensibility of commodity supply to an increase in the profit margin; on θ , the share of commodities on total exports of the country; and π , the income elasticity of imports. To conceptualize, think that commodity prices increase by 1%; *ceteris paribus*, that will increase the total currency inflows by $\theta\%$ but, at the same time, it will increase by 1% the profit margin of commodity producers, who will react increasing their production (either in the extensive or intensive margin) by $\alpha\%$. Both effects combined (the numerator of the expression) relax the external constraint, allowing the economy to grow faster, and then, increasing the demand for imports, by $\pi\%$ (the denominator) for any extra point in growth, what acts in the opposite direction, slowing growth. So, the impact on growth of a commodity-prices acceleration will be stronger:

- The more sensitive the commodity production to profits (α), what could be understood, as a function of the availability of natural resources, necessary for increases in the extensive margin, and of the technological level in commodity production, important for increases in the intensive margin.
- The more commodity dependent the country (θ)
- The lower the income elasticity of imports (π)

This result is in line with the historical evidence of South American countries, whose growth rate are very sensitive to commodity prices cycles. In particular, during the last commodity boom (2002-2012) South American countries grew at historical levels, led by commodity exports whose production frontier expanded across the region, both in the extensive and intensive margins. Hand in hand with fast economic growth, countries achieved very important social progress, but then, during the bust phase (2013-2019) they suffered from an abrupt slowdown and, in many cases, recession, what created important turmoil in the region (Ocampo, 2017, ECLAC 2014).

In fact, the expression $\frac{\theta(1+\alpha)}{\pi}$ can be viewed as an internal multiplier (or moderator) of commodity prices volatility, because it expresses the impact on y_B for any change in price-evolution.

Figure 3: The effect on y_B of a commodity-prices acceleration.



Source: Own elaboration

Next, consider the effect of a change in real devaluation rate, something that has been extensively discussed in post-Keynesian literature (see Blecker, 2022a):

$$(11) \quad \frac{\partial y_B}{\partial (e-c)} = \frac{[\theta\alpha + \psi + (1-\theta)(Y-1)](1-\beta)}{\pi}$$

As expression (12) shows, an acceleration in real devaluation rate has multiple and contradictory effects on the equilibrium growth rate, but all of them are moderated by $(1-\beta)$, the rate at which local prices depart from international ones as a consequence of a devaluation, because $\beta\%$ of the increase in nominal exchange rate is immediately transmitted to local prices³. In fact, in an extremely open economy (β tends to 1) all the effect cancels. The effects generated are:

- An increase in the profit margin in the production of commodities, what generates a supply reaction increasing the production and exports in α for each point of real devaluation increase, what impacts the external constraint in θ , the share of commodities in total exports. That is the meaning of the first term in the numerator of the expression (12). Let's call this the *commodity supply effect*, clearly positive on growth rate.

³ Also, similar to the marginal effects of p_{com} , and as will be the case in next marginal effects too, any impact in the growth rate affects imports given their income elasticity reducing that impact.

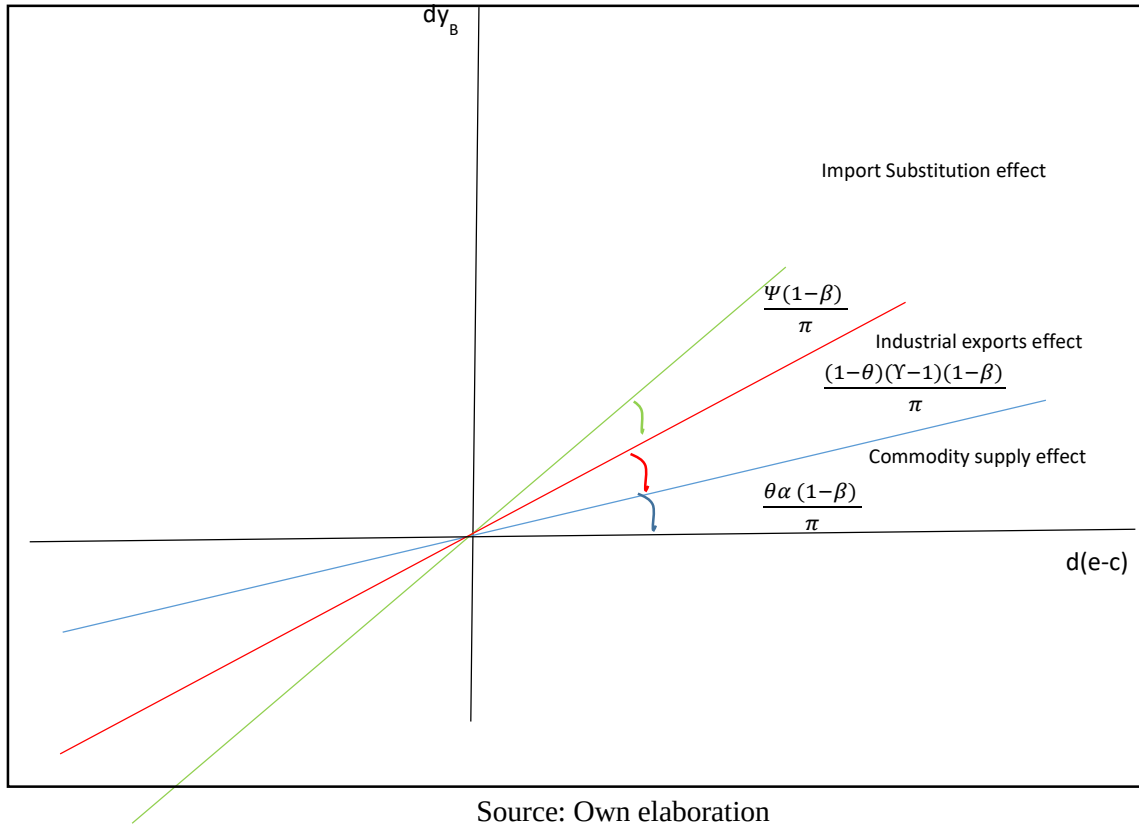
- An increase in the relative local price of imported goods (in local currency) which, will cause a fall in the demand for imports in $\psi\%$ for each point of increase in that relative price, affecting positively the external constraint. This will be called *the import substitution effect* which explains the second term in equation (12) and also relaxes the external restriction, allowing the economy to grow faster.
- Finally, an ambiguous effect on the external currency flows derived from industrial exports. On one hand, the devaluation, as it reduces the price of those exports when expressed in dollars, affects, *ceteris paribus*, negatively and proportionally, the inflows derived from those exports. That is the sense of the “-1” in that term. On the other hand, price reduction affects positively the competitiveness of industrial exports, increasing their demand (and exports) according to their price elasticity of demand (Y). So, if price elasticity of exports is higher than one, this effect would prevail, and the net effect of this term will be also positive. But if industrial exports demand is price-inelastic, then this effect would be negative, and the final effect of the real devaluation acceleration will depend on the relative amount of this effect and the previous ones. Note that these two effects are moderated by $(1-\theta)$, the share of industrial exports in total exports. This effect will be called *industrial exports effect*.

So, this combined effect will tend to be positive, the higher Y and θ , because, the only possible negative effect (the last analyzed) will tend to be smaller, while the first one, undoubtedly positive will be higher. Operating with eq. (12) it can be shown that, given $\beta < 1$, the combined effect of real devaluation will be positive if $\theta(\alpha + 1) + (1 - \theta)(Y) + \psi > 1$. That result depends on θ and there are two extreme situations:

- when θ tends to 1 (an almost exclusive commodity exporter), when last result becomes: $(\alpha + 1) + \psi > 1$ what is assured, given both parameters are positive, so the effect is positive.
- when θ tends to 0 (no commodity exports), the condition tends to the Marshall Lerner condition and Thirlwall (1979) apply, that is $Y + \psi$ must be greater than 1 to get a positive effect.

So, in this model the effect of real devaluation is always higher than in canonical BPCG model. Figure 4 show, additively, the case in which all these effects are positive ($Y > 1$).

Figure 4: The effect on y_B of an acceleration in real devaluation



In the third place, consider the effect on y_B of a change in p^* , which is the price of imports and, also, of competitors of industrial exports.

$$(12) \quad \frac{\partial y_B}{\partial p^*} = - \frac{1 + \beta\theta\alpha - (1-\beta)[\psi + Y(1-\theta)] - \beta(1-\theta)}{\pi}$$

Many different effects are mixed in this expression. In the first place, following the order of terms in equation (13), an increase in the rate of change of import prices (international inflation), generates, ceteris paribus, a proportional effect in the outflows of dollars to pay for them, what is reflected by the first “1” (note that all the term is preceded by a ‘minus’ sign). Additionally, it creates an increase in commodities production costs (in a proportion β), what, given their exogenous prices, implies a reduction in the profit margin, generating a negative reaction in commodities supply given by α , what affects a $\theta\%$ of the total exports’ dollars inflows. These two effects are undoubtedly negative, in the sense that they increase the outflows or reduce the inflows of foreign currency, strengthening

the external constraint. But in the opposite direction, or in ambiguous sense, there are several other effects:

- The international inflation increase has an ambiguous effect on dollars outflows, because, in addition to the effect already mentioned, it makes imports less competitive in local market, unleashing the import substitution through ψ . This effect is moderated by $(1-\beta)$, the percentage in which import prices departs from local ones.
- The increase in p^* increases the competitive capacity of industrial export in foreign markets given Y , in a $(1-\beta)\%$, because the other $\beta\%$ is transferred to local production costs. This effect only affects the share $(1-\theta)$ of dollars inflows explained by industrial exports.
- Finally, the increase in p^* has another positive effect on the dollar inflows associated to industrial exports; it enables prices to increase the complementary of previous effect (the other $\beta\%$ of the increase in p^*), increasing the external currency inflows without market competition negative effects, given that the competitive external industrial good is also increasing its prices. That is the sense of the last term in the right of the equation.

So, the effect of an increase in p^* has an ambiguous effect on the external constraint, but, at a first glance, it can be deduced that the higher ψ and Y (the price elasticities of imports and industrial exports respectively) the stronger the positive effects. So, if the “elasticity pessimism” assumption holds, the negative effects of the increase in international inflation would tend to prevail and vice versa. Also, the higher β , the stronger the negative effects, because the economy would internalize more of the negative shock.

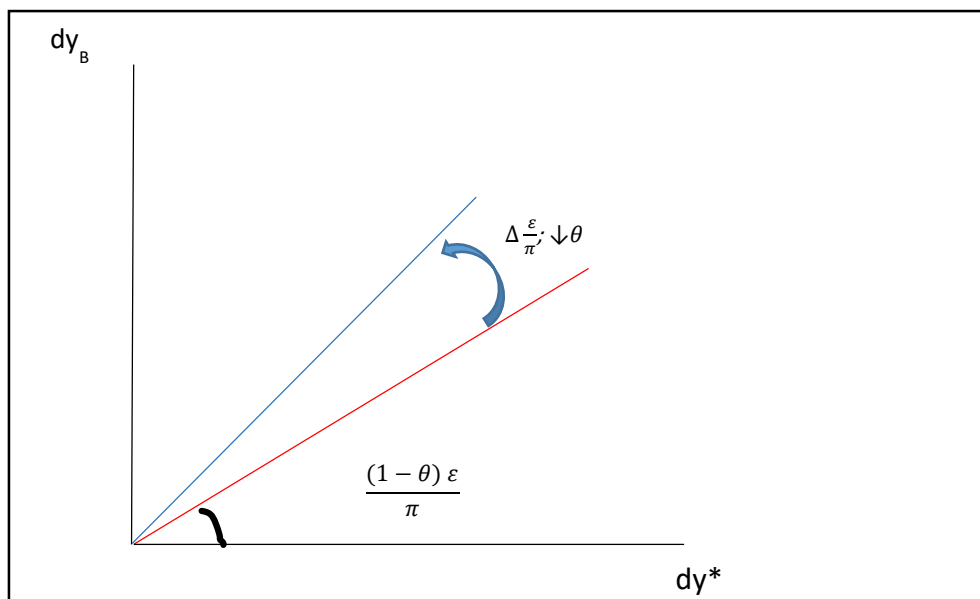
Finally, the last effect to consider is the increase in commercial partner’s growth rate:

$$(13) \quad \frac{\partial yB}{\partial y^*} = \frac{(1-\theta)\varepsilon}{\pi}$$

In this case, the effect on growth is clearly positive and depends on the industrial export’s income elasticity, the share of industrial exports and, as usual, in the imports income elasticity. This result is close to the “Thirlwall law”, but moderated by the share of industrial exports, since, in this model, there also are considered commodity exports, not

directly affected by partners' economic growth, because there are not demand constraints considered in commodity markets. Figure 5 shows this effect:

Figure 5: The effect on y_B of an increase in commercial partners



Source: Own elaboration

4- Empirical strategy and preliminary results

In this chapter, previous section model will be empirically contrasted for South American countries for the period 1962-2017. The objective is limited to validate the sign and significance of main variables in theoretical model; because given the high number of theoretical parameters, a complete validation of the model would be extremely challenging. The selected period derives from the availability of data. For this task, three different databases were assembled to create a panel and use panel-data techniques.

4.1 The Data

In the first place, Penn World Table, version 9.1⁴ (Feenstra et al, 2015), provide general macroeconomic information. Particularly the following variables are taken or built based on this database:

⁴ <https://www.rug.nl/ggdc/productivity/pwt/pwt-releases/pwt9.1?lang=en>

Table 1 – Variables taken from PWT 9.1

Variable	Description
Y _t	National account-based real GDP at constant 2011 national prices (in mil. 2011US\$), form where economic growth is calculated
xr	Exchange rate, national currency/US Dollar
pl_con	Price level of consumption (Purchase Power Parity/XR) for USA used to deflate nominal variables
csh_i	Share of gross capital formation at current PPPs - Investment
Commercial Openness	Sum of the share of merchandise exports and merchandise imports at current PPP.

Secondly, *World Bank Commodity Price Data (The Pink Sheet)*⁵ (WB database henceforth) is used, from where annual prices for 47 commodities (food, metals and minerals, raw materials and fuels) are taken for the whole period. In third place, information of international trade flows was taken from the *Atlas of Economic Complexity Database*⁶, using the Standard International Trade Classification (SITC) at 4-digit disaggregation. This provides annual information of exports for more than 700 different goods. So as to create a country-specific primary commodity price index, each commodity from WB database was associated to the corresponding good in SITC classification. The country-specific commodity price index was built weighting each commodity price by the share of that commodity in total commodity exports of the specific country each year according to the equation 15:

$$(14) \quad CPI_{i,t} = \sum_{p=1}^n \frac{PI_{p,t} * X_{p,i,t}}{\sum_p X_{p,i,t}}$$

Where $x_{p,i,t}$ is the value of exports of *commodity* “p” from country “i”, during year “t”. PI is the commodity price index (deflated by MUV⁷ index, year 2000=100) from WB

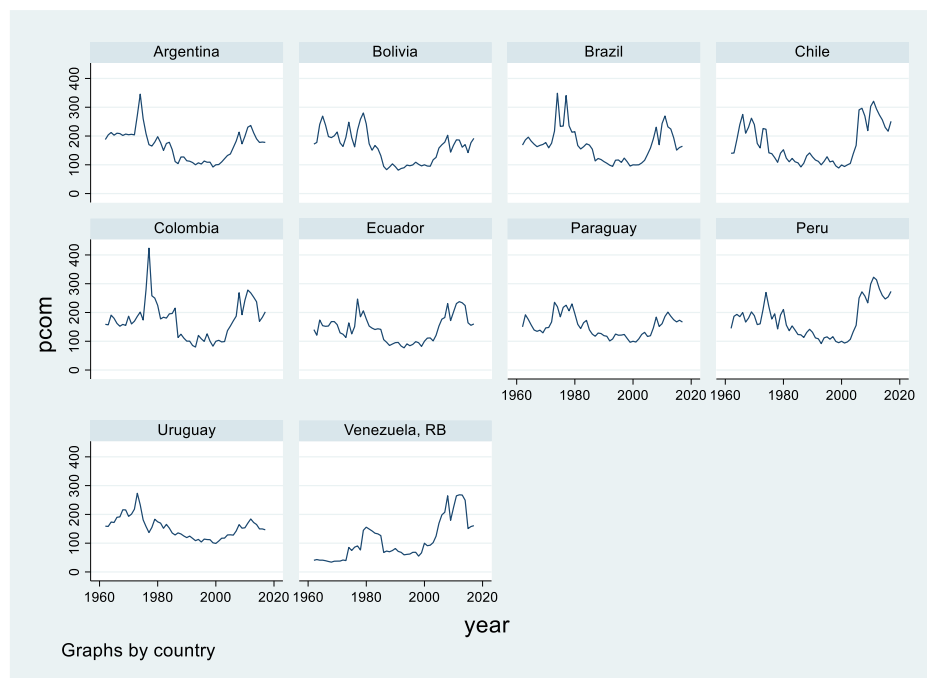
⁵ <https://www.worldbank.org/en/research/commodity-markets>

⁶ <https://atlas.cid.harvard.edu/>

⁷ Manufacture Unit Value is an index usually used to deflate commodity price indexes (Radetzky and Warrell, 2021)

database. Figure 6 shows the commodity price index for South American countries, for the period 1962-2017.

Figure 6: Country specific commodity price index



Source: Own elaboration based on PWT 9.1, Atlas Economic Complexity Database and World Bank Commodity Price data “The Pink sheet”

As can be observed, the country-specific commodity price indexes show common trends for all South American countries. All indexes show a decreasing trend from the seventies (the eighties in the case of Venezuela given its extreme specialization in oil exports) until the beginning of the present century. Then, in coincidence with the last commodity-boom, they reverse and start a sharp growth reaching a peak around 2012 and a new fall during last years. That is in line with previous research findings (Ocampo and Parra-Lancourt, 2010; Bértola and Ocampo, 2013). It also can be observed differences in the relative magnitude of the maximums and minimums in different periods for different countries.

Additionally, from the same database, a country-partner set of matrices was built which contain the share of each commercial partner (in non-commodity exports) for each country, each year. Those matrices were used to build an effective exchange rate for each country yearly, that shows the weighted average of bilateral exchange rates (variable ‘rer’) and the “relevant rest of the world” economic growth, that is the weighted rate of

growth of commercial partners (variable *yrw*), which is also specific for each country/year.

4.2 – Econometric specification and results

According to the main equation (9) of the model developed in previous chapter, the following equation is specified:

$$(15) \quad y_{i,t} = \beta_0 + \beta_1 p_{com\ i,t-1} + \beta_2 rer_{i,t-1} + \beta_3 yrw_{i,t} + X_{t,i} + u_i + \varepsilon_{t,i},$$

where $y_{i,t}$ is the growth rate of country “i” in year “t”, p_{com} refers to the country-specific commodity price index variations, rer is the variation in bilateral real exchange rate, yrw the “relevant rest of the world” growth, u are the country fixed effects and ε refers to the disturbances. X is a vector of control variables (investment share and commercial openness). The variables p_{com} , and rer are lagged one year because of statistical (avoid a possible reverse causality) and economic reasons (the effect of those variable on economic growth is expected to take some time). The change in international industrial prices (p^*), that appears in equation 10, has been removed from eq.16 because, because it is implicit in p_{com} , since, as mentioned, the index MUV (which reflects exactly that) was used to deflate commodity prices. In this way, p_{com} here is in fact a proxy to terms of trade.

According to previous chapter’s analysis, β_1 , β_2 and β_3 are expected to be positive. Panel data techniques are used mainly with fixed effects, and Arellano – Bond dynamic specification is also run to cope with possible endogeneity problems. The correlations between variables are shown in next table, where the lagged variables in eq.16 also appear in contemporaneous form to assess options:

Table 2: Correlations between main variables

	y	pcom	pcom -1	rer	rer-1	yrw
pcom	0,1667	1				
pcom -1	0,1488	-0,0064	1			
rer	-0,299	-0,1045	-0,0585	1		
rer-1	0,0484	0,0553	-0,1041	-0,0356	1	
yrw	0,2902	0,3226	-0,0096	-0,0672	0,0611	1

pcom variable in lagged and contemporaneous form show similar correlations with growth but the lagged one avoids a very high correlation with the external growth. In the **rer** case, the lagged variable avoids a reverse causality negative relation with growth of contemporaneous variable. In table 3 the results are shown, where the dependent variable is always the economic growth rate (y):

Table 3 – Econometric results

Variable	Complete FE	C.FE Robust	Complete. RE	Time cont.	Control vble 1	Control vble 2
pcom -1	0.041***	0.041***	0.041***	0.031**	0.034***	0.029***
rer-1	0.016	0.016	0.016	0.027**	0.024**	0.024**
yrw	0.755***	0.755***	0.756***	-0.974***	0.782***	0.829***
Investment					0.265***	0.237***
Openness						0.052***
Constant	0.008**	0.008	0.008*	0.115***	-0.044***	-0.054***
N	540	540	540	540	540	540
N_g	10	10	10	10	10	10
chi2			68.864			
F	22.920	19.490		4.251	32.746	28.393
r2	0.115	0.115		0.334	0.199	0.213
				Legend:	*p<.1; ** p<.05; *** p<.01	

The first specification in the left is the simplest one, using fixed effects. The second controls for heteroscedasticity; in the third case, the random effect specification is used as a robustness check. The fourth column includes time-controls and the rest of columns include, successively, control variables.

In the first place, the F and chi2 rows show that in all models variables are jointly significant in the sense that it can always be rejected that they are all zero. Additionally, we can assure that commodity prices changes are a very significant variable to explain the growth rate of the countries of the region during the period studied with the expected positive sign. Despite being a very ‘common sense’ result, it makes explicit the relationship, through the external constraint and is in line with the historical evidence mentioned in the introduction, where the relation between South American economic cycles and commodity prices has been very clear. Also, as expected, the evolution in the effective real exchange rate shows a positive sign and it becomes significant with time controls and with control variables. In the same line, the rest of the world growth (**yrw**) is always positive and significant, despite it turns negative in one specification, when time

variables are added. This should not be surprising since the main role of this variable is to signal good and bad years in world demand, so, when adding time controls, normally those controls tend to absorb the effect of international booms and crises, affecting the interpretation of **yrw** variable.

Adding some standard control variables, the model increases its explicative power, maintaining the signs and significance of main variables. Commercial openness is always positive and significant, what should not be surprising in an external sector model and Investment share also is significant and show the expected positive sign.

In this way, the theoretical model developed shows empirical adequacy, passing the first tests to which it is subjected. Nevertheless, there could be an autocorrelation problem in the dependent variable, associated to a possible drag effect on growth from one year to the next. To deal with this problem, next we run a dynamic model (GMM, Arellano – Bond specification), which includes a lag of the dependent variable as an explicative one. Table 4 shows these results:

Table 4. Dynamic specification results

Variable	A-B	A-B Robust	A-B time cont	Control vbles
y-1	0.368***	0.368***	0.294***	0.298***
pcom -1	0.026***	0.026***	0.030**	0.018*
rer-1	0.050***	0.050***	0.048***	0.050***
yrw	0.669***	0.669***	-0.847***	0.726***
Investment				0.166***
Openness				0.051***
Constant	-0.002	-0.002	0.023*	-0.047***
N	530	530	530	530
N_g	10.000	10.000	10.000	10.000
chi2	153.772	127.806	305.464	208.769
Legend:	*p<.1;	**p<.05;	***p<.01	

First column is the simple model using Arellano-Bond specification, the second is a heteroscedasticity robust specification, the third includes time controls and the last one includes control variables. The Wald tests using the chi2 show the significance of the models as a whole. This formulations confirms the existence of dynamic in the model,

but the significance and sign of the variables confirm previous results in different specifications⁸.

5- Discussion and conclusions

Commodity dependence is a long lasting structural feature in many developing countries, and particularly, in all South American countries. Its consequences on economic performance are vast and have been studied from several theoretical approaches, highlighting high volatility, a recurrent tendency to balance of payment crisis and slow long run growth. Addressing this issue requires considering several specific features related to both, the supply and the demand sides.

In this paper I propose a model that seeks to articulate mostly Post-Keynesian and Structuralist insights (with, also, some neo-Schumpeterian contributions) which seems to account for most of the stylized facts. In the first place it makes explicit the relationship between commodity prices and growth through the external constraint. But in that relation, not only demand factors are considered, but also supply factors. The capacity of commodity production to react to higher profitability conditions depends on technical and economic factors, such as the availability of unused natural resources (or previously dedicated to other uses different from producing commodities for export), the existence of intensification options (in what technological and innovation capabilities matter), and their relative costs. Those factors are summarized in the model through the parameter α , which may vary widely between countries, explaining different reactions to similar shocks. Additionally, the marginal effect $\frac{\theta(1+\alpha)}{\pi}$ can be viewed as a double edge expression, since a high value can be understood as a positive result because it means that economy can take advantage of positive international conditions (commodity prices), but, on the other hand, it means that the economy tends to multiply the external shocks (positive and negative), creating volatility. Also, a high value of this expression means that the economy is tied to external and very volatile prices, so sustained growth would only be possible through a structural transformation that creates other endogenous sources of growth (Pacheco-López and Thirlwall, 2006; Araujo and Lima, 2007; Spinola, 2020). This may be especially imperative if the widely known thesis of Prebisch-Singer holds,

⁸ Sargan and Arellano-Bond test confirmed that the models were over-identified and that there is no second order autocorrelation in the first differences of errors (Montero, 2010).

which asserts that, beside the volatility problems, the prices of commodities present a long-term trend of relative deterioration compared to industrial goods (Cimoli and Porcile, 2014).

The empirical results confirm the signification and sign of this relationship, but they suggest a (at first sight) quite low value (less than 5%). This is not surprising considering the high volatility of these prices and, specially, that, in these specifications, only year to year effects are captured when it is reasonable to think that some of the effects of a commodity price increase on growth may take several years to manifest.

Moreover, the model restores the importance of exchange rate variations to the BPCG framework, in an original way, different than the main alternatives developed in the literature, that is either affecting imports and exports income elasticities, or affecting capital accumulation in export sectors⁹. This has recently been an intensely debated issue. Interpretations from post-Keynesian and heterodox approaches, have distributed from an almost completely neglect of their importance in long run (McCombie and Thirlwall, 1994) to considering it as the most important macroeconomic price for development (Bresser-Pereira et al. 2015).

In this model, despite that, as in canonical BPCG model, the higher the price elasticities of imports and exports (ψ and Υ), the stronger the impact of real devaluation, the fulfillment of Marshall – Lerner condition is not a requirement for this mechanism to work, in clear contrast with Thirlwall (1979). That is because additionally to price competition in imports and industrial exports, there is another channel through which relative prices can affect. It is the profitability on commodity production, which is strongly affected by exchange rates changes, since prices are assumed to be set in foreign currency (U.S. dollars), so they are not affected by devaluation, but it reduces internal costs in relation to those prices, what would unleash investments to increase production and exports. This is in line with historical data and political economy approaches, where primary exporters are always interested in higher exchanges rates (Bértola and Ocampo, 2013, Porcile and Sanchez Ancochea, 2021). Another contribution of the model is that it makes explicit the role of the pass-through from devaluation to inflation, what operates in the opposite direction and, in the extreme, may completely cancel the effect (if $\beta=1$).

⁹ Despite this way can be considered close to the *commodity effect* described here

So, the openness of the economy and its macroeconomic specificities may make a difference that should be considered.

As is exposed in last section, the higher θ and Y (also α and ψ) the more positive this effect. This is in line with Oreiro et al (2015) and Blecker (2022b), who conclude that the real exchange rate tends to be more important for growth for developing countries than for advanced ones, since developing countries (and specially South American ones) are more likely to be commodity dependent (higher θ) and their industrial exports tend to be more simple and standardized (Hausmann et al, 2014), what means more dependence on price competition (high Y) (Bottega and Romero, 2021). The empirical estimations confirm the importance of this variable for growth in South American countries. This is very important, especially at the light of the current debate in the post-Keynesian literature. These results are in line with Blecker and Razmi (2010) and Blecker (2022a, 2022b) where the importance of this variable has been corroborated. So, this model reestablishes the importance of price-competition, normally neglected in BPCG models, as advanced.

Finally, the importance of the relative size of exports' and imports' income-elasticities of demand, central in traditional BPCG analysis is maintained, despite moderated by the share of industrial exports. Coincidentally with that analysis, convergence will be more likely the higher industrial export's income-elasticity, what can be considered related to exports sophistication (Araujo and Lima, 2007; Gouvea and Lima, 2010), and, as usual, the lower imports income-elasticity.

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