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**Debating the assumptions of the Thirlwall Model: A VECM  
analysis of the Balance of Payments for Argentina, Brazil,  
Colombia, and Mexico**

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# **Debating the assumptions of the Thirlwall Model: A VECM analysis of the Balance of Payments for Argentina, Brazil, Colombia, and Mexico.**

Danilo Spinola\*

## **Abstract**

This article challenges the main assumptions of the Balance of Payments Constrained Model (BPCM, aka Thirlwall model) related to the long-run: (1) equilibrium of the trade balance. (2) Stability of price-effects. (3) Foreign income growth positively affecting domestic income. Some authors raise the argument that the BP is rarely observed in equilibrium (Alonso & Garcimartín, 1998); price effects, through the real exchange rate, do affect the long-run (Rodrik, 2008); and foreign income has no effect (or negative) on domestic income (Razmi, 2016). The BPCM is based on its assumptions to defend the existence of a long-run growth rate compatible with a stable growth of the balance of payments, in which the effective growth rate converges to avoid external constraints (McCombie & Thirlwall, 1994; Thirlwall, 1979). In order to challenge the assumptions of the BPCM, we apply a time series co-integration Vector Error Correction Model (VECM) using the BPCM related variables to Argentina, Brazil, Colombia, and Mexico, the larger countries in Latin America. The data source is the Penn World Tables (PWT) for 1950-2014. We apply impulse-response and permanent shocks in selected variables, observing their effects on Real Exchange Rate, GDP, and Trade Balance. The results are compared to the assumptions raised in this research; we empirically find that the BPCM assumptions are not empirically robust for the selected countries. This offers an invitation to more empirical work that can strength the arguments of the BPCM model.

**Keywords: Balance of Payments Constrains, Latin America, Economic Development**

**JEL: O11, F41, E12**

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## 1. Introduction

In Macroeconomic theory, there is a special place to discuss the long-run properties of economic adjustments. Following a standard perspective (Samuelson, 1948), the theoretical relationship between short-run and long-run are linked to the idea of equilibrium, in which deviations are seen as short-run noises that do not affect the direction of the system. The system adjusts itself towards a fixed long-run gravitational point (or trend). This rationality also applies to cycles, which regularly oscillate around a long-run point/trend.

The Balance of Payments Constrained Model (BPCM) model, developed in the 1970's by Anthony Thirlwall (1979), follows a similar general idea about long-run adjustments. It links economic growth with the Balance of Payments (BP) behaviour. Short-run noises (changes in the real exchange rate/terms of trade or financial flows) do not affect the long-run, which is given by the Thirlwall Law – long-run growth is defined by the income elasticity ratio between exports and imports times foreign growth.

One important critique to the BPCM (raised in the literature review raised by Blecker (2016)) concerns the observance that the growth of the current account does not converge to stability. Chronic deficit and surplus are the norm, not the exception.

Latin America has been historically a region in which external constraints played a major role in halting the economic development process of the region (Bertola & Ocampo, 2012). The trade balance has been a major source of economic constraints throughout its historical development generating a pattern of strong volatility in the region (López & Thirlwall, 2006; Ocampo, Rada, & Taylor, 2009).

In the debt-crisis of the 1980's. Most Latin American countries, indebted during the 1970's, faced a halt in credit supply and a big rise in international interest rates in the beginning of the 1980's (Ocampo, 2004). This resulted in a shortage of foreign currency and high foreign debt services, forcing a strong domestic recessive adjustment that and the need for agreements with the IMF (Ffrench-Davis, 2005). In this case, the short-run situation defined the adjustment characteristics, and economies were dominated by their balance of payments ( Ocampo, 2017). There were no margins for foreign deficits.

The recurrence of this problem to Latin American countries partially explains why so many Latin American scholars are working in this topic, and why the Thirlwall model has such high acceptance in Latin American economic debates.

The Latin American region rarely showed a long period of stability in its external accounts – oscillating between large periods of deficit and short periods of surplus. This has been the core of the major interpretations of the Structuralist tradition (Cimoli, Porcile, & Rovira, 2010). Can we observe that the long-run growth rate of the Thirlwall model is a good predictor of domestic effective growth rates in Latin America? Does the long-run growth rate make any empirical

sense? Or are these economies actually just guided by short-run adjustments? If yes, what are the variables that affect long-run equilibrium growth?

To answer the above questions, we first search for the definition of long-run, so frequently used in the literatures, sometimes with different meanings, which plays a central role in this discussion. Based on Carvalho (1984) we can resume three distinct perspectives about the long-run (LR) usually observed in the post-Keynesian theory:

- (1) The LR is a process of noise removal, where full equilibrium is attained when variables move to their natural value (Samuelson, 1948). Equilibrium here follows an abstract condition, and the point reflects the conditions in which the variables “really” represent.
- (2) LR as a stable point/trend to which the countries converge to, following a gravity centre approach. The long-run is then an attractor, a gravitational point, describing actual growth paths (Kaldor, 1957; Pasinetti, 1983). Following this perspective in our analysis, countries seem to converge, despite the presence of noise, to a long-run value.
- (3) The LR seen as a conjunction of a succession of short-runs without any tendency to a stable equilibrium (Davidson, 1980; Minsky, 2016). As stated by Robinson (1971), the long-run does not exist separately from the short-run. In the case of this analysis, we observe this long-run as a persistence of imbalances in the current account, which poses an empirical challenge to justify the Balance of Payments Constrained Model assumptions.

The BPCM has many important assumptions related to the long-run (LR) that are on the basis of the idea that adjustments to the equilibrium path occur on the GPD growth rates of these countries: (1) Trade balance is in equilibrium in the LR. (2) Price-effects are negligible and do not affect the equilibrium LR growth rate. (3) Foreign income growth positively affecting domestic income. The literature shows the existence of stylized facts that question these assumptions. Some authors raise the argument that the BP is rarely observed in equilibrium (Alonso & Garcimartín, 1998); price effects, through the real exchange rate, do affect the long-run (Rodrik, 2008); and foreign income has no effect (or negative) on domestic income (Razmi, 2016). The BPCM is based on these assumptions to defend the existence of a LR growth rate compatible with a stable growth of the balance of payments, in which the effective growth rate converges to avoid external constraints ( McCombie & Thirlwall, 1994; Thirlwall, 1979). From the above definitions of the LR, we can then raise and discuss the main critiques and assumptions of the BPCM, and then test them with an empirical work that captures the short- and long-run relationship between the BPCM variables.

For the empirical work, we reverse the often used research logic of the BPCM literature tradition. Instead of imposing a specification to estimate the model parameters, we select the BPCM variables and allow the data to speak for itself. Using time-series Vector Error Correction

Models (VECM), we let the variables associated with the BP (trade balance, rate exchange rate, and domestic income) define how the relationship between them occur. The data comes from the Penn World Tables (PWT) for the largest economies in Latin America (Argentina, Brazil, Colombia, and Mexico). The VECM method defines the short- and long-run relationships of the model.

After this introduction in section 1, in section 2 we present a literature review and raise the main assumptions and critiques related to the BPCM. We define our main research questions in section 3, which are further analysed in the discussion section (section 7). In section 4 we present the data from the PWT. In section 5 we present the VECM methodology and explain how we estimated the models. In section 6 we show the overall results. In section 7 we discuss the results in the light of the literature review and the research question presented respectively in sections 2 and 3. Finally, we conclude this paper in section 8.

## **2. Literature Review**

### **2.1. Assumptions of the BPCM**

Based on the discussion of the BPCM debates and critiques raised by McCombie & Thirlwall (1994), McCombie (2012) and Blecker (2016), we raise in this section the main assumptions behind this model.

#### **Assumption 1. A country cannot have persistent trade (current account) imbalances in the long-run**

There are two perspectives associated to Assumption 1. The first concerns the imbalances on levels of the trade balance. The second concerns its rate of change. The first perspective is related to the empirical observance of persistent current account deficits for many developing countries (Alonso & Garcimartín, 1998). This persistent imbalance is easily observed, and the assumption can be easily challenged - as we can see in Figure 1 and Table 1, in the introduction of this article. The second reading concerns the argument that the rate of growth of exports should balance the rate of growth of imports in the long-run, which demands that the growth rate of the Trade Balance equals to zero in the long-run. In this way, countries can have persistent but not increasing deficits in their current account. In the first view, the short-run argument is that  $X = M$  in the long run. In the second one the condition is that  $\hat{X} = \hat{M}$ , so we should not see an explosive path in the current account behaviour.

#### **Assumption 2. Relative prices (RER) are constant in the long-run.**

In the neoclassical world, adjustments to equilibrium come from changes in relative prices. In the Thirlwall model, however, we have quantity closures. Domestic growth rate fills the role of adjustment variable as price effects are negligible. The argument is that we observe low price elasticity of imports and exports, and price in the long-run grow at zero rate, which guarantee

price-effect neutrality in long-run economic adjustment (John S. L. McCombie, 2012). Considering the constant value of the income elasticities of imports and exports, adjustments in the growth rates (Assumption 2) make the growth of imports equal to the growth of exports in the long-run (Assumption 1).

**Assumption 3. Foreign growth has a direct relationship to domestic growth.**

Returning to the Thirlwall Law equation  $\hat{Y} = \frac{\delta}{\epsilon} \hat{Y}_f$ , we observe that domestic growth depends on the income elasticity ratio times foreign growth. In the canonic BPCM (Anthony Philip Thirlwall, 1979), it is expected that both income elasticities do demand for exports and imports are have positive values. An income increase raises the demand for foreign products. In this sense, growth in foreign income leads to increase in international demand, rising exports, domestic GDP growth (income), and then imports.

**2.2.Main critiques to the BPCM**

The main arguments were taken from the broad literature review developed by McCombie (2012) and Blecker (2016).

Table 1. Literature review on the main critiques to the BPCM

<b>CRITIQUE</b>	<b>Authors</b>	<b>Argument</b>
<b>EMPIRICAL</b>		
Near Identity	McCombie (1981), Clavijo & Ros (2015), Razmi (2016)	The empirical works measure a tautology if exports and imports grow at similar rate in the long-run.
Foreign income critique	Razmi (2016)	Critique to the argument of a strong positive correlation between individual country growth rate and foreign growth.
Level and Rate debate in relative prices	Rodrik (2008), (Rapetti, Skott, & Razmi (2012), Berg, Ostry, & Zettelmeyer (2012), Razmi (2016) Oreiro (2016)	Evidence that RER levels have significant effects on income growth in many countries.
Inconsistency of the basic assumptions of the model	Research gap found in this research.	Question the empirical robustness of assumptions 1 and 2.

Sources: Author’s own. Based on McCombie (2012) and Blecker (2016).

We focus on the empirical part of critique.

**Critique 1. Near Identity Critique: The empirical works measure a tautology if exports and imports grow at a similar rate in the Long-Run.**

McCombie (1981) criticizes the Thirlwall law for having a circular reasoning. When calculating the GDP rate of growth, if we divided it by its level, we end up with the Thirlwall

law, which is the same as estimating the values of the income elasticities of demand for imports and exports when the terms of trade do not change. If exports and imports grow at similar rate in the long-run, then this leads to a circular argument in which the law is only measuring a tautology. This critique eventually comes back to the debate, and it has been debated by many critiques and defenders such as Thirlwall (1981), and more recently McCombie (2012) himself.

### **Critique 2. The role of foreign income against domestic capital accumulation**

The foreign income argument, stated mainly by Razmi (2016), questions the BPCM argument of a strong positive correlation between individual country growth rate and foreign growth. The author, using a Generalized Mixed Model (GMM) and growth data for 167 countries shows two interesting results to question some elements of the BPCM: (1) that there is a negative, or no-correlation at all, between foreign and domestic growth, and (2) Undervaluation has positive effects on growth that is statistically significant in some estimates.

### **Critique 3. The level of relative prices playing a role in the long-run**

This critique comes from two sources:

- 1) The argument of price-elasticity pessimism, in which the sum of the price elasticities of imports ( $\mu$ ) and exports ( $\nu$ ) are close to 1 ( $\mu + \nu = 1$ ). The literature show mixed evidences about that.
- 2) The relative prices are rather stable in the long-run. Lack of credibility if the real exchange rate keeps continuously rising in the long-run, which would require constant structural devaluations (McCombie, 2012).

As Rapetti et al. (2012) point out, the price effects pointed above do not imply that the level of the real exchange rate does not affect growth, only its appreciation/depreciation rate. Razmi (2016) finds out that the RER levels have significant effects on income growth in many countries (especially developing countries). Undervalued levels of RER for substantial periods of time can obtain long-term benefits as a result.

## **3. Research Questions**

The research questions are developed from the critiques presented in the previous sub-section. In this section we present the main question, briefly explaining the motives and ideas behind them. We discuss our expectations for the results and their implications for the theory behind the BPCM.

- (1) Research Question 1 (RQ1): Do countries show a trade balance equilibrium in the long-run? How to re-balance the TB to equilibrium?**

In the literature there are confusions when looking at levels and rates. As reinforced by McCombie (2012), the confusion may reside in the idea that in the BPCM model it is not  $X = M$



that applies to the long-run, but  $\hat{X} = \hat{M}$ . The Thirlwall model is about growth rates, not levels. So in the long-run it is not the BP that needs to stabilize, but the foreign deficit growth rate. In this sense, there can be persistent deficits, but they cannot consistently grow in the long-run. Otherwise, the growth rate of imports would be higher than the growth rate of exports, generating an explosive growing imbalance in the external sector. We can check that by looking at the baselines of our models. In the case of an imbalance, how to re-balance the model? Could we use an export shock which could counterbalance these effects? In order to answer that we raise the following question: what would be the impacts of a rise in export and investment shocks on growth?

**(2) Research Question 2 (RQ2): Do price effects affect the long-run equilibrium rate of GDP growth?**

This is the main aspect of the Thirlwall model that differentiates it from the neoclassical world, in which price effects are the main adjustment mechanism. In Thirlwall (1979), the adjustment to the equilibrium occurs in quantities rather than prices. Domestic growth adjusts to the external constraints, not the terms of trade or the real exchange rate. We expect the result in our test to be not as strong as theoretically defined in the BPCM, in which we see the presence of both adjustments in prices and quantities. The empirical implications maintain the existence of balance of payments constraints, although with a smaller role in defining the long-run growth. When looking at price effect, we analyse the effects of RER shocks (terms of trade) on domestic income. The presence of a Marshall-Lerner effect guarantees that an exchange rate undervaluation increases trade balance (after a short *J-curve* period of adjustment). We expect this improved trade balance to increase domestic demand, resulting in higher domestic growth.

**(3) Research Question 3 (RQ3): Do increases in foreign income result in higher economic growth?**

This research question has been historically accepted by the BPCM literature. When the world grows, does that also imply in higher growth in the domestic economy? Do we observe this positive pass-through?

Following the traditional literature (A. P. Thirlwall & Hussain, 1982) we expect increases in foreign income to generate higher international demand, resulting in higher domestic exports and higher domestic growth. Empirically this idea has been challenged by Razmi (2016) who found that increases in foreign growth may lead to either no effect on domestic income, or even in some cases a reduction. To test this, we apply shocks in the foreign demand variable (*lnusa<sub>q</sub>*) observing its effects on domestic income, and on other variables of the model. Based on the Thirlwall law, when we have a negative elasticity of foreign growth on domestic income, the ratio between income elasticity of exports and imports has a negative value. This is a result that poses a challenge to be explained economically, as this would imply that increases in income

foreign would reduce domestic exports, generating smaller income – which is not economically credible.

#### **4. Data**

The data source for the empirical work comes from the Penn World Tables' (PWT) National Accounts dataset. Data was selected for the period 1950-2014. Based on the critique 4 (section 2), we only select large economies. The focus of this research is on Latin American big countries: Argentina, Brazil, Colombia, and Mexico.

The selected variables from the PWT are: GDP ( $q$ ), total consumption ( $c$ ), total investment ( $i$ ), total exports ( $x$ ), total imports ( $m$ ), and price levels ( $pl$ ). We have a total of 65 observations for each variable. For the GDP ( $q$ ), we use the output-side real GDP at current PPPs ( $gdpo$ ) and the real GDP at constant 2011 national prices (in mil. 2011US\$) ( $rgdp\_na$ ). Following the PWT methodological notes (Feenstra, Inklaar, & Timmer, 2015), this measure is often used to compare relative productive capacity across countries at a single point in time. In order to calculate the main macroeconomic variables ( $c, i, x$ , and  $m$ ) we use the shares of each variable ( $cash\_c, cash\_i, cash\_x$ , and  $cash\_m$ ) applied to the measures of GDP.

The Real Exchange Rate (RER) is computed as the ratio between price levels of the output-side real GDP ( $country\_pl\_gdpo$ ) of the selected country divided by the reference country (USA) ( $usa\_pl\_gdpo$ ). For our estimations, we take the log of the macroeconomic variables ( $ln\_country\_1, ln\_country\_c, ln\_country\_i, ln\_country\_x$ , and  $ln\_country\_m$ ). We use the USA as reference country. US data is used in two occasions: to measure foreign income ( $lnusa\_q$ ), which is used as an exogenous variable in the estimation, and to calculate the Real Exchange Rate (from price levels). Finally, In order to avoid any incompatibility issue with units, we calculate the trade balance as  $TB = \ln(x_t) - \ln(m_t)$

#### **5. Methodology**

We observe the relationship between the macroeconomic variables that adjust the economic system to its equilibrium. For this reason, we focus on the short- and long-run properties. The time-series analysis of the Vector Error Correction Model (VECM) (Johansen, 1991) allows us to observe this relationship. In this way, we can challenge the BPCM theory and its assumptions, comparing the actual empirical results with what was theoretically expected in the research questions. All the models passed in the Unit Root test.

##### **Step I. Model Specification**

We focus on the possible variables that affect the external sector, and the three fundamental aspects in the short- to long-run aspect of the Thirlwall model: domestic income, current account,

and the real exchange rate. The GDP of the reference country (the US) is considered an exogenous variable in our specifications and taken in its first lag ( $lnusa_q(-1)$ )<sup>1</sup>.

Table 1. VECM Specification models, endogenous and exogenous variables

	Endogenous variables	Exogenous variables
<u>Specification 1</u>	<i>country_rer_ind</i>	Constant
RER, Domestic GDP, Exports,	<i>lncountry_q</i>	Trend
Imports, Investment,	<i>lncountry_x</i>	<i>lnusa_q(-1)</i>
Consumption and Foreign	<i>lncountry_m</i>	
GDP.	<i>lncountry_i</i>	
	<i>lncountry_c</i>	
<u>Specification 2</u>	<i>lncountry_tb</i>	Constant
RER, Trade Balance,	<i>country_rer_ind</i>	Trend
Domestic GDP, and Foreign	<i>lncountry_q</i>	<i>lnusa_q(-1)</i>
GDP.		

Source: Own elaboration

We result estimate 8 models: Argentina 1, Argentina 2, Brazil 1, Brazil 2, Colombia 1, Colombia 2, Mexico 1, and Mexico 2. The numbers represent which specification we are currently using.

### Step 5. Scenarios

After creating baselines, we apply (1) an impulse-response analysis and (2) some permanent shocks to selected variables to observe the behaviour of the system. We create scenarios in which the following variables are shocked:

Table 2. Scenarios shocks applied on the baseline of the VECM.

Specification 1	Shocked variable	Specification 2	Shocked variable
Scenario 1	<i>country_rer_ind</i>	Scenario 6	<i>country_rer_ind</i>
Scenario 2	<i>lncountry_x</i>	Scenario 7	<i>lncountry_tb</i>
Scenario 3	<i>lncountry_q</i>	Scenario 8	<i>lncountry_q</i>
Scenario 4	<i>lncountry_i</i>	Scenario 9	<i>lnusa_q</i>
Scenario 5	<i>lnusa_q</i>		

We apply the impulse-responses in some selected variables (real exchange rate, exports/trade balance, GDP, investment, and foreign income). For the permanent shocks we shock the intercept of the selected variables (an equation intercept shift) of 0.05 magnitude (or

<sup>1</sup> This variable enters in an equation for the first difference of your endogenous variables. For example, D(LNARG\_Q) is one of your dependent variables, and this is the first different of LNARG\_Q, or, in other words, the growth rate of GDP of Argentina. We must have also the first different of *lnusa\_q* in this equation (*LNUSA\_Q(-1)*).

5%) from 1979 until 2014. The selected period covers the 1980 crisis, period which we analyse, as discussed in the introduction of this research.

Using Scenarios 1 and 6 we can discuss the Research Question 2, observing the effects of price shocks in domestic income and on trade balance. We can check if these affect or not the long-run equilibrium rate of growth. When using Scenarios 2 and 7, we test Research Question 1, if exports can be used as an adjustment mechanism back to a stable equilibrium point (in which  $\hat{X} = \hat{M}$ ). We also observe if investment can be used as an adjustment mechanism (Scenario 4). Finally, we use Scenarios 5 and 9 to discuss the Research Question 3 – f higher foreign income growth has positive effects on domestic income.

## **6. Overall Results**

We condense our shock results observing the sign of three different effects. The first effect (E1) concerns the immediate initial effects of a shock. The second effect (E2) observes, from the initial effects, if the trajectory increased or decreased on time when reaching the stability point. The third effect (E3) is related to the net final effects.

### **6.1.1. Baselines**

The baselines, computed from the VECM, consist in our main representation of the actual model. We compute baselines for each of our endogenous variables: Real Exchange Rate (*country\_rer\_ind*), domestic income (*lncountry\_q*), total exports (*lncountry\_x*), total imports (*lncountry\_m*), total investments (*lncountry\_i*), and total consumption (*lncountry\_c*) in specification 1, and trade balance (*lncountry\_tb*), RER (*country\_rer\_ind*), and domestic income (*lncountry\_q*) in specification 2. In specification 1, the trade balance is computed from the baseline results for exports and imports. Baselines are not scenarios, but model fit to the data (Actuals) using the characterizations defined in the Johansen Method (Number of Lags, type of VEC, and number of Cointegration Equations).

From the baselines we observe the dynamic evolution of the system, checking if it converges or diverges from a long-run equilibrium point/trend. We later discuss, based on our baselines, some assumptions of the BPCM, the evolution of its variables, and implications the Thirlwall model.

### **6.1.2. Impulse-response analysis**

The impulse-response analysis measures the response of our interest variable to a shock on another variable of the system (which is called innovation). It deals with non-permanent temporary shocks. We are interested in knowing the response of a one-time shock in the system adjustment process. This impact affects not only the selected variable but a number of further variables as well. With the impulse-response analysis we can also see some convergence properties, if the system returns to an equilibrium point. We assess the stability of many

variables of the system, checking some of the research questions raised on this article. In our analysis we shock the variables with a one standard deviation residual impulse (decomposition method).

### **6.1.3. Permanent Shocks**

Permanent shocks are the ones that are repeated during a long period of time. We observe the effects of these impacts in some key variables of the system, checking to where these consistent movements lead its direction. In this analysis we apply consistent shocks after 1979 in some selected key variables (scenarios), covering a period that starts in the “lost decade” period in Latin American history (1979) to the end of the commodity boom in 2014. The shocks consist in a 0.05 (5%) consistent increases in the intercept of the selected variables.

### **6.2. Trade Balance: baseline and scenarios**

The baselines<sup>2</sup> show some of the structures of the system, and the directions to which the system goes. They also illustrate the stability conditions. We see that Argentina shows an initial behaviour that converges to a value around zero. Argentinean trade balance keeps decreasing on time since 1955 until 2014. However, the rate of reduction decreases in both specifications. That might indicate either a continuity of the decrease, or a future reversion of this trend.

In this research we avoid trying to predict the future behaviour of the variables, focusing only on the current data. What we observe in Argentina is a steady reduction of the trade balance towards zero. On the other hand, Mexico shows a strong cyclical behaviour around a positive trend, converging towards a trade balance equal to zero. Brazil and Colombia show a much smaller oscillation in their trade accounts, especially compared to Mexico. Both countries (Brazil and Colombia) seem to converge to the trade balance equilibrium (with a small positive trend). In this specification, Brazil is in a far position from the trade balance equilibrium, but it starts moving towards it, until reaching it around the 1980’s, stabilizing since then.

From a raw observation of the data we can state that Argentina has a steady long-run behaviour with negative trend in the trade balance. Mexico has a strong cyclical behaviour with positive trend, while Brazil and Colombia have a mild cyclical behaviour. All of these countries seem to converge to an equilibrium value, where the trade account is equal to zero.

Table 3. Impulse Response Analysis – Effects on Trade Balance

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<sup>2</sup> Specification 1 does not have a baseline for the Trade Balance, only for Exports. What we do from here is to calculate the effects on the Trade Balance deriving it from its effects on exports and imports.

E1 - Initial Effects on the Trade Balance											
Specification 1						Specification 2					
	Sc	Arg	Bra	Col	Mex		Sc	Arg	Bra	Col	Mex
RER (Devaluation)	1	0	↑	↑	↑	RER (Devaluation)	6	0	0	0	0
Exports	2	↑	↑	↑	↑	Trade Balance	7	↑	↑	↑	↑
GDP	3	0	0	0	0	GDP	8	0	0	0	0
Investments	4	0	0	0	0	Foreign Income	9	↑	0	↑	0
Foreign Income	5	↓	↑	↓	↓						

  

E2 - Effects on time on Trade Balance											
Specification 1						Specification 2					
	Sc	Arg	Bra	Col	Mex		Sc	Arg	Bra	Col	Mex
RER (Devaluation)	1	↑	↑	↑	↓	RER (Devaluation)	6	↑	↑	↑	↓
Exports	2	↓	↓	↓	↓	Trade Balance	7	↓	↓	↓	↓
GDP	3	↑	↓	↓	↑	GDP	8	↓	↑	↓	↑
Investments	4	↓	↑	↓	↑	Foreign Income	9	↓	↑	↓	↑
Foreign Income	5	↑	↓	↑	↑						

  

E3 - Net Effects on Trade Balance											
Specification 1						Specification 2					
	Sc	Arg	Bra	Col	Mex		Sc	Arg	Bra	Col	Mex
RER (Devaluation)	1	↑	↑	↑	↓	RER (Devaluation)	6	↑	↑	↑	↓
Exports	2	↑	↑	↑	↑	Trade Balance	7	↑	↑	↓	↑
GDP	3	↑	↓	↓	↑	GDP	8	↓	↑	↓	↑
Investments	4	↓	↑	↓	↑	Foreign Income	9	↑	↓	↑	↓
Foreign Income	5	↓	↑	↑	↓						

We look at some impulse-response analysis from the baseline data observing the three decomposed effects. We are able to check whether temporary effects can change the equilibrium values, and show a convergence or divergence pattern.

Table 3 consists in three types of effects. The initial effect (E1) measures the initial innovation (shock in each of the variables) impacts on the variables that receive the shock (short-run effect). The second effect (E2) is the effect on time, to which direction the effect diverges or converges to a higher or smaller value than the initial shock (trajectory). Finally we observe through the graphs a third effect (E3) that shows the trajectory and if the new equilibrium value is higher or smaller than the initial value (long-run effect).

Initially we apply RER shocks, being a temporary depreciation (impulse) in the domestic currency (scenarios 1 and 6). This shows a positive effect on trade balance in scenario 1 for Brazil, Colombia, and Mexico ( $E1 > 0$ ), but no initial effect in Argentina. The RER has no initial trade balance effect in any of the four countries for specification 2 ( $E1 = 0$ ). The effects on time are positive in both scenarios for Brazil and Argentina ( $E2 > 0$ ). For Colombia, It is positive in specification 2, but neutral in specification 1. The net effect is positive ( $E3 > 0$ ) for all countries but Mexico, which shows a negative LR effect in both specifications.

We have two different ways to see the foreign effects on the trade balance in this impulse-response perspective, both defined by how we specified the models. In specification 1 we are able to observe the effect of export shocks on the trade balance. In specification 2, as there is no exports variable, we check how trade balance shocks affect itself in the long-run.

In specification 1, export effects on the trade balance are initially positive in all models ( $E1 > 0$ ). In a second moment the trade balance reduces itself from its initial shock ( $E2 < 0$ ) in all cases but Brazil. The new equilibrium values are nonetheless in a higher magnitude than they were before the shocks ( $E3 > 0$ ). Argentina is the more sensitive country, while Brazil and Colombia are the less sensitive. Mexico is again the most volatile. In specification 2 we see the effects of trade balance on itself. As a tautology, the initial effect is always positive in every case ( $E1 > 0$ ). All countries show a decrease from the initial shock ( $E2 < 0$ ) but a small positive long-run effect ( $E3 > 0$ ), returning to a point that is very close to zero (no LR effect).

Looking at the GDP change effects on trade balance we observe that a positive GDP growth shock results no changes in initial value ( $E1 = 0$ ). Mexico has a positive time effect value ( $E2 > 0$  and  $E3 > 0$ ), while Argentina and Colombia have a negative ( $E2 < 0$  and  $E3 < 0$ ), Brazil shows an negative trajectory on specification 1, while it starts negative but turns positive on Specification 2. We can see the effects of investments on trade balance only in specification 1. There is no investment in specification 2. An initial investment increase has no effect in all cases ( $E1 = 0$ ). The continuous effects of economic shocks in investments are positive in the long-run only for Brazil and Mexico. It reaches a smaller equilibrium value for Argentina and Colombia. The net effects ( $E3$ ) are equal to  $E2$ , as  $E1 = 0$ . It is then positive for Brazil and Mexico ( $E3 > 0$ ), and negative for the others ( $E3 < 0$ ).

In terms of the impulse-response of the foreign income effects on trade balance, we see interesting results. On average the effects on the long-run ( $E3$ ) are close to zero (a bit below in most cases). In specification 2, the initial effects are positive to Argentina and Colombia ( $E1 > 0$ ) but negative for Brazil and Mexico ( $E1 < 0$ ), but the ones with smaller initial effects are the ones with biggest growth until reaching a steady state very close to zero. Foreign growth is absorbed and shows no long-run impacts on the trade balance.

Table 4 – Permanent Effects on Trade Balance

PERMANENT EFFECT											
E1 - Initial Effects on Trade Balance											
Specification 1						Specification 2					
	Sc	Arg	Bra	Col	Mex		Sc	Arg	Bra	Col	Mex
RER (Devaluation)	1	↑	↑	↓	↑	RER (Devaluation)	6	↑	↑	↑	↑
Exports	2	↑	↑	↑	↑	Trade Balance	7	↑	↑	↑	↑
GDP	3	↑	↓	↓	↑	GDP	8	↓	↓	↑	↓
Investments	4	↓	↑	↓	↑	Foreign Income	9	↑	↓	↑	↓
Foreign Income	5	↑	↓	↓	↓						
E2 - Effects on time on Trade Balance											
Specification 1						Specification 2					
	Sc	Arg	Bra	Col	Mex		Sc	Arg	Bra	Col	Mex
RER (Devaluation)	1	↑	↑	↓	↑	RER (Devaluation)	6	↑	↑	↑	↓
Exports	2	↑	↑	↑	↑	Trade Balance	7	↓	↑	↑	↑
GDP	3	↑	↓	↓	↑	GDP	8	↓	↓	↓	↑
Investments	4	↓	↑	↓	↑	Foreign Income	9	↑	↓	↑	↓
Foreign Income	5	↓	↑	↓	↓						
E3 - Net Effects on Trade Balance											
Specification 1						Specification 2					
	Sc	Arg	Bra	Col	Mex		Sc	Arg	Bra	Col	Mex
RER (Devaluation)	1	↑	↑	↓	↑	RER (Devaluation)	6	↑	↑	↑	↓
Exports	2	↑	↑	↑	↑	Trade Balance	7	↑	↑	↑	↑
GDP	3	↑	↓	↓	↑	GDP	8	↓	↓	↓	↑
Investments	4	↓	↑	↓	↑	Foreign Income	9	↑	↓	↑	↓
Foreign Income	5	↓	↓	↓	↓						

The permanent effects occur after a specific selected period and consist on continually shocking one specific variable to observe its continuous effects on others, and on the system. In this case we apply a shock of 5% magnitude for every year after 1979. We initially look at the economic shock effects on the trade balance (Table 4).

For Scenarios 1 and 6 we see how the Real exchange rate affects trade balance. In Scenario 1 (Specification 1) constant depreciations have a positive impact on the trade balance in Brazil, Argentina and Mexico, while it has a negative effect in Colombia. In specification 2 (scenario 5), the RER effects turn positive to Colombia and Negative to Mexico. In Scenario 2 (export effects) we see that exports have a positive effect on the trade balance in all of the cases. This was initially expected, considering that an initial growth effect on exports does not result in higher growth of imports, the same for Scenario 7, which shows the trade balance effects in specification 2.

For Scenario 3 (GDP effects) domestic growth affects positively Argentina and Mexico, but negatively Brazil and Colombia. In specification 2 (scenario 8), GDP has a negative effect in all countries but Mexico. Shocks increasing investment (scenario 4) result in mixed effects. For Brazil and Mexico, investment has in a positive effect on the trade balance, while it results in negative effect for Argentina and Mexico.



Foreign income effects (scenarios 5 and 9) have a negative impact on the trade balance in Brazil. For Argentina it has a positive impact. In Colombia it shows a positive effect in scenario 5, while it has an initial positive effect followed by a negative effect in scenario 9. In Mexico, foreign income has an ambiguous oscillatory effect (with no long-run effect) on the trade balance following specification 1, in specification 2, it has a negative effect.

### 6.3. Real exchange rate effects

The real exchange rate changes are part of the price effects discussed on the BPCM. It is expected from the standard theory that this value should show zero growth in the long-run.

Table 5. Impulse Response Analysis – Effects on the Real Exchange Rate

E1 - Initial effects on Real Exchange Rate											
	Specification 1					Specification 2					
	Sc	Arg	Bra	Col	Mex	Sc	Arg	Bra	Col	Mex	
RER (Devaluation)	1	↑	↑	↑	↑	RER (Devaluation)	6	↑	↑	↑	↑
Exports	2	0	0	0	0	Trade Balance	7	↑	0	0	0
GDP	3	0	0	0	0	GDP	8	0	0	0	0
Investments	4	0	0	0	0	Foreign Income	9	↓	↓	↓	↑
Foreign Income	5	↓	↑	↓	↓						
E2 - Effects on time on Real Exchange Rate											
	Specification 1					Specification 2					
	Sc	Arg	Bra	Col	Mex	Sc	Arg	Bra	Col	Mex	
RER (Devaluation)	1	↓	↓	↓	↑	RER (Devaluation)	6	↑	↑	↑	↓
Exports	2	↑	↓	↓	↑	Trade Balance	7	↓	↓	↑	↓
GDP	3	↓	↓	↓	↓	GDP	8	↓	↓	↓	↑
Investments	4	↑	↓	↓	↑	Foreign Income	9	↑	↓	↓	↓
Foreign Income	5	↑	↓	↑	↑						
E3 - Net Effects on Real Exchange Rate											
	Specification 1					Specification 2					
	Sc	Arg	Bra	Col	Mex	Sc	Arg	Bra	Col	Mex	
RER (Devaluation)	1	↑	↑	↑	↑	RER (Devaluation)	6	↑	↑	↑	↑
Exports	2	↑	↓	↓	↑	Trade Balance	7	↓	↓	↑	↓
GDP	3	↓	↓	↓	↓	GDP	8	↓	↓	↓	↑
Investments	4	↑	↓	↓	↑	Foreign Income	9	↓	↓	↓	↓
Foreign Income	5	↓	↓	↓	↑						

As a tautology, the effect of a real exchange rate shock on itself has a positive initial effect on the RER ( $E1 > 0$ ). In time it evolves a little bit different. For Argentina, Brazil and Colombia, depreciation results in a new equilibrium smaller than the initial shock ( $E2 < 0$ ). In all cases though, depreciation results in increase in the RER in the long-run ( $E3 > 0$ ).

In terms of the export effects on the RER (specification 1), there is no initial effect ( $E1 = 0$ ), but on time we see that Argentina and Mexico reach a higher value than the one in the initial condition ( $E2 > 0$  and  $E3 > 0$ ). Brazil and Colombia, however, reach a long-run equilibrium in a smaller value ( $E2 < 0$  and  $E3 < 0$ ). Mexico oscillates with all net effects close to zero. In specification 2 we see the effects of changes in the trade balance on the Real Exchange Rate. The effects are initially positive for Argentina ( $E1 > 0$ ) but zero for all other

countries ( $E1 = 0$ ). The new equilibrium value for Colombia is positive ( $E3 > 0$ ) but negative for all other countries.

In terms of GDP effects on the RER we see no initial effect in both specifications ( $E1 < 0$ ), meaning that the effects from the initial shock are always equal to the net effects ( $E2 = E3$ ). The time effects are negative for Argentina, Brazil and Colombia in the two specifications ( $E2 < 0$  and  $E3 < 0$ ). This means that GDP growth results in a real evaluation of domestic currency. For Mexico it is negative in specification 1 but positive in specification 2. The Investment effects on the RER show a distinct behaviour than GDP. Again we can only discuss investment for specification 1. Initially, it has no effect ( $E1 = 0$ ). A rise in Investments results in a higher RER value (depreciation) in Argentina, Brazil and Mexico ( $E2 > 0$  and  $E3 > 0$ ) Brazil being the one with higher value. For Colombia we see a reduction (negative  $E2$  and  $E3$ ).

The effects of foreign income on the RER are mixed. The initial effect depreciates currency in Brazil, but appreciates it for Argentina, Colombia and especially Mexico in specification 1. However, all the values seem to converge to zero. It is interesting to see that the foreign income effects on RER converge to almost zero (no LR effect) in all countries for specification 1. For specification 2, the initial effect in Brazil is negative, while in Mexico is positive, the rest equal to spec. 1. The final effect is negative in all cases ( $E3 < 0$ ).

Table 6. Permanent effects on the Real Exchange Rate

E1 - Initial effects on Real Exchange Rate										
	Specification 1					Specification 2				
	Sc	Arg	Bra	Col	Mex	Sc	Arg	Bra	Col	Mex
RER (Devaluation)	1	↓	↑	↑	↓	6	↓	↑	↑	↓
Exports	2	↑	↑	↑	↑	7	↑	↑	↑	↑
GDP	3	↑	↑	↑	↑	8	↑	↑	↑	↑
Investments	4	↑	↓	↑	↑					
Foreign Income	5	↓	↑	↑	↑	9	↓	↓	↓	↑
E2 - Effects on time on Real Exchange Rate										
	Specification 1					Specification 2				
	Sc	Arg	Bra	Col	Mex	Sc	Arg	Bra	Col	Mex
RER (Devaluation)	1	↓	↑	↑	↓	6	↓	↑	↑	↓
Exports	2	↑	↓	↑	↑	7	↑	↑	↑	↑
GDP	3	↑	↑	↑	↑	8	↑	↑	↑	↑
Investments	4	↑	↑	↑	↑					
Foreign Income	5	↓	↓	↓	↓	9	↓	↓	↓	↓
E3 - Net Effects on Real Exchange Rate										
	Specification 1					Specification 2				
	Sc	Arg	Bra	Col	Mex	Sc	Arg	Bra	Col	Mex
RER (Devaluation)	1	↓	↑	↑	↓	6	↓	↑	↑	↓
Exports	2	↑	↓	↑	↑	7	↑	↑	↑	↑
GDP	3	↑	↑	↑	↑	8	↑	↑	↑	↑
Investments	4	↑	↑	↑	↑					
Foreign Income	5	↓	↓	↓	↓	9	↓	↓	↓	↓

In Table 6, we observe the permanent effects of our selected shocked variables on relative prices (the real exchange rate). Depreciations of the RER have positive long-run effects on the RER for Brazil and Colombia and negative for Argentina and Mexico (scenarios 1 and 6). A rise in exports (scenario 2) has negative effects (appreciation) of the RER in Brazil, but positive effects (depreciation) for the other three countries. A trade balance increase (scenario 7 – specification 2) has positive effects in the RER for all countries. GDP increases have a positive effect on the RER. Investments (scenario 4) show a positive effect on the RER. Foreign income increases has always negative effects on the RER.

#### 6.4. Domestic Income Effects

In this section we observe the baseline for domestic income, the impulse response, and permanent effects of our selected economic shocks on this domestic income. When looking at the effects of currency depreciation, income elasticity shocks (exports), and foreign income shocks in domestic GDP, we are allowed to discuss important aspects of the BPCM, such as research questions 4 and 5 defined in section 3.

Table 7. Impulse Response Analysis – Effects on Domestic Income

E1 - Initial Effects on Domestic Income											
Specification 1						Specification 2					
	Sc	Arg	Bra	Col	Mex		Sc	Arg	Bra	Col	Mex
RER (Devaluation)	1	0	0	0	0	RER (Devaluation)	6	↓	0	0	0
Exports	2	0	0	0	0	Trade Balance	7	↓	0	0	0
GDP	3	↑	↑	↑	↑	GDP	8	↑	↑	↑	↑
Investments	4	0	0	0	0						
Foreign Income	5	↓	↑	↑	↑	Foreign Income	9	↑	↓	↓	↓
E2 - Effects on time on Domestic Income											
Specification 1						Specification 2					
	Sc	Arg	Bra	Col	Mex		Sc	Arg	Bra	Col	Mex
RER (Devaluation)	1	↓	↑	↑	↓	RER (Devaluation)	6	↓	↑	↑	↓
Exports	2	↑	↓	↑	↑	Trade Balance	7	↑	↑	↑	↑
GDP	3	↓	↑	↑	↓	GDP	8	↑	↑	↑	↑
Investments	4	↑	↑	↑	↑						
Foreign Income	5	↑	↓	↓	↓	Foreign Income	9	↓	↑	↑	↑
E3 - Net Effects on Domestic Income											
Specification 1						Specification 2					
	Sc	Arg	Bra	Col	Mex		Sc	Arg	Bra	Col	Mex
RER (Devaluation)	1	↓	↑	↑	↓	RER (Devaluation)	6	↓	↑	↑	↓
Exports	2	↑	↓	↑	↑	Trade Balance	7	↓	↑	↑	↑
GDP	3	↑	↑	↑	↑	GDP	8	↑	↑	↑	↑
Investments	4	↑	↑	↑	↑						
Foreign Income	5	↓	↓	↓	↓	Foreign Income	9	↑	↓	↓	↑

The effects of RER on domestic income have zero initial effect for all countries ( $E1 = 0$ ). The only exception is Argentina in specification 2. The net effects are positive for Brazil and Colombia and negative for Mexico. In Argentina it is close to zero in specification 1, but negative in specification 2.

Export effects on domestic income (specification 1) show no initial effect ( $E1 = 0$ ). In terms of long-run effects, Mexico and Colombia show that exports increase the equilibrium rate of domestic income ( $E2$  and  $E3$  are positive), but it decreases in the case of Brazil (after an initial increase). In Argentina there is no effect (all  $E's = 0$ ). For specification 2, a positive shock on trade balance has an initial negative only in Argentina ( $E1 < 0$ ). No effect in the others ( $E1 = 0$ ). It grows after the initial negative effect for all countries ( $E2 > 0$ ), with a very small effect in Brazil. The net effective is positive for Brazil Colombia and Mexico, but negative for Argentina.

As a tautology, GDP increases result in a positive initial shock to the domestic income ( $E1 > 0$ ) in all countries for both specifications. The adjustment goes upward in all cases in specification 2 ( $E2 > 0$ ), resulting in positive net effects in all cases for both specifications ( $E3 > 0$ ). In specification 1, the trajectory goes downward from the initial shock for Argentina (small effect) and Mexico ( $E2 < 0$ ), but positive for Brazil and Colombia ( $E2 > 0$ ). From our specification 1 result, the initial effects of investment in domestic income are zero ( $E1 = 0$ ) Investment has a positive effect in time for all countries, oscillating in Brazil.

The impulse-response analysis of a positive foreign income shock on domestic income shows some interesting pattern. In almost all cases the final effects of a rise in foreign income are negative in the long-run ( $E3 < 0$ ) with the exception of Argentina for both specifications. Initial effects are negative for Colombia but positive for Mexico in both specifications. For Brazil it is positive in specification 1 but negative in specification 2, while for Argentina it is the opposite, negative in specification 1, but positive on specification 2.

Table 8. Permanent Effects in Domestic Income

E1 - Initial Effects on Domestic Income											
Specification 1						Specification 2					
	Sc	Arg	Bra	Col	Mex		Sc	Arg	Bra	Col	Mex
RER (Devaluation)	1	↑	↑	↑	↑	RER (Devaluation)	6	↑	↑	↑	↑
Exports	2	↑	↓	↓	↓	Trade Balance	7	↓	↓	↑	↓
GDP	3	↓	↓	↓	↓	GDP	8	↓	↓	↓	↓
Investments	4	↑	↑	↓	↑						
Foreign Income	5	↓	↑	↓	↓	Foreign Income	9	↑	↓	↓	↓

  

E2 - Effects on time on Domestic Income											
Specification 1						Specification 2					
	Sc	Arg	Bra	Col	Mex		Sc	Arg	Bra	Col	Mex
RER (Devaluation)	1	↑	↑	↑	↑	RER (Devaluation)	6	↑	↑	↑	↑
Exports	2	↑	↓	↓	↑	Trade Balance	7	↓	↓	↑	↓
GDP	3	↓	↓	↓	↓	GDP	8	↓	↓	↓	↑
Investments	4	↑	↑	↓	↑						
Foreign Income	5	↓	↓	↓	↓	Foreign Income	9	↑	↓	↓	↓

  

E3 - Net Effects on Domestic Income											
Specification 1						Specification 2					
	Sc	Arg	Bra	Col	Mex		Sc	Arg	Bra	Col	Mex
RER (Devaluation)	1	↑	↑	↑	↑	RER (Devaluation)	6	↑	↑	↑	↑
Exports	2	↑	↓	↓	↑	Trade Balance	7	↓	↓	↑	↓
GDP	3	↓	↓	↓	↓	GDP	8	↓	↓	↓	↑
Investments	4	↑	↑	↓	↑						
Foreign Income	5	↓	↓	↓	↓	Foreign Income	9	↑	↓	↓	↓

Observing the effects of permanent shocks on domestic income (economic growth) we see interesting results. Firstly, an undervaluation has positive effects on growth in Brazil and negative effects on Argentina for both Scenarios. In Colombia It has a positive effect on specification 1, but a negative effect on specification 2. Mexico is the opposite of Colombia, showing a negative effect of undervaluation on growth on specification 2, but a positive on specification 2. In terms of an increase in exports (scenario 2) it has an initial positive effect on all countries, but in Brazil and Mexico it reduces its value as time goes. In specification 2 (scenario 7) we see that increases in the trade balance have positive effects for all countries. GDP positive permanent shocks have positive effects on domestic income, as expected. A rise in Investments, on the other hand, has positive effects in Argentina and Brazil, but negative effects in Colombia and Mexico (scenario 4).

In opposition to what we expected, foreign income increases (scenarios 5 and 9) have negative effects in most countries - Brazil (with an initial positive effect in scenario 5), Colombia and Mexico. It has positive net effects only in Argentina, although with an initial negative effect in specification 1. These results are valid for both specifications and are going to be further analysed in the discussion section.

## 7. Discussion of the Research Questions

### **Answer to Research Question 1. Do countries show a trade balance equilibrium in the long-run? How to re-balance the TB to equilibrium?**

Based on McCombie (2012), the equilibrium between import and export long-run growth rates is the main assumption that should be tested of the Thirlwall model. This can be empirically observed by looking at the slope of the trade balance baseline curve. The baseline model shows some mixed results in this regard. Taking the case of Argentina, its adjustment process follows a seemingly negative sloped curve. This means that imports are systematically growing more than exports to the direction in which the trade balance is equal to zero. Mexico, on the other hand, shows fluctuations around a positively sloped curve, which means that exports are, on average, systematically growing more than imports. Brazil and Colombia oscillate around the value to which trade balance is equal to zero.

Are these non-flat slopes part of a long-run adjustment process of convergence to a gravitational point? Or are they part of a structural imbalance in the current account? Depending on the answer we have different implications for the BPCM theory. In this sense we go back to the three concepts of long-run based on Carvalho (1984) raised in the introduction of this article. If the trajectory is part of an adjustment process, it does not create any problems to the BPCM theory. On the other hand, if there is enough evidence of a structural imbalance, this challenges one of the main assumptions of the Thirlwall model, which has the power to de-construct the procedure that leads to the Thirlwall Law. Our intention is not to argue against the model, neither to offer any alternative, but to challenge its robustness in empirical terms. The argument is that the BPCM would benefit for more empirical studies testing its assumptions, which could strengthen its results, and open space for other types of expansions, especially regarding the different perspective on the idea of long-run.

In the case of a structural imbalance in the trade balance and on the LR equilibrium, a way to resolve it is by shocking exports. If a rise in exports or a reduction in imports changes the long-run growth rate, then it could be used as an adjustment mechanism to re-establish the trade balance equilibrium.

When looking at the effects of export shocks on trade balance, we see that exogenous positive export shock raises the trade balance in every case, but the result of the positive initial shock is reduced on time. Nevertheless, the net final effect is positive on the trade balance equilibrium. Considering the impacts of exports on GDP, there are no initial effects of a rise in exports on GDP growth for any of the observed countries using the impulse-response function. There are final positive effects in Argentina, Colombia and Mexico, but negative in Brazil. On the permanent effects, Argentina and Colombia show positive effects. Brazil and Mexico have an initial positive effect, followed by a tendency to decline in their domestic income when exports suffer repetitive shocks.

The expected result of a positive relationship between exports and domestic growth is only valid for Argentina and Colombia (and mixed result in Mexico). For these countries, exports shocks raise the long-run equilibrium rate - exports have positive effects on trade balance, creating demand. However for Brazil and Mexico (impulse response) a rise in exports has negative effect on growth, which is probably caused by the also negative effect of a rise of exports in the RER, counterbalancing the demand increase with a reduction in the international purchasing power. The use of an increase in exports to restore the trade balance equilibrium then may result in negative effects on domestic GDP.

We can also observe if investments could work as a stabilization mechanism. Temporary increases in investments in all cases result in increases in domestic income, while permanent effects have only negative effects in Colombia. In terms of trade balance, temporary and permanent investment effects have negative effects in Argentina and Colombia, but positive in Brazil and Mexico. This states that investments can stabilize the trade balance when reduced in these last two countries. Investment growth can positively change the equilibrium growth in the LR, at the cost of generating deficits in the trade account.

An adjustment in the trade balance through a rise in exports or reduction in investments may re-establish the equilibrium in the long-run trade balance. In Brazil and Mexico, this adjustment comes at the cost of reduction in growth rates. In one hand, it goes against our expectations in which exports generate demand and raise growth. On the other hand, it goes in line to what has been empirically observed in these countries during the 80's crisis – in which a structural trade imbalance resulted in the need for an export positive shock, at the cost a low economic growth recessive policy during the “lost decade” (Bertola & Ocampo, 2012).

### **Answer to the Research Question 2: Do price effects (RER shocks) affect the long-run equilibrium rate of GDP growth?**

All countries observed in the analysis converge to a RER level close to 0.5-07 when looking at the baseline. However, in this convergence process the slopes of the RER curves differ by country. Mexico starts in a depreciated RER value and advances in appreciating the currency in a negatively sloped curve (especially for specification 2). Argentina, on the other hand, follows a completely opposite direction, starting from an overvalued RER, systematically depreciating it, showing a positively sloped curve. Brazil and Colombia show an approach towards a stable horizontal line (with Brazil showing a small decrease).

Are these Real Exchange Rate movements really part of a convergence process to the long-run, or are they part of a structural imbalance, in which price levels do not stabilize? If the latter is true, we enter in a theoretical conundrum in which quantity (GDP growth) is not the only possible adjustment to external sector imbalances in the long-run (Rodrik, 2008). This is a central aspect of the Thirlwall Law: because of the price stability assumption, the ratio between income elasticity of exports and imports define the limits to domestic economic growth. If price

effects (RER, terms of trade) do play a role, we leave the Keynesian world of the BPCM (R. A. Blecker, 2016) and enter in a gray area, in intersection with the neoclassical world. In the neoclassical world the short-run price adjustments are the main mechanisms for economies reach the equilibrium, and as in Krugman (1989), growth is supply-side dominated.

As above discussed, the central argument of the BPCM is that price effects are negligible in the long-run, do not affecting the growth rate compatible with stability in the balance of payments. This can be observed when looking at the effects of temporary and permanent RER shocks on domestic income's long-run growth.

When applying an impulse-response of RER (currency real depreciation) on GDP, it results in an income reduction for both short- and long-run for Argentina and Mexico. Following a Kaleckian wage-led interpretation (Bhaduri & Marglin, 1990; Stockhammer & Onaran, 2013), a real depreciation in the short-run reduces purchasing power, resulting in smaller domestic income. In terms of permanent shock effects, depreciations have positive effects which could be either (1) related to the fact that an exchange rate undervaluation increases exports and reduce imports, resulting in a demand increase, or (2) to the face that a devaluated exchange rate raises competitiveness, and stimulates growth in an export-led growth model.

This result lets us to questions the main assumption of the Thirlwall model. If prices effects can work as an adjustment mechanism, we cannot directly define the equilibrium GDP growth rate compatible to external sector constrains. In this scenario, a country can grow in the long run at any rate if there are price effect mechanisms that allow it. If we accept this stylized fact, we find two alternatives. The first is to accept the neoclassical critiques to the Thirlwall model (Krugman, 1989; Rodrik, 2008), growth being supply-sided dominated and given by a natural growth rate. The second is to expand the model to capture the short-term effects of terms of trade and financial flows on the long-run economic growth, as tried by Moreno-Brid (1998), Dutt (2002), Setterfield (2011), and Cimoli, Lima & Porcile (2016).

Again, our critique is directly related to how we concept long-run. If we accept the long-run as an equilibrium point to which assumptions such as zero growth in RER are valid we analyse it in one specific way. But we can also perceive the long-run as a convergence gravitational point to which the variables move (or oscillate) around, or as a succession of short-runs during a long amount of time (Robinson & 1903-, 1971).

The main point here does not only concern definitions but also the relationship between the theoretical idea and the empirics of the estimated model. In the VECM we observe the presence of short- and long- run relations. We assume that the long-run in theoretical and in empirical terms coincide in the VECM. This can be theoretically challenged, which opens the road to question if the concepts of short- and long-run match in theoretical and empirical terms.

### **Answer to Research Question 3: Do increases in foreign income result in higher economic growth?**



Foreign income shocks can affect the whole dynamics of the economic system. It is a central variable in the Thirlwall Law to define the growth rate of domestic GDP. We consider foreign income as an exogenous variable in our analysis. For instance, the US GDP would be rarely affected by trade balance changes in Argentina or Brazil, or by investments shocks in Colombia and Mexico. The opposite is not true, as the US GDP is expected to have a relevant impact in its neighbouring Latin American countries. Initially, our expectation is that foreign shocks would result in increases in domestic growth, especially in the long-run. As stated by the Thirlwall law, domestic growth in the long-run depends on the relationship between income elasticities (both positive) times foreign income. If foreign income increases, long-run growth should increase.

However, when looking at the permanent shocks results, we get opposite outcomes as expected. Foreign income reduces domestic income in three of our four countries (it only increases the GDP, and very little, in the case of Argentina). This is true for both specifications.

Initially, in specification 1, foreign growth has positive effects on domestic growth for all countries. However, it starts decreasing on time when shocks are permanent. The short-run effect can be positive, but the long-run are negative, and keep decreasing. For specification 2 it already starts decreasing since the first impact. The implications of this outcome for the BPCM theory has already been discussed in the literature by Razmi (2016). The author showed that, when included domestic capital accumulation and controlled for endogeneity, foreign income has insignificant effects on domestic income. These results can be negative when looking at their correlation for some countries.

Evidences around it are still mixed, and the debate is still open, but our results clearly indicate that permanent increases in foreign income result in a decrease in domestic income for all countries. In terms of the impacts on the Thirlwall law, if we accept the law, these results indicate that the income elasticity ratio between exports and imports have a negative value, which does not make much sense in economic terms. An income increase will most certainly result in an increase in imports. In terms of exports, foreign growth may reduce domestic growth if income elasticity of exports shows a negative value, which can be caused by an exchange rate appreciation. However, this last case would affect the other assumption of the BPCM, in which prices would not be able to keep their long-run stability. This debate opens a large space to debate the causes of this negative relationship between foreign income and domestic income.

## **8. Conclusion**

In this research we raised some of the main assumptions behind the BPCM model. Our objective, far from challenging the model in order to question its validity, is to improve the discussion on this very relevant growth model. The Thirlwall model focuses on the role of demand on growth, in which through external constraints explain why countries differ in terms of their GDP growth patterns (uneven development).

We firstly raised the some main assumptions behind the Thirlwall model: (I) Trade balance is stable in the long-run; (II) Price effects do not affect long-run economic growth; (III) foreign growth have positive effects on domestic income. Secondly, we brought from the literature the most important critiques to the BPCM, formulating from these critiques five research questions, to empirically debate the assumptions of the BPCM model. From the literature review we enter in the methodological part. We gathered data from the PWT and searched for the best methodology to answer our research questions. From the literature we selected the used of VECM methods, that are recently used in many empirical articles to measure income and price elasticities of imports and exports, such as Britto & McCombie (2013), Moreno-Brid & Pérez (1999), among other relevant works. We create baselines using a Johansen Estimation framework (Johansen, 1991), with the use of VECM estimations. We check the short- and long-run relations of selected variables for Argentina, Brazil, Colombia, and Mexico. We applied temporary shocks using impulse-response analysis and permanent shocks. From the results we discussed the main research questions raised in this research.

Our results raise some important critiques on the assumptions of the model. There are mixed evidences for both of the two assumptions initially raised. In terms of the trade balance, we see that countries possibly converge to a long-run point (stability). However, during this convergence process we observe a systematic imbalance between the growth rate of imports and exports – which potentially invalidates the first assumptions. The way we interpret the concept of *long-run* has then a central role: Is it the natural values of the variables (Samuelson, 1948) or Is it related to a gravitational point to where the time series converge/diverge/oscillate (Kaldor, 1957; Pasinetti, 1983)? Does it concern the direction (slope) to which the time series are going? Or is it a systematic succession of short-run periods (Robinson & 1903-, 1971)? We do not propose to state a final answer to these questions here in this article, but highlight that we need to discuss the concepts on the light of more elements, which is necessary to discuss the empirical evidence of the BPCM assumptions. The idea of long-run present in empirical VECM models may differ from the theoretically raised in the BPCM.

Concerning the second assumption, about price effect neutrality in the long-run, we observe that (a) In all cases, there seems to be a convergence process of the Real Exchange Rates to a specific point (b) However, some countries systematically devalue their currencies while others systematically appreciate them. If this structural behaviour defines the long-run then we observe evidences against the second assumption. (c) Real Exchange Rate devaluations affect long-run economic growth. We expected that long-run growth was not going to suffer any impact from short-run devaluations (impulse-response), but this is not what we see in the data. With these three observations we qualify the discussion about assumption 2, which defines the conditions behind the Thirlwall Law.

Being prices not stable in the long-run, the adjustments not necessarily come from quantities, or growth rates, which would make the effective growth rate be restricted to the growth rate compatible with balance of payments constrains, but also from price-effects. This would result in

a more complex environment for economic adjustment, in which price and quantities play a part in the adjustment process. These results strengthen the usual Structuralist argument of those that include terms of trade and financial flows as elements affecting the long-run economic growth rate (Cimoli et al., 2016; Dutt, 2002; J. C. Moreno-Brid, 1998; Setterfield, 2011).

For foreign income effects, we expected to observe that increases in foreign income would impact in increases of domestic growth, as stated in the Thirlwall law. However, the results point in a total opposite direction. In almost every permanent shocks scenarios, an increase in foreign income result initially in domestic income growth, followed by a strong and permanent domestic GDP reduction. This result is in line to what Razmi (2016) had on his estimations.

The three research questions in this empirical work successfully challenge the three assumptions of the BPCM. In one hand this article is able to empirically reinforce some of the empirical critiques already stated in the literature, as well as offer new estimations of the BPCM to Latin America. On the other hand, the effects on the BPCM theory depend on other conceptual debates such as the concept of short- and long-run, as well as how the current empirical methods are suitable to question theoretical arguments. This work offers an invitation to expand this debate, both theoretically as empirically.

Finally, our estimation results aim to qualify the BPCM discussion and bring new elements to the debate. This paper is an effort to add to the empirical literature of the BPCM by testing its main assumptions. I reinforce that our objective is not to challenge the validity of the model, but the robustness of some of its assumptions. In this sense, we would like to pose a challenge to further investigate the empirics of this model. Not only on estimating the income and price elasticities but also challenging what is behind the Thirlwall model. Our next steps go toward open the debate to find theoretical solutions to expand and reinvent the model, solving the empirical problems in an inductive way. We are very clear that we are limited by the data, by our methodology, and the choices in terms of countries. Nevertheless, the presence of these evidences let us open the space for new propositions aimed at reinforcing the analysis in such a relevant model.

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