MOMENTO ECONÓMICO

NÚM. 125, ENERO-FEBRERO DE 2003, PP. 18-29.

THIRLWALL´S LAW AND FOREIGN CAPITAL IN BRAZIL

ALEX LUIZ FERREIRA* AND OTAVIANO CANUTO**

Abstract

This paper addresses the hypothesis of balance of payments constraint to income growth in Brazil through an extended version of "Thirlwall´s Law" [Thirlwall (1979)]. The period covered by the tests is from 1949 to 1999. We aim to complement existing applications of open-economy Keynesian models to Brazil by explicitly introducing the effects of net payments of interest, dividends and profits (of the balance of payments' current account) on the domestic income growth rate. Additionally, the paper presents a test of Granger causality regarding, on the one hand, income-elasticities of exports and imports and, on the other, economic growth. Our findings do not reject the hypothesis underlying Thirlwall's Growth Law.

Key words: Balance of payments, current account, capital account, income growth.

Clasiffication JEL: F43, F32, F34

Recibido: 17 de julio de 2002.
Enviado a dictamen: 6 de diciembre de 2002.
Aceptado: 28 de enero de 2003.

Introduction

This paper aims to contribute to previous applications of "Thirlwall´s Law" to developing economies by explicitly introducing the net effects of interest, dividends and profits (hereafter IDP) of the Balance of Payments' (BoP) current account on the constraints imposed to aggregate demand and, consequentially, income growth.[1] We intend to illustrate how capital flows and their associated effects on the current account do not reverse Thirlwall Law's basic features, namely, the presumption that long run income growth of open economies tend to be conditioned by the income elasticities of demand for imports and exports (Thirlwall, 1979), (McCombie and Thirlwall, 1994). The paper also attempts to show that capital inflows may require changes in income elasticities in order to relax the constraints on growth derived from the net payments of foreign capital service (IDP net payments).

We apply a version of Thirlwall's growth models to the Brazilian economy for the last 50 years. The period of the tests was chosen to cover the Brazilian experience of high income growth rates over 30 years and slower rates of the more recent 20 years (see Table I). Inflows of foreign capital were very volatile during the sample period, but there were times characterised by substantial increases in capital inflows. Inspection of Table II shows that this happened especially during the seventies and nineties. The long period covered by the tests allowed us to investigate the validity of Thirlwall´s Law in conditions of foreign capital volatility.

Another objective of the paper is to test whether the direction of causality is from exports to domestic income as suggested by Krugman (1989) or the other way around, as implicit in Thirlwall (1979).

Acknowledgements: Without implicating, we would like to thank Miguel León-Ledesma and Gilberto Tadeu Lima for useful comments and insights.
* PhD student supported by CNPq (Brazil) and teaching assistant of the Economics Department, University of Kent at Canterbury. Dept. of Economics, Keynes College, University of Kent. Canterbury, Kent, CT2 7NP. Email: <alf2@ukc.ac.uk>.
** Professor of the State University of Campinas (Unicamp) and State University of São Paulo (USP).
[1] See, for example, Holland *et al.* (1998), Porcile *et al.* (2001) and Jayme Jr. (2001).

The paper is divided as follows. We initially state Thirlwall´s Growth Law and suggest how to take into account the effects of IDP net payments on the BoP constrained growth. We also present the attempt of Elliot and Rhodd (1999) to model these impacts and outline the contribution of Moreno-Brid (1998-1999) to the debate. Next, we examine the 45-degree rule as proposed by Krugman (1989) in comparison to Thirlwall´s Growth Law. Section II carries out the empirical tests for Brazil in order to verify whether the Law should be rejected.

Table I
Average Income Growth Rates in Brazil (by decade)

Decade	*Annual Income Growth*
1950	7,1
1960	6,1
1970	8,6
1980	3,1
1990	1,8
Average	5,4

Source: author's own presentation of data obtained from IPEA <www.ipeadata.gov.br>.

Table II
Financial Flows of Brazil´s BoP (by decade)

Decades	*IDP receipts*	*IDP payments*	*IDP Net payments*	*Net Capital inflows*
1950´s	0	7	7	7
1960´s	1	15	14	19
1970´s	14	73	58	194
1980´s	31	316	285	-11
1990´s	38	224	185	185
Total	85	634	549	394

Obs: Values are in billion of Reais at constant prices of 1998 (1998's average exchange rate is R$/US$= 1,16).
Source: author's own presentation of data obtained from IPEA <www.ipeadata.gov.br>.

I. Thirlwall´s Growth Law Revisited

Mainstream theory asserts that exogenous changes in factors of production (capital, labour and technological progress) determine income growth. Conversely, effective demand determines income growth in (post) Keynesian models.

Thirlwall (1979) focused on the inability of economic agents to expand aggregate demand indefinitely in an open economy as an explanation for income growth differentials across countries. He developed a Keynesian view of the determinants of growth that is based on a dynamic version of Harrod's (1933) foreign trade multiplier. In fact, Thirlwall's Growth Law (1979) states that the limit of a country's growth rate in an open economy is given by the degree of its non-price competitiveness, as reflected in the income elasticities of demand for imports and exports. The BoP constraint arises because export growth and the growth of investment in import substitution are the only components of aggregate demand that are able, not only to increase the growth of GDP, but also to relax foreign constraints. They enhance the capacity of an economy to expand while, at the same time, maintaining an equilibrated current account. They allow other components of aggregate demand to grow faster than otherwise.

According to Davidson (1997): "one of the most significant analytical contributions toward this Post Keynesian open-economy endogenous growth theory has been Thirlwall's Law". Davidson (1997) also stressed asymmetries in international payments that "can have severe real growth consequences, i.e. money is not neutral in an open economy". As can be seen in the next pages, our paper draws insights from the former idea.

Thirlwall (1979) represented current account equilibrium in the BoP according to equation [1]. Thirlwall and Hussain (1982) developed the "Extended Model" reproduced in equation [2]. Equation [3] splits up equation [1] into its invisible components, where services related to production factors (IDP) are introduced and separated from those not related to production factors. In the following pages, we argue and show that this new equation is more adequate for empirical implementation, especially for countries with large payments of IDP:

$$P_d X = P_f M E \qquad [1]$$

$$P_d X + F = P_f M E \qquad [2]$$

$$P_d X + IDP_x = P_f M E + IDP_m \quad [3]$$

Where X is the quantity of exports of goods and invisible services not related to production factors such as insurance, international travel and transportation, hereafter for simplicity, "exports"; P_d is the price of exports in domestic currency; M is the quantity of imports of goods and invisible services not related to production factors, hereafter for simplicity, "imports"; P_f is the price of imports in foreign currency; E is the exchange rate; F is the value of nominal net capital inflows measured in domestic currency; IDP_x is the value of nominal revenues, in domestic currency, of invisible services related to production factors, hereafter for simplicity, "IDP revenues"; IDP_m is the value of nominal expenditures, in domestic currency, of the invisible services related to production factors, hereafter "IDP expenditures".

Taking rates of change of the variables in equations [1], [2] and [3] gives:

$$p_d + x = p_f + m + e \quad [4]$$

$$\theta (p_d + x) + (1 - \theta) f = p_f + m + e \quad [5]$$

$$\omega(p_d + x) + (1 - \omega) idp_x = \alpha (p_f + m + e) + (1 - \alpha) idp_m \quad [6]$$

where lower case letters represent rates of growth of the variables; θ and (1-θ) represent the shares of exports and capital flows as a proportion of these receipts; ω and (1-ω) represent the share of exports of goods and IDP revenues as a proportion of total receipts in current account and, finally, α and (1-α) represent the share of imports and IDP expenditures as a proportion of total payments in current account.

Assuming the normal multiplicative import and export demand functions with constant elasticities:

$$M = a\left(\frac{P_f E}{P_d}\right)^{\psi} Y^{\pi} \quad [7]$$

$$X = b\left(\frac{P_d}{P_f E}\right)^{\eta} Z^{\varepsilon} \quad [8]$$

Where a and b are constants, Ψ is the price elasticity of demand for imports ($\Psi < 0$); η is the price elasticity of demand for exports ($\eta > 0$); Y is the domestic income; Z is the level of world income; π is the income elasticity of demand for imports, and ε is the income elasticity of demand for exports. Taking rates of change for equations [7] and [8], we have:

$$m = \psi (p_f + e - p_d) + \pi y \quad [9]$$

$$x = \eta (p_d - e - p_f) + \varepsilon z \quad [10]$$

Substituting equations [9] and [10] in [1], [2] and [3], and assuming that relative prices, measured in a common currency are relatively constant in the long run, or that $p_d = p_f + e$ and because $\varepsilon . z = x$, we obtain:

$$y_{bsr} = \frac{x}{\pi} \quad [11]$$

$$y_{bext} = \frac{\theta x + (1 - \theta)(f - p_d)}{\pi} \quad [12]$$

$$y_{bsrf} = \frac{\omega x + (1-\omega)(idp_x - p_d) - (1-\alpha)(idp_m - p_d)}{\alpha \pi} \quad [13]$$

where y_{bsr}, y_{bext} and y_{bsrf} represent the income growth rate consistent with BoP equilibrium.

The equilibrium growth rate in [11], also called "Simple Rule" [McCombie and Thirlwall (1994)], is the growth rate of exports divided by the income elasticity of demand for imports. Equation [12] is the equilibrium growth rate derived from the Extended Model of Thirlwall and Hussain (1982). It is the weighted sum of the growth of exports and real capital flows divided by the income elasticity of demand for imports. In the version that we suggest, formalised by equation [13], the equilibrium growth rate is the growth rate of exports of goods and IDP revenues subtracted from the weighted growth of IDP payments divided by the income elasticity of demand for imports weighted by the share of imports in total payments in the current account. Actually, equation [13] is derived from the initial equilibrium condition imposed

MOMENTO ECONÔMICO

by equation [1] in addition to the financial elements of the current account (IDP net payments). For this reason, we will be referring to it in the following pages as the "Financial Simple Rule".

The Extended Model equation [12] was originally created as a version to accommodate the experience of developing countries. Implicit in the addition of the term F to the equilibrium condition in equation [2] is the assumption that foreign capital flows are unrelated to the factors underlying current account imbalances. On the other hand, the breakdown of foreign capital service in its positive and negative components, as represented in equation [13], enables us to take into account the different determinants of income growth. The Financial Simple Rule, as we suggest, discloses the effects of IDP on both sides –revenues and expenditures– in the equilibrium income growth rate of a country and, for this reason, is more adequate for empirical investigation.

McCombie (1993) recognises that the Extended Model lacks the inter-temporal effects of capital movements: "strictly speaking, the balance-of-payments accounting identity should include a category, 'interest, profits and dividends' which forms part of the current account". (p. 473, footnote). Elliot and Rhodd (1999) also attempted to analyse these effects taking the Extended Model as the starting point: "although the inclusion of capital flows by Thirlwall and Hussain (1982) is widely viewed as an improvement in the original model, still we believe the model to be less complete because it omitted the effect of debt servicing" and their assumption is that capital inflow "can and does reduce demand constraints allowing a nation to grow faster than otherwise". The equation that represents their idea is:

$$P_d X + F = P_f M E + D \qquad [14]$$

which is the same (dis)equilibrium condition of the Extended Model (2) with the addition of a term D, which represents debt servicing (interest payments). Following the same steps as taken in the previous models we derive the equilibrium growth rate from equation [14]:

$$y_{ber} = \frac{\theta x + (1-\theta)(f - p_d) - (1-\rho)(s - p_d)}{\rho \pi} \qquad [15]$$

where y_{ber} represents the income growth rate consistent with BoP equilibrium. The equilibrium growth rate [15] is the weighted sum of the growth of exports and real capital flows subtracted from the weighted growth of real IDP net expenditures divided by the income elasticity of demand for imports weighted by the share of imports in total payments (in current account). The symbols ρ and (1 - ρ) represent the share of imports and interest payments on total expenditure, respectively. The inconsistency of Elliot and Rhodd's (1999) interpretation of equation [15] stems from the dual role of capital flows. In short, how can net capital inflows inexorably increase the income growth rate of a country if the debt servicing is a direct result of the capital inflows?

Another important modification of BoP constrained growth models come from Moreno-Brid (1998-1999). He relaxed the assumption that a country cannot sustain current account deficits in the long run by assuming that an economy is able to increase its capacity to import goods and services in the long-run, provided that it keeps constant the ratio between the current account deficit in relation to the GDP. This ratio is any arbitrary value that international financial markets consider acceptable to provide finance for the indebted country. Moreno-Brid (1998-1999) aims to redefine the concept of BoP equilibrium under a more realistic assumption, but his model still lacks the explicit inter-linkages between the capital and the current account. An important problem for empirical implementation is that the ratio is unknown. Consider, for instance, that the arbitrary ratio increases during a period of favourable expectations. If the stock of foreign debt as a proportion to GDP rises during this period, future constraints on growth may become severe when expectations change. Such constraints can only be analysed with equation [13].

In general, economists that have been testing the Extended Model conclude that capital inflows unconditionally allow a faster rate of income growth. Hussain (1999), for example, affirmed that "most African countries have been able to build growing current account deficits financed by capital inflows, which might allow them to grow faster than otherwise will be the case" (p. 105). Conversely, our suggested model considers that capital inflows may increase the foreign constraint, if there is not, at the very least, a compensation for the inflow's counterpart: the increase in IDP's expenditures.[2]

For instance, when the capital inflows of the seventies reverted to outflows in the eighties in Brazil, the enormous stock of foreign liabilities caused a state of persistent "structural deficits" in the BoP's current account. Because such deficits had to be financed in a context of limited international liquidity, any improvement in the trade account was counterbalanced by IDP payments. The combined effect of an increased stock and skyrocketing costs had a crucial role in determining the Brazilian income growth rate during the latter years since IDP net payments have been a major factor underlying the demand for foreign currency.[3]

We intend to show, using equations from [16] to [18], that our model accounts for the inter-temporal nature of capital flows. As stated before, the letter F of the Extended Model represents net capital inflows. This variable can be broken down according to equation [16] which shows the inflows and outflows of the capital account:

$$F = (F_i + F_p + F_{di}) - (F_{ni} + F_{np} + F_{ndi}) + (F_r - F_a) \quad [16]$$

where variables are in nominal value of domestic currency. The letter F_i is the inflow of foreign financial investments (financing; medium and long-run loans; short term capital, etc.); F_{di} is the foreign direct investment and F_p is the foreign portfolio investment. On the other hand, F_{ni}, F_{ndi} and F_{np} represent the same variables with respect to outflows, which are given by national investments overseas; the subscript n stands for national; F_a is the amortisation of foreign liabilities and F_r is the total payments made by the rest of the world for their liabilities (world's amortisation). Short run movements in capital account affect the current account. The revenues and expenditures of IDP are expressed in the current account as follows:

$$IDP_x = r_{ni}\,F_{ni} + r_{np}\,F_{np} + \sum_{t=1}^{\infty} r_{nd_t} \quad [17]$$

$$IDP_m = r_i\,F_i + r_p\,F_p + \sum_{t=1}^{\infty} r_{d_t} \quad [18]$$

where the lower case letter, r, is the yield rate by type of investment, t is the period during which an asset generates yield. The last terms of equations [17] and [18] represent the fact that an investment is undertaken if agents expect to receive back the principal of the capital employed in addition to yield from future profits. Suppose that F_{di} and F_{ndi} are transformed in fixed assets, either tangible or intangible. The returns of such investments are recorded in the current account as profit payments and receipts, which is shown in [17] and [18]. The time horizon of profit generation is assumed infinite $t \to \infty$. The other financial flows: F_i, F_{ni}, F_p and F_{np} generate their respective earnings: r_iF_i, $r_{ni}F_{ni}$, r_pF_p and r_pF_p. All earnings are accrued to the variables IDP_x and IDP_m which belong to theequilibrium condition of the current account in equation [3].

Current models derived from Thirlwall's Growth Law lack an explanation for the facts that we have highlighted throughout the paper. The intent of the model that we suggested is to incorporate the idea that capital inflows can affect income growth rate in two opposite directions. We also think that Brazil offers an interesting case to study the relationship between income growth and IDP net payments, because of IDP expenditures in the current account.

[2] By compensation we mean an improvement in the competitiveness of the indebted country which would be reflected in the income elasticities.

[3] In fact, even in models of small open economies departing from utility maximisation conditions, a current account deficit in an initial period needs to be financed through a decrease in aggregate demand in a subsequent period, if any intertemporal budget constraint is to be respected [see Obstfeld and Rogoff (1996) and Blanchard and Fischer (1989), for example]. The assumption of these models is that a country is benefiting from this intertemporal allocation of resources because the utility they get from consumption in the present is higher than consumption in the future. Another difference is that the BoP "looks after itself" in those models, in other words, relative prices, rather than income growth, act as the adjustment mechanism to correct imbalances in the foreign exchange market.

MOMENTO ECONÔMICO

As has already been stated, the second objective of this paper is to verify the direction of causality between domestic income and exports.

Krugman (1989) observed that there are no trends in real exchange rates in the long run or, in other words, that relative prices remain, to some extent, constant in the long-run. He also noted an empirical regularity between the performance of the trade account and income growth rates: "apparent income elasticities of demand for a country's import and exports are systematically related to the country's long term rate of growth" (p. 1032). The theoretical conclusion one can take from the analysis of the two facts is that, if prices do not work as a mechanism to equilibrate the balance of payments, so income (through income elasticities of demand for imports and exports) must operate as the adjustment mechanism. However, this conclusion is inconsistent with the idea that demand constraints play no significant role in the long run. Hence, Krugman supposed that the elasticities were dependent on the changes of domestic income. The following passage illustrates the fact that income demand elasticity does not determine income growth rates in Krugman (1989), but rather that it is in the other way around: "fast-growing countries **seem to face** a high income elasticity of demand for their exports, while having a low income elasticity of demand for imports. The converse is true for slow-growing countries" (p. 1032, emphasis added).

According to the view expressed in Krugman (1989), the growth of total factor productivity changes supply which, in its turn, causes the growth of domestic income. Domestic income growth shifts both the supply curve of goods that are specifically used as substitutes for imports and the supply curve of domestic goods for exports. The shifts of these curves are understood as the automatic response of the "apparent" elasticities to changes in income: on the one hand, the increase in exports associated with domestic income growth is a function of horizontal foreign demand curves for domestic goods and, on the other hand, the decrease in imports is due to an "import biased income growth", which means that the growth of imports will be simultaneous to a process of import substitution. According to our interpretation, the strong assumptions underlying Krugman (1989) transform his supposed "general rule" in a contingent possibility.

Nevertheless, it could be implied from the models of Thirlwall´s Growth Law that causality is bi-directional. Changes in the supply side affect the income elasticity of demand for imports and exports, thus constraining income growth. Constrained growth is related to the need for a balanced current account in the long run and to relatively constant elasticities. This condition holds unless it is possible to finance *ad infinitum* current account deficits or to improve competitiveness in the very short run. The following analysis of McCombie and Thirlwall (1994) can shed some light on this issue: "Income elasticities determine the balance-of-payments constrained growth rate, but the supply characteristics of goods (such as their technical sophistication, quality etc.) determine relative income elasticities. ***In this important respect, there can be a marrying of the demand and supply side explanations of the comparative growth performance of nations.***" (p. 391, emphasis added).

II. The Brazilian Case

In this section we present the results of our tests in regard to the empirical validity of Thirlwall´s Growth Law to Brazil. As will be shown, the results could not reject the strength of the Law for the Brazilian case.

(1) Data and Estimation of the Income Elasticity of Demand for Imports (π)

Data were obtained from IPEA <www.ipeadata.gov.br>, the Brazilian Institute of Applied Economic Research, with the exception of the series of import prices which was taken from the statistical tables of the IMF (CD ROM International Financial Statistics). Data are in a yearly basis and spans from 1949 to 1999.

Previously to the estimation of p, we tested for the presence of a unit root in the series that are used in the next tests in order to investigate the order of integration of the variables. The results presented below show that all variables are integrated of order one I(1) since the level is non-stationary but the first difference is stationary.

MOMENTO ECONÓMICO
NÚM. 125, ENERO-FEBRERO DE 2003, PP. 18-29.

Table III
Investigating the Stationarity of the series

Variable	*DF*	*ADF(1)*	*ADF(2)*
y	-2.9177*	-1.9087*	-1.8783*
dy	-3.9590	-2.7073	-2.7150
x	-1.0277*	-1.0025*	-0.97674*
dx	-7.2043	-6.6861	-4.5290
prel	-1.6171*	-2.6236*	-1.5696*
dprel	-4.3319	-6.3192	-3.0941
m	-0.62351*	-0.67534*	-0.67015*
dm	-5.4629	-43694	-3.2261

* indicates no-rejection of the null of a unit root at the 5% significance level.
Obs: the letter *d* stands for the first difference of the variable; variables are in log-levels (natural logarithm of the level).

We have used equation [9] to estimate the income elasticity of demand for imports (π). We have chosen an auto-regressive distributed lag model to estimate π because this model takes into account the dynamics between *m*, *y* and relative prices through time. We also avoided potential serial correlation in the residuals by selecting this model. The number of lags was chosen to maximise the Schwarz/Bayesian criterion. The long run estimates of the parameters of the ARDL (2,0,0) are reported in equation [19], where ε is the equation residual and *prel* represents relative prices:

$$m = -1.73 + 1.05y_t - 0.15prel_t + \varepsilon_t \quad [19]$$

5.698[.000] -1.703[0.096] -1.863[0.070]

$R^2 = 0.95$

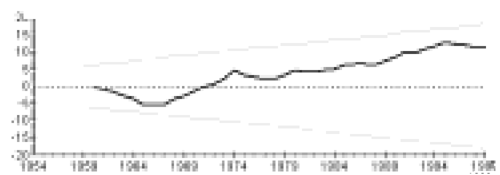
We report t-ratios under the coefficients and p-values in brackets; variables are in log-levels; the subscript *t* stands for time (years).

As can be seen in equation [19], long run parameters of the model have the expected signal and present reasonable values. The price elasticity of demand for imports is negative (-0.15) and much smaller in absolute value than π. It is significant at the 10% confidence level. The income elasticity of demand for imports is positive (1.05) and it is statistically significant at 1% confidence level. The residuals of this regression do not present any problem related to normality, serial correlation, functional form and heteroscedasticity. ADF tests for the residuals rejected the hypothesis of non-stationarity.[4] The error correction model for the regression above shows that the speed of adjustment to the long run equilibrium is high (20.2%).

As a matter of fact, the estimation of a unique income elasticity of demand for imports for the whole period (50 years) is vulnerable to critiques. In fact, structural changes are expected to change this parameter over time. However, the plot of the cumulative sum of squares of recursive residuals shown in Figure I, suggests that the parameter π does not have any problems of structural stability. As can be seen by the confidence interval represented by the straight lines, the null hypothesis that the regression equation is correctly specified is not rejected at the 5% level.

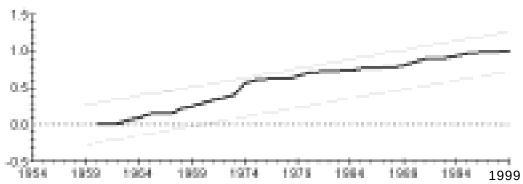
Figure I
Structural stability of π

Plot of Cumulative Sum of Recursive Residual



The straight lines represent critical bounds at 5% significance level.

Plot of Cumulative Sum of Squares of Recursive Residual



The straight lines represent critical bounds at 5% significance level.

[4] The fact that the linear combination between the three variables is I(0) suggests that they are cointegrated, but we have not tested for the presence of other cointegrating vectors.

We have also tried other possibilities for the estimation of π. We estimated, for instance, an income elasticity demand for imports for each moving period of 15 years as in the procedure followed by Atesoglu (1993). The method was shown to be inadequate because most of the 37 estimated models were not significant. Rolling or recursive regressions also suffered from the same problem raised above. Finally, we considered the possibility of estimating π for arbitrary short periods. However, there would also be critiques in relation to the criteria used to choose these arbitrary periods. The reasons highlighted above, especially the fact that the parameter π has not suffered from problems of structural stability, have determined our decision to use the unique elasticity estimated by the ARDL (2,0,0).

Given the estimated π and according to equations [11], [12], [13] and [15], we calculated the yearly BoP constrained income growth rates. Table IV presents the actual income growth rate of Brazil and the estimated BoP constrained income growth rates. Since the theory establishes a long-run relationship between the variables, we present the results as averages for 30 years moving periods. As can be seen, the estimated income growth rates are very close to the actual income growth rates for the model of the Simple Rule [Thirlwall (1979)] and even closer for the model of the Financial Simple Rule. The similarity between the estimated and actual rates is more evident in Table V where averages are presented by decade. The unusual results obtained with the models of Thirlwall and Hussain (1982) and Elliot and Rhodd (1999) arise from the inclusion of capital flows in the (dis)equilibrium condition of the current account. The volatility of net capital flows was extremely high throughout the whole sample period. The absolute value of net capital inflows varies significantly, sometimes on a yearly basis. They also change from positive to negative and, conversely, from negative to positive in a regular way. Massive changes in net capital inflows are reflected in the extremely high values of the estimated BoP constrained growth rate, even if their participation in total receipts (or expenditures) is low.

Table IV
Actual Income Growth Rate and Estimated BoP Constrained Income Growth Rates (30 years moving average)

Item	*y* *Actual*	y_{bsr} *Simple [Thirlwall (1979)]*	y_{bsrf} *Financial Simple Rule*	y_{bext} *Extended Model [Thirlwall and (1992)]*	y_{ber} *Elliot Rhood (1999)*
1	7,3%	7,7%	6,4%	284,6%	311,6%
2	7,3%	8,7%	7,2%	270,9%	296,6%
3	7,4%	9,0%	7,5%	272,5%	298,1%
4	7,1%	8,6%	6,7%	276,3%	302,0%
5	6,9%	9,0%	6,5%	286,9%	311,7%
6	6,6%	6,8%	5,8%	278,3%	302,7%
7	6,6%	6,8%	5,8%	280,7%	303,4%
8	6,5%	6,8%	6,0%	249,0%	248,3%
9	6,7%	6,7%	5,7%	130,2%	123,8%
10	6,5%	7,3%	6,7%	128,6%	122,4%
11	6,2%	6,3%	5,8%	128,3%	122,0%
12	6,0%	6,4%	6,0%	128,7%	122,9%
13	5,5%	5,9%	5,5%	127,7%	121,3%
14	5,2%	6,0%	5,9%	122,5%	115,9%
15	5,0%	7,2%	7,4%	116,3%	107,6%
16	5,2%	7,1%	7,0%	121,0%	112,6%
17	5,2%	6,2%	6,5%	134,7%	128,3%
18	5,3%	5,7%	6,1%	139,0%	133,5%
19	5,2%	6,2%	6,6%	33,5%	13,8%
20	5,1%	6,8%	7,2%	35,3%	15,7%
21	4,8%	6,3%	6,4%	-30,7%	-57,6%
22	4,5%	6,3%	6,1%	-32,2%	-59,8%

Table V
Actual Income Growth Rate and Estimated BoP Constrained Income Growth Rates (decade averages)

Decades	*y*	y_{bsr}	y_{bsrf}	y_{bext}	y_{ber}
1950´s	7,15	9,75	6,17	325,73	346,92
1960´s	6,12	4,25	3,57	466,08	522,67
1970´s	8,62	11,97	12,00	20,99	20,18
1980´s	3,12	2,91	2,38	-100,90	-174,26
1990´s	1,82	3,96	3,89	-16,72	-25,26
Average	5,41	6,18	5,23	143,65	143,10

(2) How Close is Close?

After calculating the annual equilibrium growth rates we performed a test to check whether the BoP constrained growth rate is a good predictor of the actual income growth rate. There are two main statistical procedures in the empirical literature related to Thirlwall´s Growth Law to perform this check. McGregor and Swales (1985) suggested running a regression of *y*, the actual income growth rate, in y_b, the income growth rate predicted by the models, and testing whether the regression coefficient is not statistically different from unity and whether the constant term is not statistically different from zero, as in the equations below:

$$y_t = \beta_0 + \beta_1 y_{bsrt} + \varepsilon_{2t} \qquad [20]$$

$$y_t = \beta_3 + \beta_4 y_{bsrft} + \varepsilon_{5t} \qquad [21]$$

where the subscript *i* stands for the observation (year) and ε is the equation's residual, *y* is the actual income growth and y_b is the estimated model.

McCombie (1989) observed that the problem of this method is that the independent variable (y_b) is calculated using the estimated parameter (π) which includes its associated standard error. McCombie (1989) suggests testing the prediction power of the models by running a regression of the income elasticity estimated using the import demand function in the elasticity estimated using the BoP constrained growth model. The methods of McCombie (1989) and McGregor and Swales (1985) require the use of estimated parameters. However, the method suggested by McCombie (1989) implies the estimation of 37 regressions for a moving average of 15 years and 50 regressions for annual data. Not surprisingly, most of the models that we tested were not statistically significant. For this reason, we have chosen to use the method of McGregor and Swales (1985) which implies running a single regression of *y* in y_b and testing how close the estimated income growth rate is to the actual income growth rate.

The results of the tests using equations [20] and [21] could not reject the hypothesis that income growth is constrained by the equilibrium in the BoP's current account.Because the growth rate predicted by the Extended Model and the model of Elliot and Rhodd (1999) was very different from the actual income growth rate we did not perform the tests for these models. However, we verified the closeness of the results obtained with the Simple Rule and Financial Simple Rule to the actual income growth. For this purpose, we have used an ARDL model using the annual observations from 1949 to 1999. Since adjustments in the real side of the economy are not instantaneous, the actual income growth rate was allowed to depend on its own past values and the past values of its BoP constrained values. An ARDL model was used for this purpose because it takes into account the dynamics involved in the determination of the actual income growth, given its BoP constrained growth rate. The choice of the number of lags was based on a general to specific method. We started with a maximum of 10 and decreased the number of lags until reaching a point where further decreases would generate problems of serial correlation in the residuals. The models selected were an ARDL (7,7) and ARDL (6,6) for the Simple Rule and Financial Simple Rule, respectively. Neither of the estimated models presented any problems in the residuals, with the exception of the Simple Rule. There were problems of normality in this model that could not be avoided with other lag structures. Estimated long run parameters of the models and their respective statistics are reported in the table below. We performed a t-test in the coefficients of β_0 and β_2 in the estimated versions of equations [20] and [21] and verified that they are not statistically different from 0 in either of the models. On the other hand, the results show that β_1 and β_3 are not equal to one. However, reported t-ratios and p-values demonstrate that they are statistically different from zero at the 10% significance level. In summary, the parameters β_1 and β_3 are not equal to one but they are also statistically different from zero. This fact suggests that income growth rates are, at least, partially conditioned by income elasticities. In the next section, we verify whether income elasticities determine income growth or vice-versa. We investigate these hypotheses through an analysis of the direction of causality between exports and income growth.

Table VI
How Close is Close?
Results for the Simple Rule and the Financial Simple Rule

Simple Rule (y_{bsr})	*Coefficient*	*S. Error*	*T-Ratio (Prob)*
β_0	0.025	0.018	1.383 [.177]
β_1	0.440	0.230	1.911 [.066]
Financial Simple Rule (y_{bsrf})	*Coefficient*	*S. Error*	*T-Ratio (Prob)*
β_2	0.029	0.017	1.703 [.099]
β_3	0.419	0.229	1.823 [.078]

(3) Causality Granger Test

Following Granger *et al.* (1998), we verified the direction of causality between *x* and *y* in the Granger sense (temporal causality) by estimating the following equations:

$$x_t = \beta_0^G + \delta_2 ECM_{xy} + \sum_{i=1}^{k} \beta_{1i}^G y_{t-i} + \sum_{i=1}^{k} \beta_{2i}^G x_{t-1} + \varepsilon_{3t} \quad [22]$$

$$y_t = \alpha_0^G + \delta_1 ECM_{yx} + \sum_{i=1}^{k} \alpha_{1i}^G y_{t-i} + \sum_{i=1}^{k} \alpha_{2i}^G x_{t-i} + \varepsilon_{4t} \quad [23]$$

It follows from [22] and [23] that *y* does not cause *x* in Granger sense if we fail to reject the null hypothesis:

$$H_{oa} = \beta_{11}^G = \beta_{12}^G = \beta_{13}^G = \ldots = \beta_{1k}^G = 0 \quad \text{and } \delta_2 = 0$$

Similarly, variable *x* does not cause *y* in Granger sense if we fail to reject the null hypothesis:

$$H_{ob} = \alpha_{21}^G = \alpha_{22}^G = \alpha_{23}^G = \ldots = \alpha_{2k}^G = 0 \text{ and } \delta_1 = 0$$

If the β_s and the α_s are significantly different from zero there is feedback or bilateral causality between *x* and *y*. When the set of *x* and *y* coefficients are not statistically significant in both regressions there is independence.

We ran both regressions using an ARDL model. As in the previous estimations we used annual figures. We also choose the ARDL technique for the estimation of equations [22] and [23] because it allows for past values of both *y* and *x* to influence current realizations of the dependent variable. The number of lags in the first ARDL model, which is presented in Table VII in its error correction representation, was chosen according to a general to specific method. We initially started with a maximum number of lags, 5, and reduced according to the significance of the parameters and the diagnostic tests with the residuals. The number of lags in the second model, also presented in its error correction representation (see Table VIII), was chosen to maximize the Schwarz/ Bayesian criterion. The estimated model of equation [22] corresponds to an ARDL (2,2) and the model of equation [23] to an ARDL (2,0) (see Tables VII and VIII, respectively).

T-ratios and p-values for the parameters are reported in their corresponding tables. The significance of the error correction term suggests that the variables *y* and *x* are co-integrated and that there is a bilateral causality between them. In fact, if there is a long run relationship between two variables, then there is necessarily a causality relationship between them. A joint F-test for the parameters showed that the model is significant at 5% confidence level. The residuals of both equations do not present any problem related to serial correlation, functional form, heteroscedasticity and normality. It is also not also possible to reject, in both models, the hypothesis that all estimated parameters are, in conjunction, different from zero. The main conclusion, as inferred from the discussion of Section I, is that the bilateral causality relationship between exports and income does not reject the main hypothesis underlying Thirlwall´s Growth Law.

Table VII
Causality When the Dependent Variable is *x*

Regressor	*CoefficienT*	*Standard Error*	*T-Ratio[Prob]*
INT	-.0045697	.016565	-.27587[.784]
dy_{t-1}	.30344	.15581	1.9475[.059]
dy_{t-2}	.18127	.157311	.1523[.256]
dx_{t-1}	.0038920	.030783	.12643[.900]
dx_{t-2}	.029427	.028072	1.0483[.301]
ecm(-1)	- .015410	.0087051	-1.7702[.084]
R-Squared	.34687	R-Bar-Squared	.26523
S.E. of Regression	.034456	F-stat. F(5,40)	4.2487[.003]

NÚM. 125, ENERO-FEBRERO DE 2003, PP. 18-29.

Table VIII
Causality When the Dependent Variable is *y*

Regressor	*Coefficient*	*Standard Error*	*T-Ratio[Prob]*
dx_{t-1}	.24633	.12775	1.9282[.061]
d*y*	.25637	.088034	2.9121[.006]
int	-.59578	.25535	-2.3332[.024]
ecm(-1)	-.25924	.087874	-2.9501[.005]
R-Squared	.18793	R-Bar-Squared	.12993
S.E. of Regression	.14252	F-stat. F(3,42)	3.2399[.031]

Conclusion

The results presented in Section II could not reject the hypothesis of Thirlwall´s Growth Law to the Brazilian case. The actual average income growth rate of Brazil was 5,41% per year for the last 50 years while the income growth rates estimated by the Simple Rule and Financial Simple Rule are 6,18% and 5,23% per year, respectively. This is a very close prediction. We can infer from the difference between the two predicted income growth rates that IDP net payments, derived from capital inflows, reduced the equilibrium growth rate in Brazil by approximately 1 percentage point per year during the last fifty years. Models with net capital inflows were unable to provide a closer prediction. The high volatility of capital flows casts doubt on the application of this variable in BoP constrained growth models. With regard to the causality tests, our results suggest that income growth tend to be determined by income elasticities. On the other hand, the findings also support the view that supply conditions may also play a role in the determination of exports.

Capital inflows, represented by the letters F_i, F_p and F_{di}, may relax the constraint on the demand in the short-run and simultaneously increase the income growth rate with BoP equilibrium through the enlargement of the economy's capacity to import goods and services. Capital inflows generate counterparts in IDP expenditures but they may also have a positive impact in income elasticities of exports and imports. An improvement in non-price competitiveness would compensate for positive IDP net payments. Unless positive changes in competitiveness come into play, the BoP constraint, although relaxed in the short-run, will return with greater strength.

Brazil carried out a tough monetary policy for almost the entire 1990s. Such policy was aimed to attract foreign capital and to keep balanced the BoP as a whole, given the dynamic disequilibrium of the current account.Our paper raises some questions for future research: what sort of impacts on long-run income growth should a policy maker expect from a restrictive monetary policy? In other words, what are the optimal conditions to attract F_i, F_p and F_{di}, in order to achieve faster income growth given the BoP equilibrium? What is the implication of a high domestic interest rate to the BoP equilibrium income growth rate given its determinant role in the stock and cost of external liabilities? If non-price competitiveness is affected by capital inflows, how can we measure its impacts on the elasticities? We assumed that capital inflows, because of its inter-temporal nature, affect the equilibrium income growth rate of a country, but how can we model with accuracy the lags between the moments of the foreign investment and its effects on IDP net payments and income growth? Finally, what is the transmission mechanism from a monetary problem, the BoP constraint, to the real side of the economy (income growth)?

If the return of foreign capital is expressed in terms of a diminished income growth rate in the future, than there is a *trade-off* between these variables. Thus, monetary policy is able to affect economic growth through other channels than the Keynesian effect of interest rates on investment decisions.

The behaviour of foreign direct investment over time, its relationship with the elasticities and its counterparts in the current account should be analysed in more depth. In fact, there is a need to investigate the dynamic behaviour of F, S_x, S_m and Y in order to analyse the complete effect of capital movements through time in an open economy. Our paper aimed to present the reasons why policy makers should worry about the effects of capital inflows, insofar as long run income growth is part of their agenda. Finally, we conclude that monetary policy needs to be managed considering its inter-temporal effects on the stock and cost of external liabilities. The absence of a strategy for the absorption of foreign capital, such as the promotion of systemic competitiveness or the improvement in macroeconomic fundamentals, can have crucial consequences for an economy's income growth rate.

Bibliography

- Atesoglu, H. S. [1993-1994], "Exports, Capital Flows, Relative Prices, and Economic Growth in Canada", *Journal of Post Keynesian Economics*, Vol. 16, no. 2, 289-297.
- Blanchard, O. J. and Fischer, S. [1989], *Lectures in Macroeconomics*, MIT Press.
- Davidson, P. [1997], "Note for the Symposium of Thirlwall's Law", *Journal of Post Keynesian Economics*, Vol. 19.
- Elliot, D. R. and Rhodd, R. [1999], "Explaining Growth Rate Differences in Highly Indebted Countries: an Extension to Thirlwall and Hussain", *Applied Economics,* 31.
- Granger, C. W. J., Huang, B. and Yang, C. W. [1998], "A Bivariate Causality Between Stock Prices and Exchange Rates: Evidence from Recent Asia Flu", *UCSD Economics Discussion Papers*, 98-0, <http://weber.ucsd.edu/Depts/Econ/Wpapers/>.
- Harrod, R. [1933], *International Economics*, Cambridge University Press.
- Holland, M. and Canuto, O. and Xavier, C. [1998], "Taxas de Câmbio, Elasticidades-renda e Saldo Comercial no Brasil", *Revista Brasileira de Economia*, Vol. 52, no. 2, abril-junio, 323-334.
- Hussain, M. N. [1999], "The Balance-of-Payments Constraint and Growth Rate Differences Among African and East Asian Economies", *African Development Review*, Vol. 11, 103-137.
- Jayme Jr., F. [2001], "Balance-of-payments constrained economic growth in Brazil", *CEDEPLAR*, (mimeo).
- Krugman, P. [1989], "Difference in Income Elasticities and Trends in Real Exchange Rates", *European Economic Review*, Mayo, 1031-1054.
- León-Ledesma, M. A. [1999], "An Application of Thirlwall's Law to the Spanish Economy", *Journal of Post Keynesian Economics*, Vol. 21, 431-439.
- McCombie, J.S.L and Thirlwall, A.P. [1994], *Economic Growth and the Balance-of-Payments Constraint*, London: St.Martin's Press.
- McCombie, J.S.L. [1993], "Economic Growth, Trade Interlinkages, and the Balance-of-Payments Constraint", *Journal of Post Keynesian Economics*, Vol. 15, 471-514.
- Moreno-Brid, J. C. [1998-1999], "On Capital Flows and the Balance-of-Payments-Constrained Growth Model", *Journal of Post Keynesian Economics*, Vol. 21, 283-298.
- Obstfeld, M. and Rogoff, K. [1996], *Foundations of International Macroeconomics*, MIT Press.
- Porcile, G. *et alii*. [2001], "Balance of Payments Constrained Growth in Brazil: a Test of Thirlwall´s Law (1900-1984)", UFPR, (mimeo).
- Thirlwall, A.P. [1979], "The Balance of Payments Constraint as an Explanation of International Growth Rate Differences", *Banca Nazionale Del Lavoro Quarterly Review*, 128.
- Thirlwall, A.P. [1997], "Reflections on the Concept of Balance-of-Payments-Constrained Growth", *Journal of Post Keynesian Economics*, Vol. 19.
- Thirlwall, A. P. and Hussain, M. N. [1982], "The Balance of Payments Constraint, Capital Flows and Growth Rate Differences Between Developing Countries", *Oxford Economic Papers*, 498-509.