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Some unpleasant currency devaluation arithmetic in a post-Keynesian macromodel

Rafael Saulo Marques Ribeiro
Affiliation: Graduate program at the Department of Land Economy, University of Cambridge, UK.
Email: rsmribeiro@gmail.com

John S. L. McCombie
Affiliation: Fellow in economics at Downing College, professor and director of the Cambridge Centre for Economic and Public Policy, Department of Land Economy, University of Cambridge, UK.
Email: jslm2@cam.ac.uk

Gilberto Tadeu Lima
Affiliation: Professor in the Department of Economics, University of São Paulo, Brazil
Email: giltadeu@usp.br

RAFAEL S. M. RIBEIRO, JOHN S. L. McCOMBIE, AND GILBERTO TADEU LIMA

Some unpleasant currency devaluation arithmetic in a post-Keynesian macromodel

Abstract: *Conventional view argues that devaluation increases the price competitiveness of domestic goods, thus allowing the economy to achieve a higher level of economic activity. However, these theoretical treatments largely neglect two important effects following devaluation: (i) the inflationary impact on the price of imported intermediate inputs which raises the prime costs of firms and deteriorates partially or totally their price competitiveness; and (ii) the redistribution of income from wages to profits which affects ambiguously the aggregate demand as workers and capitalists have different propensities to save. New structuralist economists have explored these stylised facts neglected by the orthodox literature and, by and large, conclude that devaluation has contractionary effects on growth and positive effects on the external balance. Given that empirical evidence on the correlation between devaluation and growth is quite mixed, we develop a more general Keynesian-Kaleckian model that takes into account both opposing views in order to analyse the net impact of currency depreciation on the short-run growth rate and the current account. We demonstrate that this impact can go either way, depending on several conditions such as the type of growth regime, that is, wage-led or profit-led, and the degree of international price competitiveness of domestic goods.*

Keywords: *currency devaluation, price competitiveness, wage-led, profit-led.*
***JEL classification*:** O40, O33, E25

Rafael S. M. Ribeiro is in the Department of Land Economy, University of Cambridge, UK, email: rsmribeiro@gmail.com; John S. L. McCombie is fellow in economics at Downing College, professor and director of the Cambridge Centre for Economic and Public Policy, Department of Land Economy, University of Cambridge, UK, email: jslm2@cam.ac.uk; Gilberto Tadeu Lima is a Professor in the Department of Economics, University of São Paulo, Brazil, email: giltadeu@usp.br. The authors gratefully acknowledge useful comments and suggestions by Ricardo Araujo and Nigel Allington. The usual disclaimer applies.

The traditional argument of the orthodox view is that currency depreciation boosts domestic output and increases net exports. This is the case of expansionary devaluation. The rationale behind the theoretical treatments supporting this view is that currency devaluation is equivalent to an increased price competitiveness of internally produced goods relative to foreign goods which leads to an improved condition of the trade balance and ultimately boosts domestic income when there is excess capacity[1]. Alternatively, the new structuralist school of thought contributed significantly to the contractionary devaluation standpoint by providing considerable additional information on the impacts of devaluation on cost of production of firms, import demand, export supply, consumption, investment, external debt, inflation and income distribution[2]. Since the orthodox theoretical treatment can be considered firmly established, in the present work we focus on the new structuralist view.

Early contributions to the new structuralist literature concentrated mostly on the demand-side adverse effects of devaluation. Diaz-Alejandro (1963) discussed the redistributive effects of devaluation from wages to profits. By assuming different marginal propensities of workers and capitalists to consume, his model shows that devaluation improves the trade balance as output growth wanes. Krugman and Taylor (1978) advanced a modeling work concerning unwanted effects of devaluation on growth. In their model the magnitude of the impact of devaluation on growth depends on characteristics of the economy such as the terms of trade, the propensity to save out of wages and profits and the value of exports and imports. They conclude that devaluation reduces total output when trade balance is initially in deficit. Razmi (2007) extends Krugman and Taylor's (1978) model by taking into account the presence of transnational corporations and differences in the pricing behaviour of exports for developed and undeveloped countries. Unlike Krugman and Taylor's model, his framework suggests that devaluation can be contractionary even if trade is initially balanced. Later on, many studies in this literature began to identify supply-side transmission channels yielding contractionary devaluation. Bruno (1979) shows that devaluation has a cost-push effect on prices and hence causes a drop in real income which, in turn improves external balance as imports tend to reduce more than exports following the decrease in the level of output. Gylfason and Schmid (1983) and Buffie (1986) also studied the adverse effects of devaluation that arises when developing countries rely heavily on imported intermediate inputs. From a post-Kaleckian perspective, Bhaduri and Marglin (1990) and Lima and Porcile (2012) show how devaluation may or may

[1] For a summary of the discussion see Johnson (1976).
[2] For a summary of the new structuralist approach to devaluation see Bahmani-Oskooee and Miteza (2003).

not increase the profit share, depending on the relative changes in money wages and mark-up, thus yielding an ambiguous impact on the utilisation capacity and capital accumulation. However, the post-Kaleckian models only take into account the effect of devaluation on growth and disregard the behaviour of the current account.

There are some empirical studies supporting a linear, positive relationship between the maintenance of a devalued currency and growth in the long run (Cottani et al, 1990; Dollar, 1992; Rodrik, 2008). However, a more recent empirical literature casts some doubts on this direct relationship between a competitive currency and growth by incorporating non-linearities in the previous models, which enables them to show that a sufficiently devalued currency might have adverse effects on growth (Aguirre and Calderon, 2005; Nouira and Sekkat, 2012; Couharde and Sallenave, 2013). Blecker and Razmi (2008) also found evidence of contractionary devaluation for more indebted undeveloped countries.

Since empirical research provides very mixed conclusions regarding the effects of devaluation on growth, our aim is to contribute to the literature by developing a more general Keynesian-Kaleckian formal model for an open economy featuring two classes (workers and capitalists) with different propensities to save that accounts for positive and negative effects of devaluation on growth and current account. In our formal model we draw upon different, but complementary strands of the Post-Keynesian literature, namely the balance-of-payments constrained growth model with financial flows set forth by Thirlwall and Hussain (1982) and an aggregate demand specification in line with the Hick's supermultiplier and Kaleckian principles of conflicting claims on income. We, then, extend the canonical models in order to incorporate simultaneously in the analysis supply- and demand-side prominent characteristics of modern economies such as the utilisation of imported intermediate inputs by domestic firms and distributional effects of devaluation on domestic expenditures[3]. Further, we extend the new structuralist approach by pointing out the existence of gains from trade following the cheapening of domestically produced goods in foreign trade through the theoretical framework of the balance-of-payments constrained growth model. We also add to the post-Kaleckian approach by considering the simultaneous determination of the impact of devaluation on output growth and the current account. Ergo, devaluation can only boost growth and improve the current account condition if the positive impact on trade overcompensate the negative demand-

[3] A more inclusive model would also take into account contractionary effects of devaluation through an increase in interest rates and external debt, as in Bruno (1979) and Médici and Panigo (2015). However, in order to keep the model more tractable and focus on cost composition and income distribution effects, we abstract from these channels.

and supply-side effects briefly mentioned above. Such extensions create a number of possible scenarios and outcomes for the simultaneous determination of growth and trade balance following devaluation not yet fully explored by the literature. Our model also sets the orthodox view as well as the new structuralist literature concerning exclusively the impact of devaluation on growth and external balance as special cases within a more general theoretical framework. In short, our formal treatment allows us to conclude that the net impact of currency devaluation on short-term growth and current account can go either way.

The reminder of this paper is organised as follows. The next section presents the extended balance-of-payments constrained growth model. After that we introduce the aggregate demand condition. Later it is shown how the system accommodates exogenous relative price shock on the dynamics of growth and trade balance in different aggregate demand growth regimes. Finally, we draw some conclusions.

An extended balance-of-payments constraint growth model

In this section we extend the standard balance-of-payments constrained growth model developed by Thirlwall (1979) by assuming that domestic firms also use imported intermediate inputs in the production process. Let us assume the global economy consists of basically two different countries: a richer foreign country and a poorer home country. The foreign country is an economy that issues the international currency and the home country is an economy facing a balance-of-payments constraint in the long run. It is also assumed that the home country is not able to finance sustainably a positive ratio of the current account deficit to GDP over time, thus implying that in the long run real exports must be equal to real imports. The foreign country is a two-sector economy which produces and exports consumption goods and industrialised intermediate inputs. The home country is a one-sector economy that produces and exports only one sort of consumption good with imperfect substitutability between the foreign and domestic consumption goods. We could also assume, at the expense of simplicity, that the home country is a two-sector economy which produces consumption goods and intermediate inputs; however, the addition of the intermediate input sector in the domestic economy would nonetheless preserve the major qualitative conclusions of the model set forth herein.[4] It is also assumed that the home country imports consumption goods and intermediate inputs from the foreign country.

[4] Admittedly, though, an extension of the model developed herein to feature a small open economy with two sectors (tradable and non-tradable) along with other related transmission channels is a possibility worth saving for future research.

In short, the home country imports are disaggregated in two different categories, namely, imported consumption good (M^c) and imported intermediate inputs $\left(M^i\right)$. Thus, we have now an extended balance-of-payments identity

$$P_d(X+F)=E\left(P_f M^c+P_f^i M^i\right) \tag{1}$$

where P_d is the domestic price, P_f^i is the price of imported intermediate inputs in foreign currency, X is the volume of exports, F is the financial inflow and E is the nominal exchange rate. Equation (1) assumes that the home country does not accumulate foreign reserves. Also assuming, for convenience, that the inflation rate of imported consumption goods and the imported intermediate inputs in foreign currency are equal $\left(p_f=p_f^i\right)$, in growth rates we have

$$\gamma x+(1-\gamma)f=\left(e+p_f-p_d\right)+\theta m^c+(1-\theta)m^i \tag{2}$$

where γ is the ratio of the value of exports to the value of total imports and θ is the ratio of the value of imported consumption goods to the value of total imports. The lower case letters represent the growth rates of the levels of the corresponding variables. It is worth noting that in our model the growth of financial inflows f is assumed to be strictly positive, which is a plausible assumption for developing economies.

In rates of change the exports and imports demand functions are given by

$$x=\eta\left(p_d-p_f-e\right)+\varepsilon z \tag{3}$$

$$m^c=\psi\left(e+p_f-p_d\right)+\pi_c y \tag{4}$$

$$m^i=y \tag{5}$$

where $\eta<0$ and $\psi<0$ are the price elasticities of demand for exports and imports respectively, ε and π_c are the income elasticities of demand for exports and imports of consumption goods respectively, and z is the foreign country income growth and y is the domestic income growth. That is, the growth of exports is a direct function of the growth of foreign demand and relative prices. The growth of imported consumption goods depends positively on the growth of domestic income and negatively on the real exchange rate. Moreover, it is assumed that the ratio of imported intermediate inputs to domestic output $\left(M^i/Y\right)$ does not change over time. This means domestic firms have a fixed proportions production function with respect to intermediate inputs. Therefore, by equation (5), M^i and Y grow at the same rate.

Now we define the domestic price index. We extend the mark-up pricing equation by making domestic prices a function of imported intermediate inputs. To do so, the unit variable cost must be disaggregated in two parts, namely the unit labour cost and unit imported intermediate inputs cost

$$P_d = T\left(\frac{W}{a} + \frac{P_f E M^i}{Y}\right) \tag{6}$$

where T is the mark-up factor (one plus the mark-up), $P_f E\left(M^i/Y\right)$ is the unit imported intermediate inputs cost in domestic currency, and W is the nominal wage, and a is the labour productivity. Assuming that the ratio M^i/Y is constant, in growth rates we have

$$p_d = \tau + \varphi(w - \hat{a}) + (1 - \varphi)\left(p_f + e\right) \qquad \varphi \in (0,1) \tag{7}$$

where τ is the growth of the mark-up factor and φ is the share of unit labour cost in total prime costs and $\hat{a}$ denotes the growth of labour productivity.

Following Blecker (1989), we redefine the mark-up as a function of the real exchange rate. As devaluation increases the market power of domestic firms, it enables them to raise their mark-up. Therefore, if the mark-up is positively related to the real exchange rate, we have (see appendix A.1)

$$\tau = -(\varphi/2)\left[(w - \hat{a}) - \left(p_f + e\right)\right] \tag{8}$$

Substitution of equations (8), (7), (5), (4) and (3) into (2) yields

$$y = \frac{\gamma\varepsilon z + (1-\gamma)f + (1 + \gamma\eta + \theta\psi)(\varphi/2)(w - \hat{a} - p_f - e)}{\pi} \tag{9}$$

where $\pi = \theta\pi_c + (1 - \theta)$. In other words, the income elasticity of demand for total imports (π) is given by the weighted average of income elasticities of demand for imported consumption goods (π_c) and imported intermediate inputs, which, by equation (5), is equal to unity. Equation (9) also shows that if the Marshall-Lerner condition holds $(1 + \gamma\eta + \theta\psi) > 0$ then the partial effect of currency devaluation on growth is positive.

Since in the long run real wages grow at the same rate as the labour productivity $(w - \hat{a} = p_d)$, relative prices do not change $\left(p_d - p_f - e = 0\right)$ and the home country does not sustain an unbalanced current account $(\gamma = 1)$, equation (9) is reduced to the standard equilibrium growth rate $y_{BP} = \varepsilon z/\pi$. The equilibrium growth rate is widely known in the literature as the Thirlwall's law. This law states that the domestic growth is directly related to the foreign demand growth rate. It also states that a country's output growth rate depends positively on its existing non-price competition factors, here expressed by the ratio ε/π. This ratio reflects disparities between countries with respect to factors determining the demand for a country's exports and imports, such as technological capabilities, product quality, stock of knowledge, and consumer preferences, for instance.

Therefore, in this section we extend the standard balance-of-payments constrained growth model by incorporating imported intermediate inputs into the canonical Thirlwall's (1979) model. Blecker and Ibarra (2013) also developed a model that allows imported intermediate inputs into the standard Thirlwall model. They assume that the imports of intermediate goods are a linear function of manufactured exports. However, in their model domestic prices do not depend on imported intermediate inputs, and hence manufactured exports are not affected by intermediate inputs. In our model, on the other hand, we allow the imported intermediate inputs into the prime costs of firms. Thus, even though the imported intermediate inputs to output ratio is assumed to be constant, in our model changes in the unit costs of intermediate inputs feed through into domestic prices and then affects exports, which, in turn, impacts on output and consequently changes the volume of imported intermediate inputs proportionally.

The aggregate demand growth rate

We know, by equation (9), that the equilibrium balance-of-payments constrained growth rate depends positively on the growth of foreign income and the trade elasticities ratio. McCombie (1985) and McCombie and Thirlwall (1994, ch. 6) argue that the actual growth rate, on the other hand, can be represented by $y = \alpha_q q + \alpha_x x$, where q is the growth rate of the domestic expenditures, and $\alpha_q, \alpha_x > 0$ are parameters. These two equations represent the dynamics of the Hick's super multiplier. In fact, if $x/\pi > \alpha_q q + \alpha_x x$, then the balance-of-payments constraint is relaxed, thus allowing the home country to increase the growth of its domestic expenditures until the current account is balanced. If, on the other hand, $x/\pi < \alpha_q q + \alpha_x x$, then the country incurs in trade deficits, and consequently must reduce the growth of domestic expenditures in order to balance the current account.

To begin with, we define the aggregate demand. In rates of change, the traditional income accounting gives

$$y = \beta_q q + \beta_x x - \beta_m\left[\left(e + p_f - p_d\right) + \theta m^c + (1-\theta)m^i\right] \tag{10}$$

where q is the growth of domestic expenditures, β_q is the ratio of the value of domestic expenditures to the value of domestic output, β_x and β_m are the ratios of the values of exports and total imports to the value of domestic output, respectively. In other words, the aggregate demand growth is determined by the weighted average of the growth rates of domestic expenditures and net exports.

We can rewrite β_x as

$$\beta_x = \frac{X}{Y} = \frac{X}{\left(EP_f/P_d\right)M}\frac{\left(EP_f/P_d\right)M}{Y} = \gamma\beta_m \tag{11}$$

where $M^c + M^i = M$. Substituting (11) into (10), and then the balance-of-payments identity (2) in the resulting equation, we have

$$y = \beta_q q - \beta_m(1-\gamma)f \tag{12}$$

Since it is assumed that in the short run the home country incurs a current account deficit $(0 < \gamma < 1)$, equation (12) shows that a decrease in the growth of net exports, or alternatively an increase in f, reduces the actual growth rate y. In the long run, given $\gamma = 1$, the growth of output equals the growth of domestic expenditures.

That said, now we move on to the analysis of the aggregate demand by specifying the growth of domestic expenditures as a function of the growth of the mark-up factor

$$q = \xi_0 + \xi_1\tau \tag{13}$$

where ξ_0 and ξ_1 are constants. There are two underlying assumption in equation (13). Firstly, we assume that workers do not save (that is to say workers' consumption is equal to the wage bill) and capitalists save a constant fraction of their profits (Kalecki, 1971). Secondly, we follow Kalecki (1971), Dutt (1984) and Bhaduri and Marglin (1990) and assume that investment decisions are positive functions of the profit share, which in turn is positively related to the mark-up. If savings are more (less) responsive than investments to an increase in the profit margin, then $\xi_1 < 0$ ($\xi_1 > 0$), which means the growth of the aggregate demand is wage-led (profit-led) (see appendix A.2 for a formal demonstration of equation 13).

If we substitute equation (8) and (13) into (12), and consider that $\beta_q = [1 - F/Y] = [1 + (1-\gamma)\beta_m]$, we obtain

$$y = [1 + (1-\gamma)\beta_m]\left[\xi_0 - \xi_1(\varphi/2)\left(w - \hat{a} - p_f - e\right)\right] - \beta_m(1-\gamma)f \tag{14}$$

Given that in the long run we have $\gamma = 1$ and $p_d = w - \hat{a} = p_f + e$, equation (14) is reduced to $y = \xi_0 = y_{BP}$. Since the need for external balance sets the limit to the sustainable growth of the aggregate demand in the long run, we can say that $\xi_0 = y_{BP}$. Therefore, $y = \xi_0 = y_{BP}$ indicates that in the long-run the growth of the aggregate demand equals the growth of the autonomous domestic expenditure.

Real exchange rate, current account and short-run output fluctuation

This section investigates the simultaneous impact of currency devaluation on short-run growth and current account. Since nothing guarantees that the responsiveness of the balance-of-payments constrained and the actual growth rates, given by equation (9) and (14) respectively, to currency devaluation is the same, different possible outcomes for the short-run growth rate and the dynamics of the current account are likely to emerge.

Using equations (9) and (14) we define the balance-of-payments and the goods market equilibrium dynamical conditions respectively. To save notation henceforth we also assume for the short run that nominal wages are given ($w = 0$), there is no technological progress[5] ($\hat{a} = 0$) and foreign prices are likewise given $\left(p_f = 0\right)$. Even though the assumptions that $w = 0$ and $\hat{a} = 0$ are chosen for convenience, they seem to correspond quite well to the stylised features of any economy in the short run; the condition that $p_f = 0$ is also assumed for simplicity since any positive value of p_f would not change the conclusions of our theoretical treatment. After a great deal of manipulation we describe the linear version of the balance-of-payments and the aggregate demand conditions below (see appendix A.3)

$$BP| \quad J_{BPy}dy + J_{BPf}df = V_{BPe}de \tag{15}$$

$$AD| \quad J_{ADy}dy + J_{ADf}df = V_{ADe}de \tag{16}$$

where $J_{BPy} = \pi > 0$

$J_{BPf} = -(1-\gamma) < 0 \quad \text{as } 0 < \gamma < 1$

$J_{ADy} = 1$

$J_{ADf} = \beta_m(1-\gamma) > 0$

[5] Kaldor (1966) persuasively argues that the growth of the labour productivity is an increasing function of the growth of output in the long run (the so-called Verdoorn's law). However, Verdoorn's law is interpreted as a long-run relationship between demand growth and labour productivity, as a demand increase leads, for instance, to higher growth of R&D activities, higher investment rate and the consequent acquisition of new and more efficient machines in some future period.

$$V_{BPe} = [(1 + \gamma\eta + \theta\psi)/2][(-e)\varphi_e - \varphi] \gtrless 0$$
$$V_{ADe} = -(\xi_1/2)[1 + (1 - \gamma)\beta_m][(-e)\varphi_e - \varphi] \gtrless 0$$

where φ_e is the partial derivative of φ with respect to e. Equations (15) and (16) describe the balance-of-payments and aggregate demand curves (henceforth BP and AD curves). As shown above, the terms J_{BPy},J_{BPf},J_{ADy} and J_{ADf} are unambiguously signed. Conversely, the partial effect of currency devaluation on the BP and AD conditions can go either way. It happens because depreciation has two effects. On the one hand, it raises the foreign demand for domestic goods, hence boosting exports. On the other hand, devaluation also feeds through into the prices of imported intermediate inputs in domestic currency, thus harming the price-competitiveness of domestic goods. That is to say that the effectiveness of the exchange rate to improve a country's price-competitiveness and so stimulate positive waves of short- to medium-run growth is closely linked to the capacity of domestic firms to reduce their dependence of imported intermediate inputs in the production process. Countries that stimulate significant technological innovations or manage to design successful strategies of import substitution industrialisation are more capable of effectively boosting exports and growth in the short run by devaluing the currency. To sum up, we can say that a successful devaluation in this context means that the gains from trade following devaluation outweigh the negative impact of increased prices of imported intermediate inputs on prime costs.

More formally, it can be observed that the share φ is inversely related to the nominal exchange rate. In other words, in order to analyse the impact of a devaluation on short-term growth it must be taken into account the partial effect, not only of e, but also of the share φ. That said, let us analyse separately each component of V_{BPe} and V_{ADe}:

- $(1 + \gamma\eta + \theta\psi)$: it is less than zero if the Marshall-Lerner condition holds;
- φ_e: by equation (7), an increase in e also increases the share of imported intermediate inputs in total prime costs, thus reducing the share of unit labour cost in total prime costs φ; therefore, the share φ is inversely related to the nominal exchange rate, that is, $\partial\varphi/\partial e < 0$;
- $[1 + (1 - \gamma)\beta_m]$: this term is strictly positive;
- ξ_1: as aforementioned, $\xi_1 < 0$ ($\xi_1 > 0$) implies that the growth of the aggregate demand is wage-led (profit-led).

By (15) and (16), we obtain the simultaneous impact of devaluation on short-term growth and financial inflows (see appendix A.4 for a formal demonstration)

$$\frac{dy}{de} = \frac{J_{ADf}V_{BPe} - J_{BPf}V_{ADe}}{2D} \qquad (17)$$

$$\frac{df}{de} = \frac{-J_{ADy}V_{BPe} + J_{BPy}V_{ADe}}{2D} \qquad (18)$$

where $D = J_{BPy}J_{ADf} - J_{ADy}J_{BPf} > 0$ is the determinant of the coefficient matrix.

Now we must evaluate the impact of a real devaluation on growth and the trade balance by taking into account the net effect of the devalued currency on the price competitiveness of the economy as well as the type of aggregate demand growth regime, namely, wage-led or profit-led. As mentioned earlier, the orthodox economic literature states that, when there is excess capacity and the Marshall-Lerner condition holds, currency depreciation relaxes the external constraint and hence allows the country to grow faster. Nevertheless, once we take into account the simultaneous determination of the aggregate demand and the balance-of-payments constrained growth rates, we find that the net impact of currency devaluation on the short-term growth rate and the current account is ambiguous, depending on several conditions to be discussed below.

In the next subsections we refer to currency devaluation as either competitive or non-competitive. Competitive devaluation increases price competitiveness of domestic goods and hence improves the current account condition. If the share of imported intermediate inputs in prime costs is sufficiently low, then we have the case of competitive devaluation. Formally, this is the case in which the value of V_{BPe} in equation (15) is strictly positive. Given that the Marshall-Lerner condition holds $(1 + \gamma\eta + \theta\psi) < 0$, V_{BPe} is positive if, and only if $(-e)\varphi_e < \varphi$. Since $\varphi_e < 0$, if the share of imported intermediate inputs in total prime costs is sufficiently low, which implies that φ is sufficiently high, then $V_{BPe} > 0$. On the other hand, non-competitive devaluation (or uncompetitive devaluation) denotes the case where the increased price of imported intermediate inputs deteriorates the price competitiveness of domestic goods in foreign trade. In terms of the model, by equation (15), this case is observed when the inequality $(-e)\varphi_e > \varphi$ holds and hence $V_{BPe} < 0$. Ergo, for ease of exposition, first we discuss the possible outcomes of competitive devaluation on the growth rate and the current account both in a wage-led economy and in a profit-led economy. Then we discuss the analogous scenarios that emerge following non-competitive devaluation in both aggregate demand growth regimes, viz., wage-led and profit-led.

The case where devaluation improves price competitiveness

This subsection analyses the impact of uncompetitive devaluation on the growth rate and the current account in the wage-led and profit-led growth regimes.

First, we plot the BP and the AD curves from equations (15) and (16) in the diagrams below. The slope of the BP curve is given by $-J_{BPy}/J_{BPf} > 0$, which means that the BP curve is upward-sloping, whereas the AD curve is downward-sloping, since $-J_{ADy}/J_{ADf} < 0$. See Figure 1 below.

[FIGURE 1 ABOUT HERE]

Given that $V_{BPe} > 0$, a devaluation unambiguously shifts the BP curve downwards. The intercept of the BP curve in equation (15) is given by $df/de|_{dy=0} = V_{BPe}/J_{BPf} < 0$, when $dy = 0$. Thus, a real devaluation reduces the rate of change of capital inflows for any given level of the growth rate y, thereby shifting the BP curve downwards. As aforementioned, the gains from trade caused by devaluation outweigh the negative impact of increased prices of imported intermediate inputs. Therefore, we can say that a downward shift of the BP curve represents the gains from trade caused by competitive devaluation. The same shift mechanism can be applied to the AD curve. Taking the intercept of the equation (16), when $dy = 0$, we have $df/de|_{dy=0} = V_{ADe}/J_{ADf} \gtreqless 0$. If the economy is in a wage-led growth regime, then $\xi_1 < 0$ and the AD curve shifts down for any given level of y; conversely, in a profit-led regime the AD curve shifts up for any given value of y, since $\xi_1 > 0$ and, consequently, $df/de|_{dy=0} > 0$. Therefore, Figure 1.a portrays the BP-AD model in a wage-led economy, whilst Figure 1.b illustrates the same system of equations in a profit-led growth regime.

To begin with, let us consider the impact of competitive devaluation on growth in the wage-led scenario illustrated in Figure 1.a. In a wage-led economy, competitive devaluation reduces the wage share of income by raising the mark-up, thereby depressing consumption, domestic expenditures and ultimately the growth of aggregate demand. It can be seen that the net impact of competitive devaluation on the growth rate y in a wage-led regime is ambiguous. The $BP' - AD'$ solution in Figure 1.a illustrates a scenario wherein the gains from trade caused by the increased price competitiveness of domestic goods (downward shift in BP curve) overcompensate the wane in consumption (downward shift in AD curve) caused by a decrease in the wage share or, alternatively, an increase in the profit margins (or mark-up). In this case, competitive devaluation boosts growth from y_0 to y_1. More formally, given that $\xi_1 < 0$ (wage-led regime), $J_{ADf} > 0$, $V_{BPe} > 0$, $J_{BPf} < 0$ and $V_{ADe} < 0$, the derivative $dy/de = J_{ADf}V_{BPe} -$

$J_{BPf}V_{ADe}$ in (17) is ambiguously signed. If in the $BP' - AD'$ setup competitive currency devaluation propels growth from y_0 to y_1, then we necessarily have $J_{ADf}V_{BPe} > J_{BPf}V_{ADe}$. On the other hand, in the $BP' - AD''$ solution, we observe that the gains from trade caused by competitive devaluation are not enough to exceed in importance the decrease in the consumption due to the raised profit margins (the shift in the AD schedule outruns the shift in the BP curve) and so a devaluation reduces growth from y_0 to y_2. In this case the country would be better off with an appreciated currency. By equation (17), now we have $J_{ADf}V_{BPe} < J_{BPf}V_{ADe}$, thus implying that $dy/de < 0$. It is worth noting that the larger the responsiveness of the growth of consumption and investment to the mark-up growth in absolute value $|\xi_1|$ the more likely it is that the inequality given by $J_{ADf}V_{BPe} < J_{BPf}V_{ADe}$ will be satisfied and hence $dy/de < 0$. In short, in a wage-led economic system the impact of competitive devaluation on short-run growth is ambiguous. If $|\xi_1|$ is sufficiently small so that the inequality $J_{ADf}V_{BPe} > J_{BPf}V_{ADe}$ holds, then competitive devaluation spurs growth, given that $dy/de > 0$. In like manner, if the inequality $J_{ADf}V_{BPe} > J_{BPf}V_{ADe}$ is not satisfied and consequently it follows that $dy/de < 0$, then a currency appreciation might be considered as a more appropriate policy measure to propel short-term growth. During a recession, for instance, if an economy is in a wage-led regime and the sensitivity of the growth of domestic expenditures to changes in the profit margins $|\xi_1|$ is sufficiently high, then devaluation may cause even more damage to the economic recovery, as it impairs household consumption and harms growth.

In a profit-led economy, on the other hand, we see in Figure 1.b that competitive devaluation invariably spurs short-term growth. Since the economy is in a profit-led growth regime, competitive devaluation increases the profit margin of domestic firms, which enables them to raise the level of investment, and propel growth (the AD schedule shifts upwards). Simultaneously, competitive devaluation will also spurs the country's net exports, thus increasing the country's gains from trade (the BP curve shifts downwards). In short, growth will be driven by an increase in exports and domestic expenditures. Algebraically, it can be seen from equation (16) that, given that $\xi_1 > 0$, the term V_{ADe} becomes positive. Hence, by equation (17), $J_{ADf}V_{BPe} - J_{BPf}V_{ADe}$ can only be strictly positive, which implies that the derivative given by dy/de must also be positive. Ergo, the impact of competitive devaluation on short-term growth in a profit-led economy is unambiguously positive ($y_0 < y_1 < y_2$). It is worth mentioning that the more responsive investment is to the mark-up growth, that is, the higher ξ_1, the larger will be the growth-enhancing effect of competitive devaluation.

Next, we analyse how competitive devaluation affects the dynamics of the financial inflows (or current account deficit as it is assumed that the home country does not accumulate foreign reserves). One should expect *a priori* that, once the Marshall-Lerner condition is satisfied, a devalued currency increases the net exports, thus reducing the growth of capital inflows and improving the external debt sustainability conditions of the economy over time. However, our model shows that this mechanism is not that straightforward and the impact of devaluation on the trade balance may be ambiguous.

Considering first a wage-led growth regime, it can be seen in Figure 1.a that competitive devaluation unequivocally reduces the growth of financial inflows f, thereby improving the sustainability conditions of the deficit on the balance of trade. It is known that competitive devaluation boosts the home country net exports (a downward shift in the BP curve). Furthermore, in a wage-led economy, competitive devaluation raises the mark-up of domestic firms, and hence brings down domestic expenditures (the decrease in household consumption outweighs the increase in investments caused by such competitive devaluation) and the country's imports (a downward shift in AD curve). These two effects combined (both the BP and AD schedules shift down) lower the deficit of the current account, and reduce the financial inflows. Given that $\xi_1 < 0$ (wage-led regime), $J_{ADy} > 0$, $V_{BPe} > 0$, $J_{BPy} > 0$ and $V_{ADe} < 0$, it can be seen from (18) that $df/de = -J_{ADy}V_{BPe} + J_{BPy}V_{ADe} < 0$. It can be said that, in a wage-led economy, the larger the parameter $|\xi_1|$ in absolute value, the more effectively competitive devaluation will reduce the country's current account deficit. Meanwhile, the more responsive the consumption is to changes in the mark-up growth, the more significant is the decrease in consumption and imports following competitive devaluation.

Conversely, as shown in Figure 1.b, in a profit-led economic system, the effect of competitive devaluation on the financial inflows f is very mixed. Looking at the $BP' - AD'$ solution in Figure 1.b, it can be seen that the gains from trade generated by competitive devaluation outweigh the rise in domestic expenditures driven by an increase in the investment (the downward shift in the BP overcompensates the upward shift in the AD). That is to say that, since the growth of imports is directly related to the growth of domestic expenditures, we can argue that the positive effects of a devaluation on the exports price competitiveness outweighs the negative effects of an increase in imports caused by a raise in the level of investment, thereby reducing the growth of the deficit on current account from f_0 to f_1. Nonetheless, it is worth noting that if the domestic expenditures respond more strongly than exports to competitive devaluation (the upward shift in AD schedule overcompensates the BP shift in the opposite direction), then we obtain the $BP' - AD''$ setup in Figure 1.b. In this scenario, competitive devaluation affects unfavourably the deficit of the balance of trade, which leads to an increase in the growth of financial inflows from f_0 to f_2. According to equation (18), given that $\xi_1 > 0$ and consequently $V_{ADe} > 0$, the condition under which devaluation expands the deficit of the current account in a profit-led scenario is given by $-J_{ADy}V_{BPe} + J_{BPy}V_{ADe} > 0$. Therefore, the larger the impact of increased mark-up growth on the growth of investment, that is, the larger ξ_1 in absolute value, the more likely that currency devaluation will raise the growth of investments above sustainable levels and hence worsens the deficit on the current account. Conversely, if we assume that, in a profit-led economy, ξ_1 is relatively small, then competitive devaluation improves the sustainability condition of the balance of trade, given that $df/de < 0$. When ξ_1 is sufficiently large so that $df/de > 0$, investment responds strongly to increased mark-up growth rates, and thus competitive depreciation raises the growth of investment beyond the limits set by the external constraints in the long run, resulting in increased growth rates of current account deficits. In this case, a country could improve the sustainability conditions of its external debt by undertaking currency appreciation.

Figure 1 shows that only the solution (y_2, f_2) in Figure 1.a following devaluation is in line with the new structuralist arguments advanced by Krugman and Taylor (1978) and Bruno (1979) amongst other, in which currency devaluation reduces growth and improves the trade balance. Solutions (y_1, f_1) in Figure 1.a and (y_1, f_1) in Figure 1.b illustrate the orthodox view in which devaluation stimulates growth and reduces trade balance deficits. Solution (y_2, f_2) in Figure 1.b, which is specific to our model, reveals a novel scenario wherein the growth of output and trade balance deficit will rise after currency devaluation. Note that solutions (y_1, f_1) in Figure 1.a and (y_1, f_1) and (y_2, f_2) in Figure 1.b stand in stark contrast to Krugman and Taylor's (1978) model by demonstrating that devaluation boosts growth even if trade is initially deficitary ($f_0 > 0$).

The case where currency devaluation worsens price competitiveness

This subsection, alternatively, assumes that the increased price of imported intermediate inputs used by domestic firms due to a currency devaluation erodes any possible gains from trade that domestic goods might obtain in foreign markets. Uncompetitive devaluation (or non-competitive devaluation) denotes the case where devaluation worsens the price competitiveness of internally produced goods. That said, we analyse the impact of uncompetitive devaluation on the growth rate and the current account in the wage-led and profit-led growth regimes.

Formally, this scenario is captured by the strictly negative value of $V_{BPe} < 0$ in equation (15), as discussed above.

Since the slopes of the BP and AD schedules from the equations (15) and (16) do not change, we plot both curves once again in Figure 2 below.

[FIGURE 2 ABOUT HERE]

Now we have $V_{BPe} < 0$ which means that non-competitive devaluation unequivocally shifts the BP curve upwards. The intercept of the BP curve, by equation (15), is determined by the differential given by $df/de|_{dy=0} = V_{BPe}/J_{BPf} > 0$. Thus, given $dy = 0$, uncompetitive devaluation increases the rate of change of capital inflows, thereby shifting the BP curve up. The same shift mechanism applies to the AD schedule. The intercept of the equation (16), given $dy = 0$, is $df/de|_{dy=0} = V_{ADe}/J_{ADf} \gtreqless 0$. In a wage-led growth regime we have $\xi_1 < 0$ (and consequently $V_{ADe} > 0$) and hence the AD curve shifts to the right; in a profit-led regime, on the other hand, the AD curve shifts to the left, as $\xi_1 > 0$ which implies that $df/de|_{dy=0} < 0$. Thus, Figure 2.a illustrates the BP-AD setup in a wage-led economy, whereas Figure 2.b shows the same system of equations in a profit-led growth regime. Uncompetitive devaluation deteriorates the price competitiveness of domestically produced goods by exceedingly raising the prime costs of domestic firms, thus increasing the external debt for any given value of y (an upward shift in the BP curve). Such an inflationary effect on imported intermediate inputs due to non-competitive devaluation harms gains from trade thus forcing domestic firms to reduce their profit margins in order to stay competitive in foreign markets. In a wage-led economy, by lowering the mark-up of domestic firms, uncompetitive devaluation transfers income from capitalists to workers, thereby increasing the wage share, boosting consumption and ultimately raising the current account deficit for any given level of the actual growth rate y (an upward shift in the AD curve). In a profit-led regime, on the other hand, a decreased mark-up reduces the profit share, which brings investment down and improves the current account condition for any given level of y (a downward shift in the AD curve).

Next, we consider the impact of non-competitive devaluation on growth in a wage-led regime as shown in Figure 2.a. In this case, the effect of uncompetitive devaluation on the growth rate y in a wage-led regime is also ambiguous. The $BP' - AD'$ solution in Figure 2.a illustrates a scenario wherein the worsened price competitiveness of domestic goods (an upward shift in the BP curve) is not compensated by the increased consumption (an upward shift in the

AD curve) due to a raising wage share as a consequence of reduced profit margins. In this case, a real devaluation leads to a decrease in the growth rate from y_0 to y_1, thus implying that the country would be better off by appreciating its currency instead. In terms of the formal model, by equation (17), given that $\xi_1 < 0$ (wage-led regime), $J_{ADf} > 0$, $V_{BPe} < 0$, $J_{BPf} < 0$ and $V_{ADe} > 0$, the derivative $dy/de = J_{ADf}V_{BPe} - J_{BPf}V_{ADe}$ is ambiguously signed. If in the $BP' - AD'$ setup non-competitive devaluation impairs growth, then we necessarily have $-J_{BPf}V_{ADe} < J_{ADf}V_{BPe}$, so that $dy/de < 0$. Alternatively, in the $BP' - AD''$ solution, we observe that the increased consumption due to the reduced mark-up (the AD schedule shifts to the right) outweighs the erosion of the price competitiveness caused by uncompetitive devaluation (the BP curve shifts up) and so currency devaluation spurs growth from y_0 to y_2. This case shows that even non-competitive devaluation can be effective if the monetary authority is trying to stimulate growth in a wage-led economy. By equation (17), now we have $-J_{BPf}V_{ADe} > J_{ADf}V_{BPe}$, which means that $dy/de > 0$. There is a marked difference between this case and the analogous case shown in the previous subsection. Unlike the case illustrated in Figure 1.a where a sufficiently high responsiveness of the growth of consumption and investment to the mark-up growth in absolute value $|\xi_1|$ implies that competitive devaluation may harm growth $dy/de < 0$, in the scenario portrayed in Figure 2.a a higher value of $|\xi_1|$ leads to a stronger increase in consumption due to a reduction in the mark-up and hence non-competitive devaluation boosts growth, given that $dy/de > 0$. In short, in a wage-led economic system the impact of uncompetitive devaluation on short-run growth is ambiguous. If $|\xi_1|$ is sufficiently high so that the inequality $-J_{BPf}V_{ADe} > J_{ADf}V_{BPe}$ is satisfied, then non-competitive devaluation boosts growth $dy/de > 0$. However, if this inequality does not hold, then a currency appreciation seems to be more appropriate if the monetary authority is targeting a higher growth rate.

In a profit-led economy, on the other hand, it is shown in Figure 2.b that uncompetitive devaluation unequivocally reduces the growth rate. Since the economy is in a profit-led growth regime, uncompetitive devaluation reduces the profit margins, which in turn causes a decrease in the level of investments and curtails growth (the AD schedule shifts to the left). At the same time, non-competitive devaluation will also harm the price competitiveness of domestic goods, thus reducing the country's gains from trade (an upward shift in BP schedule). In short, growth will be hampered by a decrease in net exports and domestic expenditures. Algebraically, it can be seen from equation (16) that, given that $\xi_1 > 0$, the term V_{ADe} becomes negative. Hence $J_{ADf}V_{BPe} - J_{BPf}V_{ADe}$ in (18) can only be strictly negative, which leads to a negative effect of a currency devaluation on growth, given that $dy/de < 0$. Therefore, the impact of uncompetitive devaluation on short-term growth in a profit-led economy is unambiguously negative ($y_0 > y_1 > y_2$). Unlike the case illustrated in Figure 1.b where the more responsive investment is to the mark-up growth, that is, the higher ξ_1, the larger will be the impact of competitive devaluation on growth, in Figure 2.b the higher ξ_1, the worst the effect of non-competitive devaluation on investment and growth.

Now we discuss the impact of uncompetitive devaluation on the growth of financial inflows (or current account deficit as the home country does not accumulate foreign reserves). Considering first a wage-led growth regime, it can be seen in Figure 2.a that non-competitive devaluation unambiguously increases the growth of financial inflows f, which reflects a raising deficit on the balance of trade. Uncompetitive devaluation hampers the home country net exports (an upward shift in the BP schedule). Moreover, non-competitive devaluation in a wage-led economy lowers the mark-up of domestic firms, and hence curtails domestic expenditures by reducing proportionally more household consumption than increasing investment which leads to a decrease in the country's imports (an upward shift in the AD curve). These two effects combined (both the BP and AD schedules shift upwards) raise financial inflows f by expanding the deficit of the current account. Given that $\xi_1 < 0$ (wage-led regime), $J_{ADy} > 0$, $V_{BPe} < 0$, $J_{BPy} > 0$ and $V_{ADe} > 0$, it can be observed from (18) that $df/de = -J_{ADy}V_{BPe} + J_{BPy}V_{ADe} > 0$. Thus, in a wage-led economy the larger the parameter $|\xi_1|$ in absolute value, the more non-competitive devaluation will increase the country's current account deficit. The more strongly consumption responds to a decrease in mark-up growth due to non-competitive devaluation, the faster imports will grow and the higher f will be. This case stands in clear contrast to the analogous scenario portrayed in Figure 1.a where competitive devaluation in a wage-led economy unambiguously reduces the current account deficit.

Conversely, Figure 2.b shows that in a profit-led economic system the effect of competitive devaluation on the financial inflows f, and consequently on the current account, is ambiguous. Looking at the $BP' - AD'$ setup in Figure 2.b, we see that even though imports are reduced due to the decrease in the growth of investment caused by non-competitive devaluation that reduces the mark-up, such a drop in imports is not enough to compensate the decrease in the gains from trade caused by uncompetitive devaluation which reduces net exports and ultimately expands the current account deficit (the upward shift in the BP schedule overcompensates the downward shift in AD schedule). In the $BP' - AD'$ solution in Figure 2.b we see that non-competitive devaluation raises the current account deficit from f_0 to f_1. However, if the negative impact of uncompetitive devaluation on domestic expenditures outweighs the negative effect caused by such a devaluation on net exports (the downward shift in the AD schedule overcompensates the upward shift in the BP schedule), then we obtain the $BP' - AD''$ setup in Figure 2.b. In this scenario, non-competitive devaluation improves the condition of the balance of trade, which reduces the growth of financial inflows from f_0 to f_2. According to equation (18), given that $\xi_1 > 0$ and consequently $V_{ADe} < 0$, the condition under which uncompetitive devaluation expands the current account deficit in a profit-led scenario is $-J_{ADy}V_{BPe} + J_{BPy}V_{ADe} > 0$. Therefore, the larger the impact of an increased mark-up growth on the proportionate rate of change of investment, that is, the larger ξ_1, the more likely it is that non-competitive devaluation will curtail the growth of investment, thus causing a reduction on the current account deficit. On the other hand, if we assume that in a profit-led economy ξ_1 is relatively small, non-competitive devaluation worsens the sustainability condition of the current account, as it follows that $df/de > 0$ due to an erosion of the price competitiveness in foreign trade. In this case, a country could improve the sustainability conditions of its external debt by appreciating its currency. Alternatively, when ξ_1 is sufficiently large so that $df/de < 0$, investment responds strongly to reduced mark-up growth rates and, despite the impairment in terms of price competitiveness in foreign trade, a decrease in investment of such a magnitude improves the current account condition by strongly reducing imports.

In Figure 2 no solution illustrates the orthodox case of increased growth and improved trade balance condition following devaluation. The case pointed out by the new structuralist approach of a decrease in the growth rate and favourable response of the current account to devaluation is shown only by the solution (y_2, f_2) in Figure 2.b. The original arguments advanced by our model are represented in solutions (y_1, f_1) and (y_2, f_2) in Figure 2.a in which devaluation reduces the net exports regardless of the trajectory of the output growth, and in the solutions (y_1, f_1) in Figure 2.b which is the worst scenario that consists of reduced growth and increased trade deficit.

Summary

This paper contributes to the literature by developing a Keynesian-Kaleckian macromodel in open economies to account for the effects of currency devaluation, not only on the short-run output fluctuation, but also on changes in the current account balance. This is achieved by analysing simultaneously differences in the impact of relative price variations on the growth rate compatible with the balance-of-payments equilibrium and the actual growth rate. The model contributes to the literature by demonstrating that the sensitivity of the price competitiveness of internally produced goods to changes in relative prices as well as the responsiveness of consumption and investment to variations in the profit margins of domestic firms determine the effectiveness of either appreciation or depreciation of the exchange rate for propelling output growth and improving the current account condition in the short run.

The multiplicity of results obtained from the theoretical framework set forth in this paper contribute to the literature by demonstrating that the scenarios in which a currency devaluation simultaneously increases growth and improves the conditions of the trade balance, as predicted by the orthodox literature, are in fact scant. This paper sets the conditions under which currency devaluation becomes either competitive or uncompetitive. This distinction between competitive and uncompetitive devaluation, associated with different aggregate demand growth regimes (viz. wage-led and profit led), allows us to lay out a number of possible scenarios describing unpleasant currency devaluation effects on growth and current account still left unattended by the economic literature. It is noteworthy that the model also opens a theoretical possibility that even competitive/uncompetitive devaluation might cause negative/positive effects on the growth rate and the current account balance.

In terms of policy making, this model shows that the task of promoting short-run waves of growth and improving the sustainability conditions of the current account deficit only by depreciating the currency is full of nuances and may provide unwanted, or dissatisfactory results at best, if policymakers overlook relevant aspects constituting the economic setup they are faced with.

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Appendix

A.1 The growth rate of the mark-up factor

The real exchange rate can be rewritten as $EP_f/P_d = EP_f/T\left[(W/a) + P_f E\mu\right] = (1-\varphi)/\mu$, where $\mu = M^i/Y$. If we assume that $T = \delta\left(EP_f/P_d\right)$, where $\delta > 0$, then, after rearranging the terms we have

$$T = [(\delta/\mu)(1-\varphi)]^{1/2} \qquad (i)$$

In rates of change

$$\tau = -\frac{\varphi}{2(1-\varphi)}\frac{d\varphi}{\varphi} \qquad (ii)$$

Now we must find $d\varphi/\varphi$. By definition, we have

$$\varphi = \frac{T(W/a)}{T\left(\frac{W}{a} + P_f E\mu\right)}$$

In rates of change

$$\frac{d\varphi}{\varphi} = \frac{dln}{dt}\left[\frac{T(W/a)}{T\left(\frac{W}{a} + P_f E\mu\right)}\right] = \frac{d}{dt}\left[\ln(W) - \ln(a) - \ln\left(\frac{W}{a} + P_f E\mu\right)\right]$$

$$\frac{d\varphi}{dt} = \varphi(1-\varphi)\left(w - \hat{a} - p_f + e\right) \qquad (iii)$$

Substitution of (*iii*) into (*ii*) gives equation (8)

A.2 Domestic expenditure and the mark-up growth

We need to define some functions for the components of domestic expenditure, namely consumption and investment.

$$q = \beta_C \hat{C} + \beta_I \hat{I} \qquad (iv)$$

where q is the growth of domestic expenditures, $\hat{C}$ is the growth of consumption, $\hat{I}$ is the growth of investment, and β_C and β_I are the share of consumption and investment in domestic expenditures, respectively.

Consumption C is the sum of consumption of workers and capitalists. Following Razmi (2013) and using the extended markup pricing equation (6), we have

$$C = \frac{WL}{P_d} + (1-s)\frac{R}{P_d} = \left[\frac{T - s(T-1)}{T}\right]Y \qquad (v)$$

where L is the amount of employed workers, s is the saving rate and R is the total profit. In growth rate we have

$$\hat{C} = y - \left[\frac{s}{T - s(T-1)}\right][\tau - \hat{s}(T-1)] \qquad (vi)$$

where $\hat{s}$ is the growth of the saving rate and $0 < s/T - s(T-1) < 1$. Equation (vi) shows that the growth of consumption $\hat{C}$ is inversely related to the mark-up factor growth τ.

Following Bhaduri and Marglin (1990), we assume that investment decisions depend on the profit share

$$I = I(\sigma_K) \qquad (vii)$$

where I is investment, σ_K is the profit share of income and $I_{\sigma_K} > 0$. Since the home country imports intermediate inputs, the profit share can be define as follows

$$\sigma_K = 1 - \frac{W}{P_d a} - \frac{EP_f}{P_d}\frac{M^i}{Y} \qquad (viii)$$

Rearranging the extended markup price equation (6) gives

$$P_d = T\left(\frac{W}{a} + \frac{P_f E M^i}{Y}\right) \quad \Rightarrow \quad \frac{1}{T} = \frac{W}{P_d a} - \frac{EP_f}{P_d}\frac{M^i}{Y} \qquad (ix)$$

Substitution of (ix) into (viii) yields

$$\sigma_K = 1 - \frac{1}{T} \qquad (x)$$

Substitution of (x) into (vii) gives

$$I = I^*(T) \qquad (xi)$$

where $I_T > T$. Or, in growth rate

$$\hat{I} = \hat{I}(\tau) \qquad (xii)$$

where $\hat{I}_\tau > 0$. In other words, the growth of investment $\hat{I}$ is directly related to the growth of the mark-up factor τ.

Therefore, by equation (iv), we have that the impact of an increase in τ on q is ambiguous

$$q = q(\tau) \qquad (xiii)$$

where $q_\tau \gtreqless 0$.

That is, when the response of investment growth $\hat{I}$ to a changes in the mark-up factor growth τ is relatively weak, the decrease in consumption growth $\hat{C}$ is not entirely mitigated by the increased investment growth, thus implying a reduction in the growth of domestic expenditures q. The opposite happens if the investment growth rate responds relatively strongly to a positive variation in τ.

A.3 The balance-of-payments and the aggregate demand curves

Rearranging equation (9) and (14) and then taking the total differential of the variables y, f and e with respect to time and assuming, for simplicity, that $z, w, \hat{a}, p_f, \beta_m$ and θ are held constant gives

$$BP| \; \pi dy - \left[h\gamma_f + (1-\gamma)\right]df = \left\{h\gamma_e + (1/2)(1+\eta+\theta\psi)\left[\left(w - \hat{a} - p_f - e\right)\varphi_e - \varphi\right]\right\}de \qquad (xiv)$$

$$AD| \; dy + \left[k\gamma_f + \beta_m(1-\gamma)\right]df = \left\{k\gamma_e - (1/2)\xi_1[1+(1-\gamma)\beta_m]\left[\left(w - \hat{a} - p_f - e\right)\varphi_e - \varphi\right]\right\}de \qquad (xv)$$

where $h = \varepsilon z - f + (\varphi/2)\left(w - \hat{a} - p_f - e\right)$; $k = \beta_m\left[\xi_0 - \xi_1(\varphi/2)\left(w - \hat{a} - p_f - e\right) - f\right] = \beta_m(q - f)$; $\gamma_f = \partial\gamma/\partial f$ and $\gamma_e = \partial\gamma/\partial e$.

Note that the terms h and k are ambiguously signed. In order to keep the model tractable and highlight the links between competitive currency, gains from trade and the dynamics of domestic expenditures, we adopt the simplifying assumption that the components of h and k cancel each other out, which yields negligible values of h and k. Equations (xiv) and (xv), then, become (15) and (16).

A.4 The joint effect of a currency devaluation on growth and the current account

Let **A** be a 2x2 matrix and **x** and **b** be 2x1 matrices. Therefore, the non-trivial solution of the linear system **Ax**=**b** is given by **x**=**A**$^{-1}$**b**, where **A**$^{-1}$ $= (1/D(\mathbf{A}))adj\mathbf{A}$.

In terms of the model set forth in this paper, if we rearrange equations (15) and (16) in matrix notation and invert the system, we obtain

$$\begin{bmatrix} dy \\ df \end{bmatrix} = \frac{1}{2D} \begin{bmatrix} J_{ADf} & -J_{BPf} \\ -J_{ADy} & J_{BPy} \end{bmatrix} \begin{bmatrix} V_{BPe} \\ V_{ADe} \end{bmatrix} de \qquad (xvi)$$

Therefore, the determinant of the coefficient matrix is positive, that is, $D = J_{BPy}J_{ADf} - J_{ADy}J_{BPf} > 0$.