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Currency Devaluations, Aggregate Demand, and Debt Dynamics in Economies with Foreign Currency Liabilities

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Abstract
The paper employs a post-Kaleckian model to analyse how currency devaluations affect aggregate demand and capital accumulation in an economy with foreign currency liabilities in the short-run. In benchmark post-Kaleckian open economy models currency devaluations have two effects. First, they change international price competitiveness and thus affect net exports. Second, devaluations change income distribution and thereby affect consumption and investment demand. The overall effect on aggregate demand and investment is ambiguous and depends on parameter values. Existing models, however, disregard balance sheet effects that arise from foreign currency-denominated external debt. The paper develops a novel post-Kaleckian open economy model that introduces foreign currency-denominated external debt and balance sheet effects to examine the demand-effects of devaluations. Furthermore, the paper models the dynamics of external and domestic corporate debt. It discusses how an economy may end up in a vicious cycle of foreign-currency indebtedness, and derives the conditions under which indebtedness becomes stable or unstable. It shows that the existence of foreign currency-denominated debt means that contractionary devaluations are more likely, and that foreign interest rate hikes, and high illiquidity and risk premia compromise debt sustainability. Devaluations only stabilise debt ratios if they succeed in boosting domestic capital accumulation.

Keywords: currency devaluation, balance sheet effects, external debt, debt dynamics, currency mismatch, Kaleckian model

JEL classifications: E11, E12, F36, F41

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1 Introduction

Strong liquidity in the global financial centres in the post-crisis period has made it easier for firms of middle-income countries to borrow abroad. As a result, the share of foreign-currency denominated liabilities on the balance sheets of corporations in many middle-income countries has increased sharply since 2010 (IMF, 2015, chap. 3; Chui et al., 2016). The resulting currency mismatch, however, exposes corporations to greater risks of currency, interest rate, and liquidity shocks.[1] In economies with strongly managed exchange rates, this situation raises the question of the effectiveness of currency devaluations as a macroeconomic adjustment tool. While currency devaluations may – after some time – succeed in improving the trade balance, it is less clear whether they also boost aggregate demand and growth. Indeed, the belief that devaluation is an effective tool for raising aggregate demand is wide-spread. The theoretical argument behind this view stems from the classic Mundell-Fleming model. In this framework, the real exchange rate has a positive effect on net exports, while domestic absorption is exchange rate inelastic. A real depreciation then boosts aggregate demand. This mechanism is sometimes also invoked by post-Keynesian economists (e.g. Bougrine and Seccareccia, 2004).

This view has been challenged, however, by various authors. Alexander (1952), Diaz-Alejandro (1963), and Krugman and Taylor (1978) pointed out that devaluations can be contractionary for several reasons. Most importantly, it was argued that

a) real devaluations may fail to increase net exports if the Marshall-Lerner condition (MLC) is not satisfied;[2] and

b) real devaluations are likely to redistribute income from workers to profit earners, who normally have a lower propensity to consume, and thereby depress consumption demand.

After the Asian financial crisis in 1997-98, adverse balance sheet effects from foreign-currency denominated private debt have been added to the list of contractionary channels (e.g. Krugman, 1999). [3] Moreover, besides their short-run effects on output and growth, devaluations are likely to have an impact on external and domestic debt sustainability. The recent surge in foreign currency corporate debt in middle-income countries demands a stronger theoretical engagement with the driving forces of foreign-denominated external indebtedness, vulnerabilities to external shocks, and how currency devaluations affect debt sustainability.

This paper employs a post-Kaleckian open economy model, firstly, to analyse how currency devaluations affect aggregate demand and capital accumulation in externally indebted economies in the short-run. Secondly, it models the driving forces of corporate foreign-currency debt in the medium-run, and identifies stabilising and destabilising factors. The focus is on small open economies with a fixed exchange rate.[4] The post-Kaleckian framework captures several channels of currency devaluations that have been mentioned in the debate on (contractionary) devaluations, and thereby allows for a joint assessment of the relevant mechanisms. However, so far it has not accounted for issues of external indebtedness. The paper contributes to the existing literature by developing an extension of the post-Kaleckian open economy model that allows for an analysis of currency devaluations in economies with externally indebted private sectors. Firstly, the model captures balance sheet effects that arise from changes in the nominal

value of foreign currency-denominated debt due to devaluation. Secondly, the paper analyses the dynamics of external and domestic corporate debt. It discusses how an economy may end up in a vicious cycle of foreign-currency indebtedness, and derives the conditions under which indebtedness becomes stable or unstable. Moreover, it shows how devaluations and external shocks affect the stability of debt in the medium-run. Thereby, the model brings several strands of the heterodox literature together: post-Kaleckian models of distribution and growth, Minskyan approaches to financial instability, and mainstream and post-Keynesian analyses of international finance. The main findings are that the existence of foreign currency-denominated debt means that devaluations are more likely to take a contractionary form, and that foreign interest rate hikes, and high illiquidity and risk premia compromise debt sustainability. Devaluations only stabilise debt ratios if they succeed in boosting domestic capital accumulation.

The paper is structured as follows: The second part provides a brief review of the existing post-Kaleckian literature on currency devaluations and external debt dynamics. The third part presents a short-run post-Kaleckian model with balance sheet effects and analyses the effect of devaluations on aggregate demand and growth. The fourth section discusses the medium- run dynamics and stability of domestic and external debt. The last section concludes.

2 Currency devaluations and external debt dynamics in post-Kaleckian open economy models

Open economy versions of the post-Kaleckian model typically focus on the relation between currency devaluations and functional income distribution, and their subsequent effects on aggregate demand and growth. While the profit share is fully exogenous in benchmark closed economy versions of the model, this assumption is relaxed in its open economy extensions. Blecker (1989) and Hein and Vogel (2008) point out that in an open economy the causes of a change in distribution, e.g. nominal appreciations/depreciations, changes in nominal wages or changes in the pricing mark-up, matter for the relationship between distribution and aggregate demand, due to different consequences for international competitiveness.

Blecker (1989) argues that the pricing mark-up may be flexible in an open economy in which firms are subject to international competition. A reduction in international competitiveness, e.g. due to an increase in nominal wages, might force firms to reduce the mark-up in order to maintain their shares in international markets. By the same token, a real depreciation would ameliorate competitive pressures as it improves international price competitiveness, and thus allows for higher mark-ups. A real depreciation thus raises the profit share.

Other authors (Bhaduri and Marglin, 1990; Taylor; 2004, chap. 7; Lopez and Perrotini, 2006; Hein and Vogel, 2008) argue that real depreciations affect functional income distribution through imported raw materials. Bhaduri and Marglin (1990) and Blecker (1999; 2011) leave the overall effect of a depreciation-induced increase in the cost of imported inputs on the profit share open and argue that it depends on the relative ability of firms and workers to roll over the cost increase on prices and nominal wages, respectively. Taylor (2004, chap. 7), Lopez and Perrotini (2006), and Hein and Vogel (2008), in contrast, assume that nominal wages are inelastic with respect to the exchange rate so that a real depreciation always raises the profit share.

Blecker (1999; 2011) and Taylor (2004, chap. 7) show that if the real devaluation raises the profit share, this in turn increases or decreases domestic demand depending on whether the expansionary effect on investment outweighs the contractionary effect on consumption. Second,

the effect on the trade balance is positive, provided that the MLC holds. The overall effect on aggregate demand is thus ambiguous and depends on the relative size of the effects on consumption, investment, and net exports.

Sasaki et al. (2013) and Rezai (2015) develop these models further. Sasaki et al. (2013) draw on Blecker (2011), but add feedback effects from the goods market to the labour market fuelling conflict inflation and inducing Kaldor-Verdoorn-type technical progress. However, in the steady state, the effect of a depreciation on the rate of capacity utilisation depends on the same mechanisms as in Blecker (2011) (Sasaki et al., 2013, pp. 701-702). Rezai (2015) analyses the effects of a devaluation in a two-country framework. In his model, a devaluation redistributes income from domestic to foreign workers due to higher import prices, since mark-ups are fixed and there is no conflict inflation. In such a set-up, devaluations can only be expansionary for the domestic economy if foreign workers have a significantly lower propensity to save than domestic workers and thereby compensate for the decline in domestic consumption demand.

Despite these rich extensions of the post-Kaleckian open economy model, monetary aspects, especially those arising from external indebtedness, have been neglected. This omission is unsatisfactory given the recent surge in foreign currency corporate debt in middle-income countries (IMF, 2015, chap. 3; Chui et al., 2016). Foley's (2003) Minskyan open economy model is an exception; however, he focuses on interest rate and growth dynamics instead of balance sheet effects. Porcile et al. (2011) analyse the effects of different monetary policy rules on external debt sustainability in a post-Keynesian model. However, they do not take income distribution into account, and balance sheet effects are absent. Cline and Vernengo (2015) analyse external debt dynamics in semi-fixed exchange rate regimes but neither do they provide an analysis of the goods market nor propose a behavioural function for the change in external debt.

3 The short-run model: Currency devaluations, aggregate demand, and growth

Balance sheet effects

The importance of balance sheet effects was fiercely brought to attention after the South East Asian crash in the late 1990s, during which the affected countries experienced severe drops in output after their currencies depreciated. These contractionary effects arose from large degrees of currency mismatch in the financial and business sector (Allen et al., 2002). The depreciation led to a nominal jump in foreign currency-denominated debt, which pushed many banks and firms into bankruptcy and caused a decline in capital formation. Econometric studies confirm that devaluations are more likely to have a negative effect on output and growth in countries with high external debt burdens (Galindo et al., 2003; Bebczuk et al., 2007; Blecker and Razmi, 2007; Janot et al., 2008).

Theoretically, balance sheet effects have mostly been analysed within New Keynesian frameworks (Krugman, 1999; Aghion et al., 2000; Céspedes et al., 2004; Cook, 2004; Gertler et al., 2007; Delli Gatti et al., 2007). Most of these models employ some version of Bernanke et al.'s (1999) financial accelerator model, in which the costs of external finance depend inversely on firms' net worth because of asymmetric information between borrowers and lenders. Due to incomplete information about the future profitability of investment projects, lenders incur agency costs which are increasing in the leverage ratio of the firm. This information problem translates into higher costs of capital for the borrowing firm. In the case of a foreign currency-indebted

firm, a devaluation of the currency reduces its net worth, thereby increasing its costs of capital, which in turn depresses investment. This mechanism resembles Kalecki's (1937) 'principle of increasing risk' and Keynes' (2013[1936], pp. 144–145) 'borrowers' and lenders' risk'. However, the supply-side focus of New Keynesian models makes them rather unsuited for an analysis of devaluations as a short-run policy measure in demand-constrained recessionary economies. Moreover, distributional aspects and issues of external debt dynamics and sustainability are ignored in these approaches.

The goods market

The model put forth in this paper draws on existing post-Kaleckian open economy models[5] but introduces foreign-currency denominated private debt and balance sheet effects. The model describes a small open economy that keeps its exchange rate fixed over the medium-run and is integrated into international financial markets through an open financial account.[6] It is an economy whose currency does not function as an international reserve and is of lower quality. As a consequence, foreign debt can only be obtained in foreign currency – a phenomenon which is often called 'original sin' (Eichengreen et al., 2007).[7]

The model economy consists of one sector that produces a homogenous good (Y) using capital (K) and labour, which can be used for consumption and investment. For simplicity, there is no depreciation of the capital stock and no overhead labour. The technical coefficients of labour (a) and capital (v) are assumed to be constant in the short-run, so there is no substitution between capital and labour and no technical progress. There are unutilised capacities and unemployment (or an elastic labour supply). The focus of the model is on the short-run, so that the rate of capacity utilisation (u) functions as an endogenous adjustment variable, implying that there is quantity adjustment if demand changes. For the sake of simplicity, there is no government sector, no inflation, and the open economy is small, so that all foreign variables are exogenously given. There is no substitution between the imported good and the domestic good.

Pricing, the real exchange rate, the mark-up, the wage and profit share are given by equations (1)-(5):

(1) $p = (1 + m)wa; \qquad m > 0$

(2) $e_r \equiv \frac{e}{p}$

(3) $m = m(e_r, \delta, \eta); \qquad \frac{\partial m}{\partial e_r} \lessgtr 0; \frac{\partial m}{\partial \delta} > 0; \frac{\partial m}{\partial \eta} < 0$

(4) $(1 - \pi) \equiv \frac{wa}{p} = \frac{1}{1+m(e_r,\eta,\delta)}$

(5) $\pi \equiv \frac{R}{pY} = \frac{m(e_r,\eta,\delta)}{1+m(e_r,\eta,\delta)}$

In incompletely competitive markets, prices (p) are set by firms who charge a mark-up (m) on nominal unit labour costs (wa) which are constant up to full capacity utilisation. I abstract from raw material inputs for simplicity. The real exchange rate (e_r) is defined in equation (2), setting the foreign price level to unity. Note that the nominal exchange rate (e) is defined as the domestic price of foreign currency, so that a depreciation implies an increase in the exchange rate. Following Blecker (1989), the real exchange rate affects the mark-up through its effect on international competitiveness. However, capturing another idea from Blecker (2011), the

distributional effect of a real depreciation is unclear a priori and depends on the relative bargaining power of firms (δ) and workers (η). If the bargaining power of firms is larger ($\delta > \eta$), a depreciation raises the mark-up $\left(\frac{\partial m}{\partial e_r} > 0\right)$ as firms are successful in using the leeway that has been created by the improvement in their international competitiveness for raising the mark-up. If, however, trade unions are very strong and/or nominal wages are indexed to the exchange rate ($\delta < \eta$), a real depreciation might lead to aggressive nominal wage increases, which compromise firms' international competitiveness and force them to reduce the mark-up. In this case, a real devaluation reduces the mark-up $\left(\frac{\partial m}{\partial e_r} < 0\right)$. According to Blecker (2011), the case of a positive relation between the real exchange rate and the mark-up appears to be empirically more likely.[8] The mark-up fully determines the profit share (π) and the wage share ($1 - \pi$), where R denotes total profits.

Table 1 presents the balance sheet matrix of the model. There are four economic sectors: workers, firms, banks, and the external sector. Workers neither hold assets nor liabilities. Firms' liabilities consist of foreign credit denominated in foreign currency (eB^f) and loans denominated in domestic currency (B). For simplicity, there is no equity (the net worth of the firm sector, NW_F, is kept within the firm sector).

Table 1: Balance sheet matrix

	Workers	**Firms**	**Banks**	**External**	$\sum$
Fixed Capital		$+pK$		$+K^f$	$+pK + K^f$
Foreign currency-denominated foreign loans		$-eB^f$		$+eB^f$	0
Domestic currency-denominated loans		$-B$	$+B$		0
Domestic currency-denominated deposits of foreigners			$-D$	$+D$	0
$\sum$ **(Net worth)**	0	$+NW_F$	0	$+NW_{EXT}$	$pK + K^f = NW_F + NW_{EXT}$

Note: Plus signs denote assets, while minus signs indicate liabilities The superscript *f* denotes foreign variables. The subscripts *F* and *EXT* stand for firms and external, respectively. *p*: domestic price level; *e*: nominal exchange rate.

Banks are pure intermediaries which give loans in domestic currency to domestic firms (B) and take deposits only from abroad (D), since workers do not save and firms retain their net profits. The external sector holds the bonds that have been issued by domestic firms in foreign currency (eB^f), and holds deposits (D) at domestic banks in domestic currency. Subtracting liabilities from assets yields the net worth (NW) of the respective sectors. If $eB^f + B > pK$, the domestic firm sector faces balance-sheet insolvency. Note that a country can also be in a positive net foreign asset position if $eB^f + B < 0$. B and/or eB^f would then be liabilities of the external sector. I restrict the focus to the case where eB^f is positive, but B may become negative. In this

case, domestic banks would lend to foreigners, while domestic firms hold deposits at domestic banks.
Further we have:

(6) $\frac{eB^f}{pK} \equiv e_r\lambda$

(7) $\frac{B}{pK} \equiv \tau$

(8) $r \equiv \frac{R}{pK} \equiv \frac{\pi u}{v}$

(9) $s \equiv \frac{S}{pK} = r - i^f e_r\lambda - i\tau = \frac{\pi u}{v} - i^f e_r\lambda - i\tau$

(10) $NX \equiv pX - eM$

(11) $b \equiv \frac{NX}{pK} \equiv \frac{pX - eM}{pK} = b_0 u^f + b_1 e_r - b_2 u; \qquad b_0, b_2 > 0, b_1 \lessgtr 0$

The external debt in foreign currency to capital ratio ($e_r\lambda$), and the domestic debt in domestic currency to capital ratio (τ) are defined in equations (6) and (7), respectively. The profit rate (r) in equation (8) can be decomposed into the product of the profit share (π), the rate of capacity utilisation (u), and the inverse of capital productivity, the capital coefficient (v). Workers and banks do not save, whereas firms save all their net income, i.e. their profits after interest payments on domestic and foreign credit. It is assumed that lending rates are equal to deposit rates, so that banks do not make any profits. Given that deposits are only held by foreigners, all interest payments go abroad. Total domestic saving is then given by firms' saving (equation 9), where i^f represents the foreign and i the domestic interest rate.
Equation (10) defines net exports in domestic currency (NX). Equation (11) is a behavioural function that relates the net export ratio (b) to the foreign rate of capacity utilisation (u^f), the real exchange rate, and the domestic rate of capacity utilisation. The foreign rate of capacity utilisation is assumed to improve the trade balance as it translates into export demand for the home country, so the parameter b_0 is positive. The inclusion of the foreign rate of capacity utilisation, however, requires that the domestic and foreign capital stock grow at the same rate – an assumption that might not be satisfied over longer periods. Second, whether the effect of an increase in the real exchange rate on the trade balance is positive depends on whether the MLC holds, which is captured by parameter b_1.[9] The larger the price elasticities of import and export demand, the larger b_1. Third, the domestic rate of capacity utilisation has a negative effect on the trade balance, as an increase in domestic demand will increase import demand.
Equations (12), (13) and (14) specify the rate of investment, the goods market equilibrium condition, and the Keynesian stability condition.

(12) $g \equiv \frac{I}{K} = g_0 + g_1 u + g_2 \pi - g_3 e_r\lambda; \qquad g_1, g_2, g_3 > 0$

(13) $g + b = s + i^f e_r\lambda + i\tau = r$

(14) $\frac{\partial s}{\partial u} - \frac{\partial g}{\partial u} - \frac{\partial b}{\partial u} > 0 \Leftrightarrow \frac{\pi}{v} + b_2 > g_1$

The first three components of the investment function (12) are standard in the post-Kaleckian model. First, investment is affected by a shift parameter (g_0) which captures 'animal spirits', i.e.

the state of business confidence, changes in expectations, etc. Second, investment is assumed to be positively related to the rate of capacity utilisation. This is because the current rate of capacity utilisation functions as an indicator of aggregate demand. A high rate of capacity utilisation induces firms to expand their productive capacities in order to be able to meet demand in the future. Third, the profit share enters the investment function. It is assumed that the profit share has a positive effect on investment; first, because it functions as a proxy for expected profitability, and second because retained profits constitute internal finance. Internal finance is often a pre-condition for access to credit in financial markets with uncertainty and asymmetric information as discussed previously. Fourth, balance sheet effects enter the model through the investment function. Similar to Krugman (1999), investment expenditures are negatively affected by the external-debt-to-capital ratio. From a post-Keynesian perspective, this mechanism is due to 'borrower's risk', which is the subjective risk of illiquidity and bankruptcy of the entrepreneur due to the possibility of lower than expected cash flows despite fixed payment obligations (Kalecki, 1937; Keynes, 2013[1936], pp.144–145). Foreign-currency denominated debt especially raises borrower's risk because it implies a currency mismatch: firms' cash flows are denominated in domestic currency, while some of their liabilities are denominated in foreign currency. Firms thus bear severe exchange rate risk. A sudden devaluation not only decreases their net worth but also makes the foreign currency they need to repay their debt more expensive.[10]

The open economy goods market equilibrium condition is given by equation (13). It accounts for interest payments on external debt and deposits of foreigners, which count as leakages along with domestic saving. Lastly, it is assumed that the Keynesian stability condition (14) is satisfied, which requires that the marginal effect of an increase in the rate of capacity utilisation on the saving and net export rate is larger than the respective effect on the investment rate.[11]

The transaction flow matrix of the model is depicted in Table 2.

Table 2: Transaction flow matrix

	Workers	**Firms**		**Banks**		**External**	∑
		Current	***Capital***	***Current***	***Capital***		
Consumption	$-C$	$+C$					0
Investment		$+pI$	$-pI$				0
Wages	$+W$	$-W$					0
Net profits		$-R^{Net}$	$+R^{Net}$				0
Imports		$-eM$				$+eM$	0
Exports		$+pX$				$-pX$	0
Interest payments on foreign currency-denominated foreign loans		$-ei^fB^f$				$+ei^fB^f$	
Interest payments on domestic currency-denominated loans		$-iB$		$+iB$			0
Interest payments on domestic currency denominated loans of foreigners				$-iD$		$+iD$	0

Change in foreign currency-denominated foreign debt			$+e\dot{B}^f$			$-e\dot{B}^f$	0
Change in domestic currency-denominated loans			$+\dot{B}$		$-\dot{B}$		0
Change in domestic-currency denominated deposits of foreigners					$+\dot{D}$	$-\dot{D}$	0
$\sum$	0	0	0	0	0	0	0

Note: A plus sign indicates a source of funds, while a minus sign denotes a use of funds. The rows display where the different components of national income are earned and spent, and the columns constitute sectoral budget constraints. The superscript *f* denotes foreign variables. A dot over a variable represents its derivative with respect to time $\left(\dot{x} = \frac{dx}{dt}\right)$. *p*: domestic price level; *e*: nominal exchange rate; *i*: interest rate.

It is worthwhile taking a closer look at the budget constraint of the firm sector, which can be found in its capital account column:

$$pI \equiv R^{Net} + e\dot{B}^f + \dot{B} \equiv R - ei^f B^f - iB + e\dot{B}^f + \dot{B}$$

Firms can finance their investment expenditures either through net profits (R^{Net}), by taking out a loan in domestic currency ($\dot{B}$), or by issuing bonds denominated in foreign currency ($e\dot{B}^f$). Firms have a preference for foreign debt because the interest rate on external debt (i^f) is normally lower than the domestic rate (i) (see section 4). The higher domestic interest rate also motivates foreigners to hold domestic-currency denominated deposits at domestic banks. If firms choose the level of investment expenditures, their saving, and their issuance of foreign currency-denominated bonds independently, domestic lending ($\dot{B}$) has to accommodate. It absorbs the total expenditures of firms that exceed their retained profits, and that are not already financed through foreign currency-denominated debt. The dynamics of domestic currency-denominated debt are then given by:

$$\dot{B} \equiv pI - R + ei^f B^f + iB - e\dot{B}^f \equiv pI - R^{Net} - e\dot{B}^f$$

Note that the endogeneity of domestic lending does not imply that there are no credit supply constraints. Credit rationing may occur and is captured by a lower demand for credit for higher levels of external debt through the investment function (12). Moreover, higher stocks of external debt come with higher default risks, which translate into higher risk premia on interest rates (see below).

Exchange rate regime and interest rate determination

The central bank keeps the exchange rate fixed in the short- and medium-run, perhaps because it seeks to improve the trust in the currency or to reduce economic uncertainty. Occasional currency devaluations enacted by the central bank are a possibility agents are aware of, but they cannot anticipate them. Thus, agents do not hold concrete expectations about future changes in the exchange rate. Foreign and domestic assets are imperfect substitutes as the domestic currency is of lower quality. Moreover, agents may be worried about default and devaluation risks. The domestic interest rate, therefore, has to offer a monetary premium to incentivise foreigners to

hold deposits with domestic banks. Under these circumstances, the central bank cannot set the domestic interest rate below the level determined by international arbitrage conditions without inducing a capital flight that is unsustainable, given that foreign reserves are limited.[12] It is thus forced to set a domestic interest rate that is consistent with uncovered interest rate parity (UIP) plus a premium that reflects risks and the low quality of the currency:[13]

$$(15) \quad i = i_B^f + \rho; \qquad \rho > 0$$

where i is the domestic rate of interest, $i_B^f$is the exogenous foreign base rate, and ρ the premium domestic currency assets have to offer to make foreign investors indifferent between foreign and domestic assets.[14]

What determines the premium? First, there is an exogenous component that compensates for the low quality and liquidity of the currency due to its low position in the international currency hierarchy (i.e. it is neither an international means of payment, nor unit of credit contracts, nor store of value). Second, the premium is affected by the total stock of foreign currency-denominated external debt (Kaltenbrunner, 2015; Rocha and Oreiro, 2013). Foreign depositors may be worried about unpredictable future devaluations due to unsustainable external debt burdens. Devaluations directly translate into capital losses for foreign depositors. Moreover, being aware of the possibility of balance sheet effects, foreign depositors interpret a high burden of external debt as a high risk of default. Using a simple linear function for the illiquidity and risk premium, $\rho = \rho_0 + \rho_1 e_r \lambda$, we get:

$$(15') \quad i = i_B^f + \rho_0 + \rho_1 e_r \lambda; \qquad \rho_0, \rho_1 > 0$$

where ρ_0 is the illiquidity premium and ρ_1 is the sensitivity of the risk premium with respect to foreign currency-denominated external debt.

By the same token, the interest rate on foreign-currency debt includes a premium to compensate for default risks due to unsustainable debt burdens. However, in contrast to domestic debt, there is no illiquidity premium.

$$(16) \quad i^f = i_B^f + \rho_1^f e_r \lambda; \qquad \rho_1^f > 0$$

Currency devaluations, aggregate demand, and growth

Making use of equations (9), (11), (12) and (13), the goods market equilibrium rate of capacity utilisation is given by:

$$(17) \quad u^* = \frac{b_0 u^f + b_1 e_r + g_0 + g_2 \pi - g_3 e_r \lambda}{\frac{\pi}{v} + b_2 - g_1}$$

An equilibrium rate of profit can be derived by plugging (17) into (8):

$$(18) \quad r^* = \frac{\frac{\pi}{v}(b_0 u^f + b_1 e_r + g_0 + g_2 \pi - g_3 e_r \lambda)}{\frac{\pi}{v} + b_2 - g_1}$$

The equilibrium rate of capital accumulation is obtained by substituting equation (17) into (12):

$$(19) \qquad g^* = \frac{g_1(b_0 u^f + b_1 e_r) + (g_0 + g_2\pi - g_3 e_r \lambda)\left(\frac{\pi}{v} + b_2\right)}{\frac{\pi}{v} + b_2 - g_1}$$

Lastly, using (17) and (11), the equilibrium trade balance is given by:

$$(20) \qquad b^* = \frac{\left(\frac{\pi}{v} - g_1\right)(b_0 u^f + b_1 e_r) - b_2(g_0 + g_2\pi - g_3 \lambda e_r)}{\frac{\pi}{v} + b_2 - g_1}$$

Suppose the central bank decides to adjust the peg by devaluing the currency, perhaps in order to boost aggregate demand. It announces a new real exchange rate target, which is instantly reached.[15] The effect of a real devaluation on the equilibrium rate of capacity utilisation is then given by:

$$(21) \qquad \frac{du^*}{de_r} = \frac{b_1 + \frac{\partial \pi}{\partial e_r}\left(g_2 - \frac{u}{v}\right) - g_3\lambda}{\frac{\pi}{v} + b_2 - g_1} \gtreqless 0$$

$$\Rightarrow \frac{du^*}{de_r} > 0, \;\; if: b_1 + \frac{\partial \pi}{\partial e_r}\left(g_2 - \frac{u}{v}\right) - g_3\lambda > 0$$

The denominator contains the Keynesian stability condition, which is assumed to be positive. The overall sign of the derivative thus depends on the numerator. Three distinct effects can be distinguished. The first term in the numerator captures the effect of a devaluation on the trade balance. The coefficient b_1 can be positive or negative, depending on whether the MLC is satisfied or not.[16] This makes the sign of the first term in the numerator ambiguous.

The second term captures the effect of a devaluation on the profit share. It can be positive or negative, depending on the relative bargaining power of workers and firms, but it is expected that the effect is normally positive. The term in brackets captures whether domestic aggregate demand is wage- or profit-led. If it is profit-led, the term is positive because a redistribution in favour of profit earners boosts investment more than it depresses consumption. A devaluation then has an expansionary effect on domestic absorption if it raises the profit share. If, however, the term in brackets is negative so that the economy is domestically wage-led, and the devaluation raises the profit share, the devaluation depresses domestic absorption. Contractionary effects on domestic absorption arise when the devaluation raises the profit share but the domestic demand-regime is wage-led, and vice versa.

A major novelty for the post-Kaleckian approach is the balance sheet effect, which is captured by the third term. External debt in foreign currency exercises an unambiguously negative effect on the rate of capacity utilisation, which is the stronger, the higher the external debt ratio (λ), and the larger the sensitivity of investment with respect to foreign currency-denominated debt (g_3). Balance sheet effects increase the overall likelihood of contractionary devaluations, as they potentially turn the numerator negative.

The model can also be used to analyse the effect of a real devaluation on the equilibrium rate of capital accumulation:

(22) $$\frac{dg^*}{de_r} = \frac{g_1\left(b_1 - \frac{u}{v}\frac{\partial \pi}{\partial e_r}\right) + \left(g_2\frac{\partial \pi}{\partial e_r} - g_3\lambda\right)\left(\frac{\pi}{v} + b_2\right)}{\frac{\pi}{v} + b_2 - g_1} \lessgtr 0$$

$$\Rightarrow \frac{dg^*}{de_r} > 0, \;\; if: g_1\left(b_1 - \frac{u}{v}\frac{\partial \pi}{\partial e_r}\right) + \left(g_2\frac{\partial \pi}{\partial e_r} - g_3\lambda\right)\left(\frac{\pi}{v} + b_2\right) > 0$$

The same mechanisms that determine the overall effect on aggregate demand are at work in the determination of the equilibrium rate of capital accumulation. However, the effects on domestic investment get a stronger weight than the effects on net exports and consumption (remember that we assume $\frac{\pi}{v} + b_2 > g_1$), so that balance sheet effect have a stronger impact on growth than on demand.

Finally, the effect of a devaluation on the equilibrium trade balance can be examined:

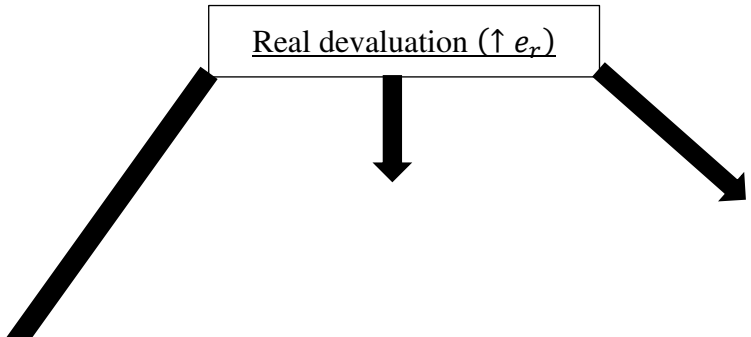
(23) $$\frac{db^*}{de_r} = \frac{b_1\left(\frac{\pi}{v} - g_1\right) - b_2\left[\frac{\partial \pi}{\partial e_r}\left(g_2 - \frac{u}{v}\right) - g_3\lambda\right]}{\frac{\pi}{v} + b_2 - g_1} \lessgtr 0$$

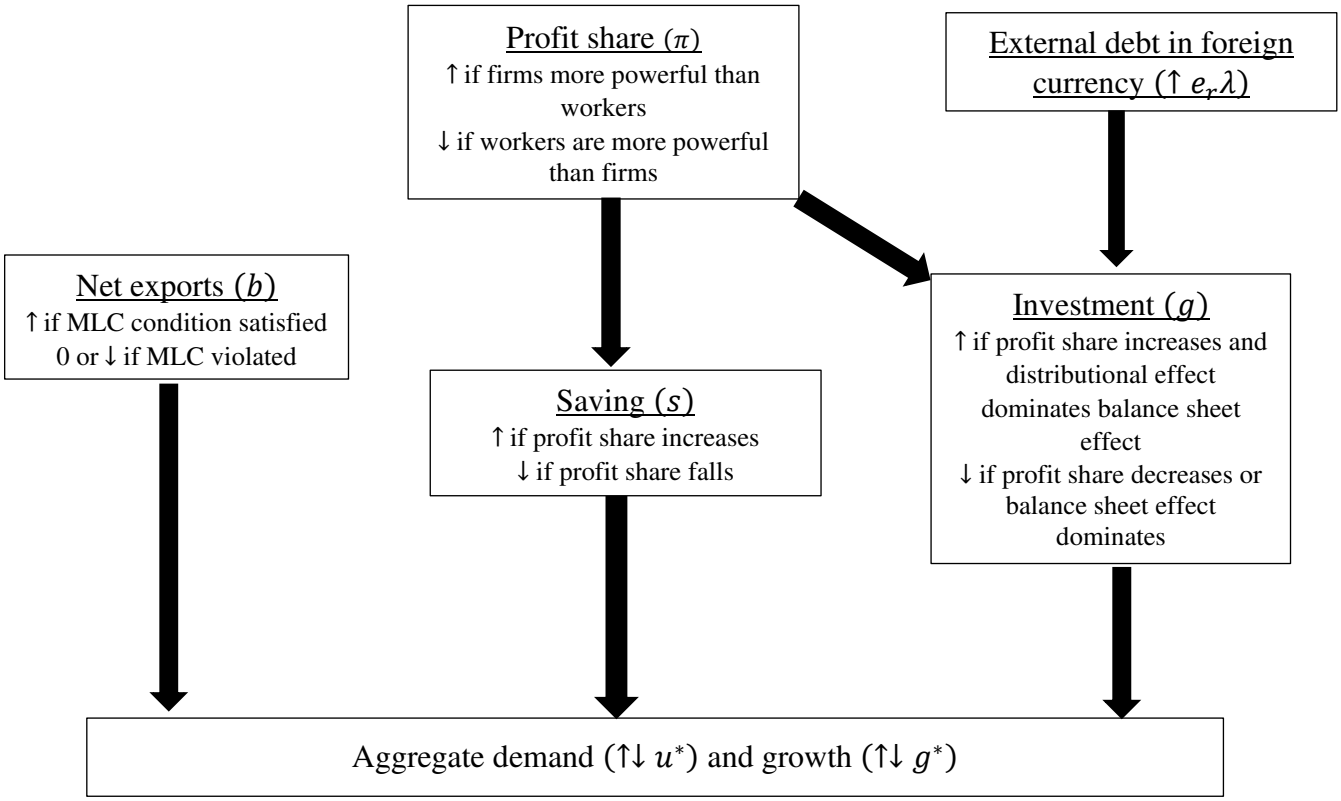
$$\Rightarrow \frac{db^*}{de_r} > 0, \;\; if: b_1\left(\frac{\pi}{v} - g_1\right) - b_2\left[\frac{\partial \pi}{\partial e_r}\left(g_2 - \frac{u}{v}\right) - g_3\lambda\right] > 0$$

Again, the overall effect depends on the numerator. Two channels are relevant here: the price competitiveness channel captured by parameter b_1, and the domestic demand channel which is represented by b_2. The first channel depends on the MLC and the closed economy Keynesian stability condition $\left(\frac{\pi}{v} - g_1 > 0\right)$. Provided that the latter is satisfied, the direction of the price competitiveness channel is given by the MLC. The second channel depends on the effect of a devaluation on domestic absorption. If the devaluation raises domestic absorption, for example because the economy is profit-led and balance sheet effects are weak, its effect on the equilibrium trade balance may be negative. If, however, the domestic economy is wage-led and the devaluation raises the profit share, it suppresses domestic absorption, so that its effect on the equilibrium trade balance may be positive. It is thus possible that a devaluation improves the equilibrium trade balance by depressing import demand, even if the MLC is not satisfied.

The analysis shows that the overall effect of a real devaluation on aggregate demand, growth, and the trade balance is ambiguous, and depends on the individual effects on net exports, consumption and investment. Introducing balance sheet effects into the Kaleckian model adds a negative effect on planned investment expenditures, which makes overall contractionary effects on the equilibrium rates of capacity utilisation and growth more likely. This effect is predicted to be strong in countries that are heavily indebted in foreign currency. The different channels are visualised in Figure 1:

Figure 1: Causation graph of the effect of a real devaluation on aggregate demand and growth





Note: MLC: Marshall-Lerner condition.

4 The medium-run model: Dynamics and (in)stability of domestic and external debt

The dynamics of domestic and external debt

From the point of view of external creditors, new credit is typically granted when the domestic economy is booming. Strong capital inflows into developing and emerging market countries during boom phases are indeed a familiar phenomenon. Domestic firms, in turn, use external credit in foreign currency in order to finance a share ϕ of their total nominal investment expenditures:

(24) $\quad e\dot{B}^f = \phi pI; \quad 0 < \phi \leq 1$

The preference for foreign currency debt, ϕ, is unlikely to be constant. Firms often prefer external debt simply because it is cheaper (Williamson, 2005, chap. 4). ϕ then becomes a function of the differential between the interest rates on foreign-currency and domestic-currency debt: $\phi = \phi(i - i^f)$. The bigger the differential, the larger the propensity to finance investment out of foreign currency-denominated external debt. The differential is given by:

(25) $\quad i - i^f = \rho_0 + \left(\rho_1 - \rho_1^f\right)e_r\lambda \gtreqless 0$

It can be positive or negative, but will typically be positive in economies with low quality currencies due to high illiquidity premia (ρ_0).

The propensity to finance investment out of foreign currency-denominated external debt then becomes a function of the illiquidity and risk premia: $\phi = \phi\left[\rho_0 + \left(\rho_1 - \rho_1^f\right)e_r\lambda\right]$. A simple linearization yields: $\phi = \phi_0 + \phi_1 e_r\lambda$. We then have:

(24') $\quad e\dot{B}^f = (\phi_0 + \phi_1 e_r\lambda)pI; \quad 0 < \phi_0 + \phi_1 e_r\lambda \leq 1$ and $\phi_1 \gtreqless 0$

The parameter ϕ_0 is composed of an independent preference for external debt plus the illiquidity premium ρ_0, while the parameter ϕ_1 expresses the sensitivity of the propensity to finance investment out of foreign currency-denominated external debt with respect to external debt. The sensitivities of the risk premia with respect to external debt, ρ_1 and ρ_1^f, are thus incorporated in ϕ_1. I shall assume that the independent propensity to finance investment out of external debt is constant in the medium-run, and that the sensitivity of ϕ with respect to the premia is strong (i.e. close to unity), so that changes in ϕ are mainly determined by changes in the illiquidity and risk premia. Hence, an increase in the illiquidity premium translates into a higher propensity to finance investment out of foreign currency-denominated external debt because it makes domestic loans more expensive. The effect of a shock to external debt on ϕ depends on the relative sensitivities of the foreign and domestic interest rate on debt. If $\rho_1 > \rho_1^f$, an increase in external debt will raise the propensity ($\phi_1 > 0$). In this case, there is a *vicious cycle of external debt*, in the sense that an increase in foreign currency-denominated debt accelerates the issuance of new foreign currency debt. Considering that a devaluation will always involve a capital loss for foreign investors in the case of domestic currency debt, while it only increases the likelihood of default on both kinds of debt, it is not unlikely that ρ_1 is larger than ρ_1^f. However, if $\rho_1 = \rho_1^f$, there will be no effect of a shock to external debt on debt dynamics ($\phi_1 = 0$), and in the rather unlikely case of $\rho_1 < \rho_1^f$, an increase in external debt reduces the rate of change of external debt $\phi_1 < 0$). I assume that $\phi_1$is normally positive.

The dynamic equation for the external debt in foreign currency-to-capital ratio can be obtained by totally differentiating equation (6) with respect to time:

(26) $\quad \frac{d\left(\frac{eB^f}{pK}\right)}{dt} \equiv \left(\frac{e\dot{B}^f}{pK}\right) \equiv \dot{e_r\lambda} \equiv \frac{e\dot{B}^f}{pK} + e_r\lambda(\widehat{e_r} - g)$

The goods market has already reached its short-run equilibrium ($g = g^*$), and the exchange rate is fixed ($\widehat{e_r} = 0$). Inserting (24') into (26) then yields the following differential equation:

(27) $\quad \dot{e_r\lambda} = g^*[\phi_0 + e_r\lambda(\phi_1 - 1)]$

The ratio of domestic currency-denominated debt is the second state variable. Taking the time derivative of the debt in domestic currency to capital ratio (7), we obtain:

(28) $\quad \frac{d\left(\frac{B}{pK}\right)}{dt} \equiv \left(\frac{\dot{B}}{pK}\right) \equiv \dot{\tau} = \frac{\dot{B}}{pK} - \tau g - \tau\hat{p}$

Making use of the firm sector budget constraint $\left(\dot{B} \equiv pI - R + i^f eB^f + iB - e\dot{B^f}\right)$, the interest rate equations (15') and (16), equation (24') for the dynamics of external debt, and recalling that inflation is assumed away, we get:

$$(29) \quad \dot{\tau} = \tau\left(i_B^f + \rho_0 + \rho_1 e_r\lambda - g^*\right) + g^*(1 - \phi_0 - \phi_1 e_r\lambda) + \left(i_B^f + \rho_1^f e_r\lambda\right)e_r\lambda - r^*$$

Stability of debt at the steady state

A non-trivial steady state of the external debt in foreign currency ratio (27) arises if:

$$(30) \quad e_r\lambda^*_{|\dot{e_r\lambda}=0} = \frac{\phi_0}{1-\phi_1}$$

ϕ_0 has to be positive and ϕ_1 must be smaller than unity to ensure the existence of external debt. Under these conditions, the external debt in foreign currency ratio is positive. We can see that a devaluation has no effect on it in the steady state. The steady state external debt ratio is solely determined by the propensity to finance investment through foreign-currency denominated debt, which in turn is determined by the illiquidity and risk premia. A higher illiquidity premium, e.g. because of a loss of trust in the domestic currency, as well as a higher sensitivity of the domestic interest rate premium with respect to external debt, e.g. because of stronger concerns about devaluation and default risks, raise the steady state external debt ratio. A higher sensitivity of risk of foreign investors with respect to foreign-currency debt, however, reduces the steady state debt ratio.

The steady state of the domestic currency-denominated debt ratio is given by:

$$(31) \quad \tau^*_{|\dot{\tau}=0} = \frac{g^*(1-\phi_0-\phi_1 e_r\lambda)+\left(i_B^f+\rho_1^f e_r\lambda\right)e_r\lambda-r^*}{g^*-i_B^f-\rho_0-\rho_1 e_r\lambda}$$

This steady state debt ratio can become positive or negative. As will be demonstrated below, the denominator must be positive for stability. The steady state domestic debt ratio then becomes positive if the share of investment that is financed through domestic debt plus interest payments on external debt exceeds the profit rate. The debt ratio can also become negative if profits exceed interest payments on external debt plus expenditures on investment that are not financed through external debt. Firms then save more than they spend and hold deposits with domestic banks.

Equations (27) and (29) form a two-dimensional dynamic system. The Jacobian matrix of the system, evaluated at the steady state, is given by:[17]

$$(32) \quad \boldsymbol{J}(e_r\lambda^{**}, \tau^{**}) = \begin{bmatrix} \frac{\partial \dot{e_r\lambda}}{\partial e_r\lambda} & \frac{\partial \dot{e_r\lambda}}{\partial \tau} \\ \frac{\partial \dot{\tau}}{\partial e_r\lambda} & \frac{\partial \dot{\tau}}{\partial \tau} \end{bmatrix} = \begin{bmatrix} J_{11} & J_{12} \\ J_{21} & J_{22} \end{bmatrix},$$

where

$$J_{11} = g^{**}(\phi_1 - 1)$$
$$J_{12} = 0$$

$$J_{21} = \frac{\partial g^*}{\partial e_r \lambda}(1 - \phi_0 - \frac{\phi_1 \phi_0}{1-\phi_1} - \tau^{**}) + i_B^f + \frac{2\rho_1^f \phi_0}{1-\phi_1} + \tau^{**}\rho_1 - g^{**}\phi_1 - \frac{\partial r^*}{\partial e_r \lambda}$$

$$J_{22} = i_B^f + \rho_0 + \frac{\rho_1 \phi_0}{1-\phi_1} - g^{**}$$

The necessary and sufficient stability conditions for of a two-dimensional system of differential equations are:

$$tr(\boldsymbol{J}) = J_{11} + J_{22} < 0$$
$$det(\boldsymbol{J}) = J_{11} J_{22} - J_{12} J_{21} > 0$$

Stability of the present system is given if and only if both diagonal elements of the Jacobian matrix are negative. The first element is:

(33) $$J_{11} = g^{**}(\phi_1 - 1) = \left\{ \frac{g_1(b_0 u^f + b_1 e_r) + \left(g_0 + g_2 \pi - \frac{g_3 \phi_0}{1-\phi_1}\right)\left(\frac{\pi}{v} + b_2\right)}{\frac{\pi}{v} + b_2 - g_1} \right\} (\phi_1 - 1)$$

$$\Rightarrow J_{11} < 0, \;\; if: g^{**}(\phi_1 - 1) < 0$$

As long as the equilibrium rate of capital accumulation is positive and $\phi_1 < 1$, this element is negative. Instability may arise during recessions, which could occur because animal spirits (g_0) turn negative or export demand ($b_0 u^f$) collapses, while other driving forces of capital accumulation such as export competitiveness ($b_1 e_r$) are weak, and balance sheet effects $\left(\frac{g_3 \phi_0}{1-\phi_1}\right)$ are strong. Instability could also occur if the propensity to finance investment out of foreign currency-denominated debt with respect to external debt is larger than unity ($\phi_1 > 1$), i.e. the risk premium on domestic-currency debt is very sensitive towards external debt, while the risk premium on foreign-currency debt is rather inelastic. Such a situation may occur shortly before currency crises, when foreign investors are nervous and interpret a small increase in external indebtedness as a strong predictor of a future devaluation, so that the central bank must respond by raising the interest rate. This response, however, may compromise debt sustainability. Currency crises and banking crisis indeed often go hand in hand (Kaminsky and Reinhart, 1999). In normal times, however, J_{11} should be negative.
The second element of the diagonal is:

(34) $$J_{22} = i_B^f + \rho_0 + \frac{\rho_1 \phi_0}{1-\phi_1} - g^{**}$$

$$\Leftrightarrow i_B^f + \rho_0 + \frac{\rho_1 \phi_0}{1-\phi_1} - \left\{ \frac{g_1(b_0 u^f + b_1 e_r) + \left(g_0 + g_2 \pi - \frac{g_3 \phi_0}{1-\phi_1}\right)\left(\frac{\pi}{v} + b_2\right)}{\frac{\pi}{v} + b_2 - g_1} \right\}$$

$$\Rightarrow J_{22} < 0, \;\; if: g^{**} > i \;\Leftrightarrow\; g^{**} > i_B^f + \rho_0 + \frac{\rho_1 \phi_0}{1-\phi_1}$$

This element is negative as long as the equilibrium steady state rate of capital accumulation exceeds the domestic interest rate. This stability condition resembles earlier findings of the literature on public debt sustainability, which demonstrated that the economy can grow out of

the public debt burden if the condition $g > i$ is satisfied (see Taylor, 2004, chap. 6). However, meeting the stability condition for the non-reserve currency economy of this model is more difficult, as the domestic interest rate is determined by factors that are partly beyond the control of domestic authorities. A foreign interest rate hike, for instance, may destabilise the system and induce a debt crisis – a familiar scenario in developing countries (Cline and Vernengo, 2015). The Latin American debt crisis of the early 1980s is a prime examples of such a disaster (Errunza and Ghalbouni, 1986). Another potentially destabilising factor is a sudden increase in the illiquidity premium (ρ_0), e.g. because of a loss of confidence in the domestic currency or because of a rise in international liquidity preference (Dow, 1999). Lastly, a high sensitivity of the domestic interest rate premium with respect to the steady state external debt ratio (ρ_1) and a high debt ratio $\left(\frac{\phi_0}{1-\phi_1}\right)$ also compromise stability.

How does a devaluation affect the stability of the system? A devaluation has a stabilising effect if it diminishes the diagonal elements of the Jacobian matrix. Taking the total derivatives of J_{11} and $J_{22}$with respect to the real exchange rate, we find:

$$\frac{dJ_{11}}{de_r} = \left[\frac{g_1\left(b_1 - \frac{u}{v}\frac{\partial \pi}{\partial e_r}\right) + \left(g_2\frac{\partial \pi}{\partial e_r}\right)\left(\frac{\pi}{v} + b_2\right)}{\frac{\pi}{v} + b_2 - g_1}\right](\phi_1 - 1) \lesseqgtr 0 \tag{35}$$

$$\frac{dJ_{22}}{de_r} = -\frac{g_1\left(b_1 - \frac{u}{v}\frac{\partial \pi}{\partial e_r}\right) + \left(g_2\frac{\partial \pi}{\partial e_r}\right)\left(\frac{\pi}{v} + b_2\right)}{\frac{\pi}{v} + b_2 - g_1} \lesseqgtr 0 \tag{36}$$

We see that a devaluation can have a stabilising effect on the external debt in foreign currency ratio under similar conditions under which a devaluation increases the equilibrium rate of growth (cf. equation 22). A difference is that the balance sheet effect arising from external indebtedness in foreign currency is gone at the steady state since the steady state external debt ratio is fixed by the parameters that determine the propensity to finance investment through external debt $\left(\frac{\phi_0}{1-\phi_1}\right)$. Contractionary devaluations are therefore less likely in the steady state. To conclude, whenever a devaluation in the stable steady state succeeds in boosting capital accumulation, it also improves stability of the debt ratios. This holds despite the assumption that external debt dynamics are driven by capital accumulation. In contrast, devaluations that depress investment compromise debt sustainability. Note that this can happen even if the MLC is satisfied, so that a devaluation may improve the trade balance but induce a debt crisis.

5 Conclusion

The paper has firstly addressed the question of how currency devaluations affect aggregate demand and capital accumulation in the short-run in small open economies with a fixed exchange rate and foreign-currency denominated corporate debt. The post-Kaleckian model shows that devaluations induce several mechanisms that affect aggregate demand and growth, and the overall outcome cannot be established a priori. Devaluations are likely to induce a redistribution of income towards profit earners, which in turn can have different effects on domestic absorption, depending on whether the economy is in a wage- or profit-led regime. Moreover, the effect of a devaluation on net exports is not necessarily positive if the Marshall-Lerner condition is not satisfied. Lastly, balance sheet effects have a depressing effect on investment, so that devaluations are less likely to be expansionary in externally indebted economies. Therefore, it is

necessary to empirically obtain the relevant parameters of the model before a prediction about the demand- and growth-effects of devaluations can be made for a specific country.

Secondly, the paper has analysed the dynamics and stability of debt within the proposed framework. It has been argued that domestic firms take on foreign currency debt because it is cheaper. This, in turn, is due to a high illiquidity premium on domestic currency debt. Moreover, if the risk premium on domestic currency debt is more sensitive to the stock of external debt than the risk premium on foreign currency debt, a vicious cycle of external debt can occur. A higher stock of foreign currency debt then leads to an acceleration of external indebtedness. The main finding of the stability analysis is that strong animal spirits, high export demand, and export competitiveness improve stability, while strong balance sheet effects compromise it. Furthermore, foreign interest rate or illiquidity premium shocks, as well as a high sensitivity of the domestic interest rate premium with respect to external debt may turn a stable system unstable. Devaluations are stabilising only if they succeed in boosting domestic capital accumulation. If, however, devaluations depress domestic investment, they may undermine debt sustainability. This problem can occur even if the devaluation succeeds in improving the trade balance.

When a country faces a balance-of-payments crisis, devaluation can be inevitable. However, an adjustment programme that seeks to improve international competitiveness at the expense of domestic capital accumulation can compromise debt sustainability. Moreover, if devaluations are combined with austerity policies that depress animal spirits they are even more likely to worsen the debt problem. Although such a deflationary approach may eventually improve the trade balance, the economic and social damage that is being incurred in the meantime can be substantial. Besides the effects of devaluations on aggregate demand, capital accumulation, and debt sustainability, the distributional effects should be evaluated in their own right. Especially if there are strong regressive distributional effects, and the expansionary effects are small, devaluations might do more harm than good. However, more empirical research on the distributional effects of devaluations is needed.

The analysis suggests some measures to reduce external vulnerability. To reduce the likelihood of financial instability, the domestic interest rate would have to be reduced. Capital outflow controls would allow the central bank to do that. Moreover, capital inflow controls can prevent firms and banks from taking on foreign debt in the first place. However, they may not always be easy to enforce. Since foreign interest rate shocks are not under the control of domestic policy makers, the focus should lay on reducing the illiquidity and risk premia on domestic-currency debt that drive a wedge between the domestic and foreign interest rate. Large interest rate differentials due to high premia not only motivate domestic firms to take on risky foreign currency-denominated debt but also undermine debt sustainability. A reduction of the illiquidity and risk premium on domestic debt requires a stronger trust in the domestic currency, which can be achieved by strengthening the domestic financial sector. Investment-oriented prudential regulations and a domestic central bank that acts as a lender of last resort – in emergencies also for foreign currency-denominated debt by drawing on its foreign reserves – may be conducive to this end. Public and development banks that selectively provide cheap credit for long-term investment might play an important role too, as China and the East Asian Tigers have shown (Herr and Priewe, 2005; Stiglitz and Uy, 1996). This would stimulate a domestic credit-investment-income-saving circuit and make the economy less dependent on foreign capital.

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[1] Currency mismatch occurs when assets and liabilities are denominated in different currencies.

[2] The MLC for unbalanced trade and a perfectly elastic supply of goods is given by $\left(\frac{X}{e_r M}\right)\eta_x + \eta_m > 1$, where η_x and η_m are the absolute values of the real exchange rate elasticities of exports and imports respectively, X is exports, e_r is the real exchange rate and imports is M. In case of a trade deficit, the ratio of exports to imports is smaller than unity. Thus, the MLC might not always be satisfied, especially in countries with strong trade deficits.

[3] Surveys of the contractionary devaluation debate are provided by Lizondo and Montiel (1989), and Bahmani-Oskooee and Mitzea (2003). Bahmani-Oskooee and Mitzea (2003) also review the empirical evidence and conclude that the effects of real depreciations on output and growth have turned out to be rather inconclusive and country-specific. A recent study (An et al., 2014) with 16 high and middle income countries also finds mixed results.

[4] I do not address the question whether a long-term undervaluation strategy is conducive to long-run growth. This is a separate topic that requires a different theoretical framework (see for example Razmi et al., 2012). Furthermore, the focus is restricted to small open economies whose domestic policies have no or negligible effects on the rest of the world – a plausible assumption for most developing and emerging market countries.

[5] For benchmark versions see Hein (2014, chap. 7) and Blecker (2011).

[6] Bulgaria, Bolivia, Dominican Republic, Guatemala, Guyana, Jordan, and Oman are a few examples of countries that have fallen into this category for several years since the millennium.

[7] Original sin, i.e. the 'inability of a country to borrow abroad in its own currency' (Eichengreen et al., 2007, p. 122) is pervasive in developing countries, but also significant in developed countries outside the financial centres (USA, UK, Switzerland and Japan) and the Eurozone.

[8] Although many authors have claimed that a devaluation typically worsens income distribution (Alexander 1952; Diaz-Alejandro 1963; Krugman and Taylor 1978), there is little empirical research on this question. Bahmani-Oskooee (1997) finds that devaluations increase income inequality measured as the ratio of the income of the top 20% to that of the bottom 40% of the population. Dünhaupt (2017) estimates the effect of various financialisation variables on the wage share and finds import prices to exercises a negative effect on the wage share. Hence, there is some indirect evidence that devaluations more commonly raise the profit share.

[9] It has to be noted that the linear specification in (11) assumes away a non-linearity in the Marshall-Lerner condition that stems from the valuation of imports by the exchange (see footnote 3). It can be shown that the implicit assumption behind equation (11) is an exchange rate elasticity of import demand of -1.

[10] Domestic currency debt does not enter the investment function not only to keep the model parsimonious, but also because the profit share in the investment function already captures the ability of firms to obtain liquid funds in domestic currency. Domestic currency debt is also not subject to exchange rate risk and thus less risky. Moreover, I abstract from negative effects of interest payments on investment to focus the analysis on balance sheet effects. For a post-Kaleckian model that analyses effects of interest payments on investment, see Hein (2014, chap. 9).

[11] The Keynesian stability condition may not be satisfied in the long-run (Skott, 2012). This constitutes another reason why the present model is confined to the short- and medium-run.

[12] Although in principle the central bank can set a rate above the one given by equation (15), it is assumed that the floor given by international arbitrage conditions is a binding constraint because the central bank has no interest in raising the rate further. It might be worried about negative effects on economic activity since the domestic rate is already high due to a large premium. Furthermore, commercial banks may charge a (constant) mark-up on the central bank base rate. For simplicity, it is assumed that the central bank directly sets the domestic lending rate.

[13] UIP is a strong but straightforward assumption that serves to capture the empirical fact that monetary policy in fixed exchange rate regimes with limited foreign reserves is significantly constrained (Obstfeld et al., 2005; Hosny et al., 2015).

[14] This idea is prominent in post-Keynesian work on currency and exchange rate issues (e.g. Herr, 2008; Andrade and Prates, 2013; Kaltenbrunner, 2015). Some authors use the notion of a 'currency premium', which is a subjective international liquidity premium that hard currencies offer because they function as relatively safe stores of wealth. The domestic interest rate premium ρ can be regarded as the inverse of such a currency premium.

[15] Although exchange rate policy can only manipulate the nominal exchange rate, the real exchange rate follows the nominal exchange rate quite closely, so that a nominal devaluation usually translates into a real devaluation (Razmi et al., 2012, p. 152).

[16] In a survey of empirical studies over the past 50 years, Bahmani et al. (2013) show that empirical estimates of the MLC have often been either contradictory or changed over time. They conduct a meta-analysis of existing studies and find that the MLC is only statistically significantly satisfied in just under 30 percent of 92 estimated elasticities. Moreover, the authors conduct their own empirical analysis for a set of 29 countries over the period 1971-2009 and find the MLC to be met in only three countries. The case $b_1 \leq 0$ is therefore entirely possible, if not likely.

[17] Double-asterisks denote equilibrium variables into which both steady state debt ratios have been substituted.