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Neo-Kaleckian models with financial cycles: A center-periphery framework

DAVID GUIMARÃES COELHO and ESTEBAN PEREZ CALDENTEY

Abstract:

The article develops a Neo-Kaleckian model that takes into account the impact of financial cycles on demand regimes. Both the financial instability hypothesis and the paradox of debt are considered, as well as both the upward and the downward phases of the economic cycle. The baseline model is insufficient to analyze financial variables in underdeveloped countries, as it does not take into consideration the non-neutrality of international financial markets. Following a center-periphery structure, we extend the model in order to discuss how financial movements in the periphery are mainly associated with external vulnerability.

Guimarães: Federal University of Minas Gerais, email: davidguimaraescoelho@gmail.com
Perez: Economic Commission for Latin America and the Caribbean,
email: esteban.perez@eclac.org

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Minsky (1982) developed a theory that focuses on financial cycles, with particular emphasis on the role of uncertanty, historical time and liquidity preference (Davidson, 1991; Amado, 2000). This tripod is crucial to determine output and employment in a framework that includes demand-led growth and an endogenous supply of money. For instance, liquidity preference has a major role in the supply of credit to finance investment. When the cycle is positive, financial innovations are featured and new mechanisms are introduced in order to increase the volume of financial activity. However, these cycles are also correlated with financial instability (Minsky, 1986). Minsky argues that financial instability negatively affects the productive sector of the economy. This process is associated with an increase of banks' leverage ratio, thus introducing the possibility of non-fulfillment of expectations in an uncertain and non-ergodic future. This process has a negative impact on investment, which engenders a downward phase of the economic cycle and a process of deleveraging.

According to Minsky, a firm's amount of profits has a double role: first, it encourages the firm to increase investment due to higher expectations, and, second, it encourages banks and

other institutions to lend bigger amounts of credit to the firm. As the cycle continues, there is a self-reinforcing psychological process, so that an increase in profits influences both lenders and borrowers to become less cautious and more optimistic. This process, according to his Financial Instability Hypothesis (FIH), results in an increase in the debt stock at a faster rate than the amount of capital stock or the amount of profits (leveraging), thus raising the ratio of payment to commitments – even if a constant interest rate is considered. A further consequence is a transfer of economic units from a safer position to a more fragile one, raising short-term debt and the demand for credit itself. As financial instability becomes more evident, an increase in the interest rate is inevitable, as demand for credit overcomes the available supply. Increases in banks' perception of fragility decreases their willingness to continue financing enterprises, causing a generalized rise in uncertainty. This will affect the level of investment and decrease the expected rate of profit of future investments, engendering a process of deleveraging.

Some critiques to Minsky's theory have emerged, highlighting the problems of economic aggregation from the microeconomic to the macroeconomic level. Lavoie and Seccareccia (2001) argue that Minsky actually creates a fallacy of composition and some results do not hold in the aggregate, raising the possibility of the exact opposite path when one takes into account effective demand effects. Their main point is that, as investment increases in the upward phase of the cycle, the aggregate profits level is higher than expected, so that the leverage ratio does not necessarily increase. This result will depend then on the magnitude by which internal funding (or retained earnings) will increase relative to debt commitments. On the other hand, in the downward phase of the cycle, investment goes down, negatively affecting future aggregate profits more than expected, which may lead to an increase in the leverage ratio. This argument is known in the literature as the paradox of debt (Lavoie and Seccareccia, 2001).

At the same time, neo-Kaleckian models have focused solely on productive variables of the real sector in developed countries and had little emphasis on monetary or financial variables. In general, these models mostly focus on demand regimes, income distribution and growth. As developed by Kalecki (1971), wages do not enter into economic models only as variable costs, but also as components of aggregate demand in an economy divided between capitalists and workers with different propensities to consume. Moreover, the economy presents an oligopolized production structure, with a mark-up rate on prices crucial to determine functional income distribution at the aggregate level.

In the 1980s, some authors (Rowthorn, 1981; Dutt, 1984; Dutt, 1987) followed this structure, without assuming investment demand as exogenous. For them, producers maintain a normal degree of capacity utilization that persistently generates idle capacity in order to respond to unanticipated movements of demand. Endogenous capacity utilization emerges as the adjusting variable, reacting to demand movements. The investment function is crucial to these models, presenting as explanatory variables capacity utilization – the accelerator effect – and the profit rate – as an index of future earnings expectations. One of the main characteristics of these models is that income redistribution towards workers always leads to higher growth rates, i.e. both growth and demand regimes are necessarily wage-led. Bhaduri and Marglin (1990), and Blecker (1989) break this mathematical obligation: the former by modifying the investment function and using the profit share instead of the profit rate, and the latter by introducing external competition in an imperfect substitute goods framework. As a result, the demand regime may be either profit-led or wage-led.

Later Lavoie (1995), Hein (2007), Ryoo (2013), and Michopoulou (2014) tried to incorporate in these models monetary and financial variables such as internal funds, interest rates, the leverage ratio, and others. Nevertheless, none of these efforts focused properly on how demand regimes themselves change along the economic cycle.

In order to fill this gap, we propose a neo-Kaleckian model allowing for both profit-led and wage-led regimes, in which internal funding and external financing are incorporated. We allow the leverage ratio to affect internal finance both positively and negatively during the expansion phase of the cycle – as argued by the paradox of debt and the FIH, respectively. Furthermore, we assume that this framework is incomplete once one tries to analyze financial movements in underdeveloped countries. Following a center-periphery structure (Prebisch, 1949), we discuss how financial movements in the periphery are mainly associated with external vulnerability. This may either lead to different movements regarding demand regimes, if compared to the center countries' cycle behavior, or highlight a reflex-cycle. We use trade income elasticities in order to mimic an external financial constraint, thus linking to the debate on balance-of-payments (BOP) constrained models (Thirlwall, 1979; McCombie and Thirlwall, 1994).

By introducing these aspects, we expect to highlight some public policy opportunities – both for center and periphery countries – in order to improve the efficiency of income distribution according to cyclical movements. Different economic responses with respect to the cycle allow for distinct political possibilities and more socially progressive propositions.

1. FIH and the paradox of debt

1.1. FIH

Minsky classifies financial instability, ranked by its degress of vulnerability, into three groups: hedge, speculative, and Ponzi. Hedge finance appears in a scenario in which the gross capital income (gross profits before taxes minus interest paid on business debts) is expected to be sufficiently large to pay debt commitments in all outstanding periods. Speculative finance happens in a scenario where total expected gross profits overcome debt commitments. Gross profits are able to meet interest payments but are not sufficient to meet total payment commitments. Summarizing, firms use short-term debt to finance long-term assets (Evans, 2004). Lastly, a firm engages in Ponzi finance when cash payment commitments on debt are met by increasing the quantity of debt outstanding. Therefore, short-term gross profits are not sufficient to meet the payment of interest rates, obligating firms to borrow more to finance the debt itself. The proportion of each sort of financial position in the whole economy will determine its financial instability.

The second aspect regarding the FIH is that prosperity periods lead to financial instability. As the upward cycle continues, Minsky argues that the market tends to increase the share of the most vulnerable units in the overall composition, weakening the economic structure. In a way, the cycle would carry then the seeds of its own destruction. To explain how this occurs, it is necessary to relate it to five different concepts: the supply price of investment, the demand price of a capital asset, borrower's and lender's risk, internal finance constraints, and a demand-led profit equation (González and Perez-Caldentey, 2016). The supply price of investment is the price that would induce a manufacturer to newly produce an additional unit

of such asset (Keynes, 1936). In turn, González and Perez-Caldentey (2016) define the demand price of capital assets as determined by the expected quasi-rents accruing to capital goods. The level of investment will be determined by the equality between the supply price of investment and the demand price of capital assets adjusted for the lender's and the borrower's risk, respectively.

During the upward period, Minsky assumes achieved investment to be higher than its expected level, resulting in an achieved profit also above its expected level. This higher level of expected profits will result in higher internal funds, leading to a decrease of the lender's risk and to an increase in the demand price of capital assets due to expectations of higher quasi-rents in the future. Moreover, the borrower's risk also decreases, due to an increase in the capitalization rate associated with a change in the portfolio composition towards non-monetary assets as a result of a rise in liquidity featured in prosperity periods.

As the cycle continues its expansionary stage, two conditions must be met in order to truly increase the instability of the economic structure (Minsky, 1995): *i*) debt commitments must grow at a pace faster than the underlying gross profits associated with those debts; and *ii*) short-term debt financing increases in relation to long-term debt and equity financing.

Furthermore, this scenario makes a greater number of economic units more dependent on the normal functioning of financial markets into which debt can be rolled over. This behavior can also be seen through the higher and increasing necessity of asset liquidity by economic agents. Therefore, the normal functioning itself depends on the realization of optimistic expectations that sometimes are not fulfilled due to the unpredictability of the future. The unfulfillment of these expectations is followed by a later generalized attempt to sell assets with a higher degree of illiquidity in order to raise cash and meet debt commitments. This results in a devaluation of these assets and a decrease in the demand price of capital goods.

Regarding interest rates, Minsky argues that the process described above could raise the short-term interest rate and also the long-term interest rate by combining a rising inelastic demand for financing, due to the increasing necessity to roll over the debt as investment continues, and an inelastic (or less than infinitely elastic) supply of finance. This increases the short-term interest rate. A sharp rise in the short-term interest rate raises the long-term interest rate through a change in market conventions. A rise in the short-term interest rate increases the supply price of investment by raising its cost. In turn, a rise in the long-term interest rate negatively affects income expectations, lowering the demand price of capital assets. These two movements (a rise in the supply price of investment and a decrease in the demand price of capital assets) will reduce investment, which will lead to lower expected profits. Furthermore, declines in expected profits deteriorate firms' cash conditions to fulfill debt obligations, raising both the borrower's and the lender's risk. This will lead to a new and reinforcing decrease in investment, engendering a process of deleveraging.

Several formalizations of Minsky's argument emerged in the past decades. Nikolaidi and Stockhammer (2017) split the formalization of Minsky's models between eight different groups led by two distinct dynamics. Regarding debt or interest rates dynamics, they highlight: *i*) Kalecky-Minsky models; *ii*) Kaldor-Minsky models; *iii*) Goodwin-Minsky models; *iv*) credit rationing models; *v*) endogenous target debt ratio models; and vi) Minsky-Veblen models. Considering asset price dynamics, they distinguish between models dealing with equity prices and those dealing with real estate prices. Focusing on Kalecky-Minsky models (Meirelles and Lima, 2006; Charles, 2008; Fazzari et al., 2008), Nikolaidi and Stockhammer (2017) argue that this framework follow a structure in which output is demand-determined, the goods market is

stable, and the debt-capital ratio appears as an index of financial instability. In general terms, these models combine both retained earnings and bank loans to finance investment activity. There is no equity market and, consequently asset prices are not considered.

Summarizing, according to the financial instability hypothesis, a rise in investment will unambiguously be followed by a rise in the leverage ratio, i.e. upward phases of the cycle will be followed by a rise in the debt-capital ratio. Conversely, decreases in investment will lead to a reduction in the leverage ratio. However, it is important to emphasize that this analysis gives little attention to the impact of higher profits on internal funds, which is a crucial hypothesis for the movement of economic units towards more unstable positions. That is exactly the main point highlighted by the paradox of debt.

1.2. The paradox of debt

Lavoie and Seccareccia (2001) went in the opposite direction from the abovementioned hypothesis, analyzing financial cycles by assuming that the leverage ratio does not necessarily increase (decrease) in the upward (downward) phase of the cycle. They argue that, as investment increases, achieved aggregate profits are higher than expected aggregate profits, leading to an increase of retained earnings and of internal funds. As risk perception by lenders and borrowers changes during the cycle due to increases in investment leading to higher profits, internal funds and finance conditions must also change, breaking the assumptions of the FIH in a representative firm framework.

Accordingly, Bellofiore and Halevi (2011) argue that, although firms do borrow and make debt commitments at the micro level, new profits are realized in new sectors once firms undertake investment in capital goods and new plants. In a nutshell, what they argue is that a logical construction for the micro level may not make sense once one incorporates effective demand and demand-led profit equations, leading to a fallacy of composition.

Ryoo (2013) defines the argument as a phenomenon in which the individual attempts to reduce their indebtedness by cutting investment, leading to an increase in indebtedness itself due to the impact of lower investment on aggregate demand. Delli Gatti and Gallegati (1990) try to incorporate in a formal model Kalecky, Keynes, and Minsky's arguments by taking effective demand into account and finding that FIH does not hold in all possible scenarios, i.e. the leverage ratio does not need necessarily rise once the cycle expands. In conclusion, once one tries to incorporate Minsky's theory as a representative firm framework into the macro level, the paradox of debt implies that some theoretical macroeconomic obligations are not very consistent with effective demand and Keynes' framework.

2. The model

We assume a one sector closed economy with no government activity. Production requires only labor and capital, and labor emerges as the only variable cost. The market is not complete, assuming an oligopolized production structure with idle capacity utilization. We do not assume overhead labor.

Focusing on the behavior of the interest rate, we suppose the horizontalist view whereby interest rates are exogenously determined by the central bank due to its role as lender of last resort (Moore, 1979; Kaldor, 1986). This approach is often assumed, as in Meirelles and Lima

(2006), Lavoie (1995) and other neo-Kaleckian models that try to incorporate interest rates and finance restrictions.

Total national income is:

$$Y = W + R \tag{1}$$

where Y represents total output, W total income of workers and R total income of capitalists. The wage income is given by $W = wL$, where w is the nominal wage rate and L is the level of employment. The level of employment is then determined by:

$$L = bY \tag{2}$$

where $b = L/Y$ is the labor required per unit of final output. We follow Kalecki (1971) to propose an oligopolistic sector applying a fixed mark-up rate (τ) over prices (p). Formalizing:

$$p = \tau bw \tag{3}$$

where $\tau > 1$ is exogenously determined. From equation (3), we have the profit share (h) and the wage share (φ), respectively defined as:

$$h = \frac{\tau - 1}{\tau} \tag{4}$$

$$1 - h = \varphi = \frac{1}{\tau} \tag{5}$$

Therefore, changes in the mark-up rate itself determine income share variations for the two classes. In turn, the mark-up rate represents Kalecki's argument of the monopoly power of firms (Kalecki, 1971).

We represent the profit rate as:

$$r = \frac{R}{K} = \frac{R}{Y}\frac{Y}{K} = hu \tag{6}$$

where K is the stock of capital and $u = Y/K$ is a proxy for capacity utilization.

We follow Meirelles and Lima (2006) by assuming two different sectors in the capitalist class, the rentiers and the productive firms:

$$rK = r_r K + r_f K \tag{7}$$

where r_r represents the share of the rate of profit accruing to the rentier sector and the cost of debt itself, and r_f the share of the rate of profit of the productive firms. The division between capitalists' incomes depends on the stock of debt of the productive firms with the rentier sector, given by:

$$r_r = i\theta;\ \theta = \frac{D}{K} \tag{8}$$

where θ is the leverage ratio (or the debt-capital ratio), i is the nominal interest rate and D is the stock of debt. Therefore, a rise either in the interest rate or in the debt-capital ratio represents a net transfer from the productive firms towards the rentier capitalists. We abstract from explicit changes in the leverage ratio nor in the interest rates, though we assume some of their associated effects, especially internal and external funds' variations during the economic cycle. Therefore, we assume the shares of profits of rentiers and productive firms as constant.

In Minsky, internal funds are central to the investment decisions of the firms (Minsky, 1975). Following the formalization of Delli Gatti et al. (1994), we define internal funds (IF) of the current period as the difference of the gross profits and the cost of debt:

$$IF = a_1 hKu - a_2 i\theta u \quad (9)$$

where a_1 and a_2 are both positive and determine the sensitivity of internal funding with respect to the profit rate and the cost of debt, respectively. Once we insert u in the second term of the right side equation too, we make it dependent on the cyclical variation itself. In the case that gross profits' sensitivity with respect to the economic cycle is higher than the leverage ratio's sensitivity, we obtain a paradox of debt scenario. Otherwise, internal funding decreases and firms become more dependent on banks' finance, which validates Minsky's framework. Formalizing:

$\frac{\partial IF}{\partial u} \lessgtr 0$

where the positive (negative) result of the equation leads to the paradox of debt (FIH). In explicit terms, $\partial IF/\partial u = a_1 hK - a_2 i\theta$.

We determine the desired rate of accumulation g^i as:

$$g^i = \frac{I}{K} = \alpha_0 + \alpha_1 h + \alpha_2 u + \alpha_3 IF + \alpha_4 f_b \quad (10)$$

where all coefficients are positive, I/K represents the desired rate of investment normalized by the capital stock, and f_b represents banks' external finance to investment. We follow Kalecki (1971), Rowthorn (1981), and Dutt (1984) by explicitly emphasizing the importance of internal funding to facilitate accumulation plans and financing restriction relief. Equation (10) represents an augmented function of the Bhaduri and Marglin (1990) model, enabling either profit-led or wage-led regimes of accumulation in a neo-Kaleckian structure. In turn, external finance is also positively related with accumulation plans by enabling it to raise investment beyond retained earnings in spite of the equity market's conditions (Stiglitz, 1993). Capacity utilization emerges as one main determinant of investment demand in order to respond to unanticipated movements of demand (Steindl, 1952). Although we explore the endogeneity of capacity utilization, we will consider different capacity utilization stages to reflect different stages of the economic cycle.

To capture the correlation between internal funds and external financial needs (f_b), consider:

$$f_b = b_1 - b_2 d_0 \frac{\partial IF}{\partial u} h \quad (11)$$

where all coefficients are positive, and b_1 is an autonomous parameter that inversely varies with the liquidity preference of banks. In high (low) liquidity preference scenarios, b_1 is low (high). The second term represents the variation of the channel of external credit when facing internal financing variations during the economic cycle. Moreover, we feature $d_0 = 1$ when the cycle is on its upward phase and $d_0 = 0$ when the cycle is in its downward period, the latter representing a cease of external credit.

The profit share h in the second term incorporates both hedge, speculative and Ponzi unit firms. A higher effect of the leverage ratio, leading to $\partial IF/\partial u < 0$ drives more economic units towards speculative and Ponzi positions. This enhances the financial instability of the economic cycle. In this scenario, firms then become more sensitive to financial availability in the investment function by rising f_b. Moreover, this changes the composition of h towards more speculative and Ponzi units. This leads to an even higher rise in the demand for credit due to both an increase of financial debts' cost and a higher necessity to roll over the debt.

However, in the downward period of the cycle, when uncertainty is high and banks are less willing to lend, the scenario changes significantly. Only hedge firms manage to play an active role in capital accumulation due to their equity finance. Therefore, consumption becomes more important in a period where financial availability is harmed (a lower f_b), followed by a process of deleveraging.

In the case where the leverage ratio has a lower effect than retained profits in the upward phase of the cycle, $\partial IF/\partial u > 0$, the external finance need decreases, thus favoring consumption towards a more wage-led path.

To analyze financial effects in the desired rate of accumulation, we replace (11) and (9) in (10), so that:

$$g^i = \frac{I}{K} = \gamma_0 + \alpha_1 h + \alpha_2 u + \gamma_1 huK - \gamma_2 i\theta u - \gamma_3 d_0 h \frac{\partial IF}{\partial u} \tag{12}$$

where $\gamma_0 = \alpha_0 + \alpha_4 b_1, \gamma_1 = \alpha_3 a_1, \gamma_2 = \alpha_3 a_2$ and $\gamma_3 = \alpha_4 b_2$.

We reach a neo-Kaleckian equilibrium when $I/K = S/K$, where S represents aggregate savings. This scenario allows us to analyze capacity utilization as the adjustable variable. We assume the classical Kaleckian hypothesis that aggregate savings arise from the capitalist class whereas workers spend all of their income. As the focus proposed here is to analyze the behavior of demand regimes during the economic cycle through exogenous income distributions, we will only consider the savings of the capitalist class as a whole. To simplify, we will assume that the propensities to save between the two capitalists classes are the same. Formalizing:

$$g^s = \frac{S}{K} = \frac{sR}{K} = s\frac{R}{Y}\frac{Y}{K}$$

$$g^s = \frac{S}{k} = shu \tag{13}$$

In equilibrium, $g^s = g^i$:

$$u^* = \frac{\gamma_0 + \alpha_1 h - \gamma_3 d_0 h \frac{\partial IF}{\partial u}}{(s - \gamma_1 K)h + \gamma_2 i\theta - \alpha_2} > 0 \tag{14}$$

so that the Keynesian stability condition holds. We focus our analysis on four cases: *i*) the expansion cycle underlying the paradox of debt hypothesis; *ii*) the expansion cycle underlying Minsky's FIH; *iii*) the downward period of the cycle underlying the paradox of debt; and *iv*) the downward period of the cycle underlying Minsky's FIH. As a reminder, we call $d_0 = 0$ when the cycle is on its downward phase, and $d_0 = 1$ otherwise. There are two different scenarios of u coming from this specification, which lead to two different degrees of capacity utilization. Formalizing:

$$u_1^* = \frac{\gamma_0 + \alpha_1 h - \gamma_3 h \frac{\partial IF}{\partial u}}{\phi} > 0 \tag{15}$$

$$u_2^* = \frac{\gamma_{0\prime} + \alpha_1 h}{\phi} > 0 \tag{16}$$

where $\phi = (s - \gamma_1 K)h + \gamma_2 i\theta - \alpha_2$, and the superscript * denotes the upward phase of the cycle. We assume $u_2 < u_1$, followed by $\gamma_{0\prime} < \gamma$ due to a higher liquidity preference of banks in the former equation (i.e. in the upward phase of the cycle), captured by the autonomous term. Therefore, we suppose that this effect overcompensates the negative effect of internal finance in the first scenario of capacity utilization, $\partial IF/\partial u > 0$.

In order to analyze the economy in growth terms (g), we replace both specifications, u_1^* and u_2^*, in (13), which leads, respectively, to:

$$g_1^* = \frac{\left(\gamma_0 + \alpha_1 h - \gamma_3 h \frac{\partial IF}{\partial u}\right) sh}{\phi} \tag{17}$$

$$g_2^* = \frac{(\gamma_0 + \alpha_1 h) sh}{\phi} \tag{18}$$

As $u_1 > u_2$ by hypothesis, it follows that $g_1 > g_2$ also holds since sh multiplies both terms. This way we highlight the fact that the growth rate is higher in expansion phases of the cycle. Replacing (15) and (16) in (6), we state that the profit rate too is higher in the upward phase:

$$r_1^* = \frac{(\gamma_0 + \alpha_1 h - \gamma_3 \partial IF/\partial u) h}{\phi}$$

and

$$r_2^* = \frac{(\gamma_0 + \alpha_1 h) h}{\phi}$$

where $r_1^* > r_2^*$.

Deriving (15) with respect to h in order to analyze the demand regime:

$$\frac{du_1}{dh} = \frac{1}{\phi}(\alpha_1 - \gamma_3(\frac{\partial IF}{\partial u} + a_1 hK) - u_1^*(s - \gamma_1 K)) \lesseqgtr 0 \tag{19}$$

If the resulting sign is positive, the demand regime is profit-led in the upward period of the cycle. If it is negative, the demand regime is wage-led. Under the paradox of debt scenario, $\frac{\partial IF}{\partial u} > 0$, the economy becomes more wage-led in the upward period of the cycle compared to Minsky's hypothesis. In the latter, firms become more dependent on external finance by rolling the debt itself. FIH consequently leads to less sensitivity with respect to capacity utilization responses resulting from consumption increases.

Now, deriving (16) with respect to h:

$$\frac{du_2}{dh} = \frac{1}{\phi}(\alpha_1 - u_2^*(s - \gamma_1 K)) \lesseqgtr 0 \tag{20}$$

This result allows us to compare the demand regime's behavior under the same economic scenario's hypothesis. This leads to a dubious scenario concerning the change of the demand regime's magnitude, if one tries to incorporate a comparison with the FIH scenario itself. If

$$-\gamma_3 \partial IF/\partial u + \gamma_3 a_1 hK > (u_1 - u_2)(s - \gamma_1 K)$$

the economy becomes more wage-led compared to the upward period under the same hypothesis (i.e. either FIH or paradox of debt). As commented before, the unwillingness of banks to lend in a high liquidity preference scenario raises the relative importance of hedge units in the composition of the profit share. These units often recur to equity markets and are more sensitive to consumption variations to adjust excess capacity utilization. If the above inequality is reversed, the economy becomes more profit-led due to a strong capacity utilization effect on the multiplier related to investment. If one tries to incorporate both phases under the paradox of debt scenario, the economy always becomes more wage-led in expansion cycles in comparison with the downward scenarios. That relates to higher availability of credit as the cycle continues, leading to higher capacity utilization sensitivity of consumption

variations. The opposite applies when the cycle is on its downward phase. Model results are summarized in table 1.

Table 1 – *Model results*

Hypotheses	Cycle	Demand-regime	Necessary condition
Paradox of debt	Upward phase	More wage-led	
	Downward phase	More profit-led	
FIH	Upward phase	More profit-led	$-\gamma_3(\partial IF/\partial u + a_1 hK) > (u_1 - u_2)(s - \gamma_1 K)$
	Downward phase	More wage-led	$-\gamma_3(\partial IF/\partial u + a_1 hK) < (u_2 - u_1)(s - \gamma_1 K)$
Paradox of debt vs. FIH	Upward phase	More wage-led	

3. The periphery

Dow (1986) affirms that balance of payment surpluses increase the availability of finance in open economies, thus enhancing discrepancies among economies. Moreover, she argues that the international distribution of credit is non-neutral. This relates to an endogenous supply of money in which the credit supply of banks plays a crucial role in economic accumulation process by allowing investment to be realized in income generation processes (Dow, 1993; Rodríguez-Fuentes, 1998). Banks possess their own liquidity preferences according to certain perceptions of risk of the borrowers. Rodriguez-Fuentes (1998) also argues that economic scenarios changes that lead to a higher liquidity preference situation, affect the lender's behavior towards safer financial assets or units. Accordingly, peripheral regions assume a more unstable structure with regard to international capital flows.

Fritz et al. (2014) highlight the concept of currency hierarchy, where currency has a lower liquidity premium in peripheral countries compared to developed economies. Agents hold different financial assets in specific currencies in order to maximize their total expected earnings. The authors argue that expected appreciation will tend toward even more unstable and volatile scenarios in emerging countries due to their position at the lower end of this currency hierarchy scheme in the international monetary system. The latter is assumed to be a hierarchical and asymmetrical institutional arrangement orbiting around a key currency.[1]

More importantly, Dow (1993) affirms that international banks engage in activities that imply sovereign risk under conditions of uncertainty. In that way, they have a discretionary role in the volume distribution of international credit. Risk perception acts in a similar way within Minsky's framework by classifying countries as economic units according to their capacity to honor their outstanding debt by obtaining foreign currency. Several authors, such as de Paula and Alves Jr. (2000), Resende (2005), and López (1997), applied this framework in order to analyze exchange rate crises in emerging countries. Nevertheless, constraints are more severe within countries as opposed to within firms. While the latter solely include the expectation of a return, represented mostly by the profit rate, the former relates to balance-of-

[1] Something also highlighted by Eichengreen et al. (2007).

payments (BOP) constraints. Therefore, financial cycles in periphery economies depend mostly on their capacity to repay debt in foreign currency. This relates with an 'original sin' hypothesis: the incapacity of financing trade deficits in their own currencies in the first place. Thus, asymmetry in credit distribution in international markets emerges due to different classifications of economic units. According to Resende (2005), countries classified as speculative/Ponzi are the ones that have less capacity to generate net foreign currencies surpluses.

Complementarily, Albuquerque (1999) classifies developing economies as the ones exhibiting an incipient National System of Inovation (NSI). Fajnzylber (1983) argues that technological progress and its spillovers towards productivity and competitiveness of an economy have a localized and a concentrated aspect in geographical terms. In this context, a least developed NSI leads to less competitiveness and technological progress. Accordingly, the productive structure is less diversified, implying higher imports relatively to exports. Prebisch (1949) focused his analysis on the structural type of insertion of Latin America into international trade as "backward" countries. He highlighted the mismatch concerning the high income-elasticity of imports and the low income-elasticity of exports leading to a BOP crisis and stop-and-go growth cycles. Thirlwall (1979) then introduced the idea of a growth rate compatible with BOP constraints, adapting Prebisch's insights (McCombie and Thirwall, 1994). Resende and Torres (2016) go beyond this by arguing that NSI are crucial in determining trade income-elasticities themselves, affecting growth rates compatible with a BOP equilibrium and a catch-up model of historical processes. Therefore, an incipient NSI of emerging countries leads to a structural scenario of external vulnerability and a trend towards a chronic shortage of foreign exchange. With this theoretical framework in mind, we are able to classify developing economies as speculative or Ponzi.

On this subject, Resende and Amado (2007) suggest a reflection-cycle for underdeveloped economies with respect to developed ones. The periphery tend to absorb the center's willingness to lend and finance credit towards more speculative markets in upward phases of the cycle. International banks amplify their loans through financial innovations, managing to reach more speculative units. When perception of risks change unfavorably, emerging countries face huge capital outflows, which lead to currency and exchange rate crises.

Therefore, the trade elasticities ratio of demand emerges as the main determinant of finance investment availability. In underdeveloped economies, this ratio tends to be low, reflecting not only an asymmetrical shortage of financial credit in downward phases of the cycle, but also an increase in the uncertainty perception directed towards these economies, resulting in decreases in the animal spirits of the economic environment.

3.1. The model

We assume again a one sector economy with no government activity. However, the economy is now open to international markets. Production still requires only labor and capital. Labor emerges as the only variable cost and the economy presents an oligopolized economic structure. Equations (1) through (9) still apply, and we now assume that external savings represent external trade balances. We suppose an initial condition of equilibrium in the trade account. Moreover, we assume that financial cycles both in the periphery and in the center countries occur simultaneously due to the spread effect of the latter into the former.

Formalizing external financing (f_p) of periphery firms, we get:

$$f_p = b_1 - b_2 d_0 \frac{\partial IF}{\partial u} h + b_3 \frac{e}{\pi} u \quad (21)$$

where all coefficients are positive. We define f_p as the external financing to peripheral countries; e is the income-elasticity of demand for exports, and π is the income-elasticity of demand for imports. We repeat the structure of equation (eq. 11), augmenting the last term on the right side equation above. The trade elasticities ratio captures the increasing trend of imports in the upward period of the cycle (times capacity utilization). As in the previous model, $d_0 = 1$ represents the financial cycle when it is increasing. We assume $d_0 = 0$ when the economy is in its downward period of the cycle, which results from a cessation of international credit affecting the supply of finance when facing high uncertainty perceptions.

Following Ribeiro et al. (2016) and Neto (2017), the elasticities-ratio of the demand function is positively correlated with the technological gap and has an ambiguous correlation with the wage share ratio. We define the former as the home country's technological capabilities in relation to the level of the foreign country's technological capabilities. It is associated with NSI's domestic development and the composition of the trade balance, which determines demand elasticities (Prebisch, 1949; McCombie and Thirlwall, 1994; Resende and Torres, 2016). The argument underlying the ambiguous correlation with the wage share represents a net effect between a decrease in the capitalists' demand for imports and an increase in the workers'. The formalization is as follows:

$$\frac{e}{\pi} = x_1 \pm x_2 \varphi + x_3 T \quad (22)$$

where x_1 is the autonomous term. x_2 and x_3 represent the trade elasticities ratio's sensitivity to the income share and the technological gap (T), respectively. All coefficients are positive.

We first assume that the net effect is positive, i.e., the increase of demand for imports by workers is not sufficient to compensate for the decrease in the demand for imports by capitalists due to the high demand for luxury goods of the latter (Ribeiro et al., 2016). Therefore:

$$\frac{e}{\pi} = x_1 + x_2(1 - h) + x_3 T \quad (23)$$

where $\varphi = 1 - h$ following the derivative structure of the first model.

We define S_e as the external savings representing a trade surplus (deficit) when it is negative (positive). Its derivative represents the external currency's channel variation weighted by the cycle variable. In turn, we define the external savings variation as follows:

$$\frac{\partial S_e}{\partial u} > 0$$

where trade deficits vary directly with respect to capacity utilization. Moreover, we assume that income redistribution towards the worker class increases income elasticities, following (23). Therefore, it has a positive effect on current account surpluses, i.e.:

$$\frac{\partial S_e}{\partial h} > 0$$

Replacing (23) in (21):

$$f_p = b_1 - b_2 d_0 \frac{\partial IF}{\partial u} h + b_3 x_1 u + b_3 x_2 (1 - h) u + b_3 x_3 T u \quad (24)$$

We now determine the desired rate of accumulation, g^i, as:

$$g^i = \frac{I}{K} = \alpha_0 + \alpha_1 h + \alpha_2 u + \alpha_3 IF + \alpha_4 f_p \quad (25)$$

Therefore, substituting (9) and (24) into (25) yields

$$g^i = \lambda_0 + \omega u + \alpha_1 h + \alpha_2 u + \alpha_3 IF - \lambda_1 d_0 h \frac{\partial IF}{\partial u} + \lambda_2 (1-h)u + \lambda_3 Tu \quad (26)$$

where $IF = \gamma_1 huK - \gamma_2 i\theta u$, $\lambda_0 = \alpha_0 + \alpha_4 b_1$ $\omega = \alpha_4 b_3 x_1$, $\lambda_1 = \alpha_4 b_2$, $\lambda_2 = \alpha_4 b_3 x_2$, and $\lambda_3 = \alpha_4 b_3 x_3$. In order to analyze the investment function of a "backward" open economy, we maintain the demand for investment as positively correlated with both capacity utilization and internal funds. The crucial change involves the external finance variable, which now includes trade elasticities weighted by capacity utilization. If the trade elasticities ratio is low, representing higher BOP constraints, investment demand is also low due to both less external finance availability and eventual import restrictions. The latter, in turn, lowers possible technological spillovers and productivity gains. This discussion may represent some of the features of the stop-and-go growth cycles literature.

We again assume the classical Kaleckian hyphothesis that workers consume all their income. Nevertheless, the savings function changes:

$$g^s = \frac{S}{K} = shu + S_e(h,u) \quad (27)$$

where S_e is an implicit function of h and u. Its derivatives have been defined above. Therefore, a Kaleckian equilibrium follows the same structure:

$$\frac{S}{K} = \frac{I}{K}$$

$$u^* = \frac{\lambda_0 + \alpha_1 h - \lambda_1 d_0 h \frac{\partial IF}{\partial u} + S_e(h,u)}{(s-\gamma_1 K)h + \gamma_2 i\theta - \alpha_2 - \omega - \lambda_2(1-h) - \lambda_3 T} > 0 \quad (28)$$

in order for the Keynesian stability function to still hold. Assuming an upward phase of the financial cycle, i.e. $d_0 = 1$, capacity utilization is:

$$u_4^* = \frac{\lambda_0 + \alpha_1 h - \lambda_1 h \frac{\partial IF}{\partial u} + S_e(h,u)}{\Phi} > 0 \quad (29)$$

where $\Phi = (s-\gamma_1 K)h + \gamma_2 i\theta - \alpha_2 - \omega - \lambda_2(1-h) - \lambda_3 T$. In turn, capacity utilization in the downward phase of the cycle ($d_0 = 0$) is:

$$u_5^* = \frac{\lambda'_0 + \alpha_1 h + S_e(h,u)}{\Phi} > 0 \quad (30)$$

in order that $u_4^* > u_5^*$ is guaranteed by assumption, representing the cycle movement (as above, the asterisk representing the autonomous parameter when the cycle is on its upward phase). In addition, $\lambda_0 > \lambda'_0$, due to a higher international liquidity preference scenario.

Now we analyze capacity utilization compatible with BOP constraints. As we depart from a previous international trade equilibrium condition when $S_e(h,u) = 0$, it follows that we require no trade balance variations to reach it. Therefore, the resulting u_4 and u_5 compatible with BOP constraints are respectively:

$$u_4^{BOP} = \frac{\lambda_0 + \alpha_1 h - \lambda_1 h \frac{\partial IF}{\partial u}}{\Phi} > 0$$

and

$u_5^{BOP} = \frac{\lambda_{0\prime} + \alpha_1 h}{\Phi} > 0$

so that $u_4^{BOP} \geq u_5^{BOP}$. In the paradox of debt scenario, i.e. $\partial IF/\partial u > 0$, the assumption holds only when $\lambda_0 - \lambda_{0\prime} \geq \lambda_1 h \partial IF/\partial u$. Therefore, we notice that even in an initial equilibrium condition capacity utilization has a short variation margin in this case, due to $\partial S_e(h,u)/\partial u > 0$. In turn, the growth rates compatible with BOP constraints are:

$g_4^{BOP} = (\frac{\lambda_0 + \alpha_1 h - \lambda_1 h \frac{\partial IF}{\partial u}}{\Phi}) sh > 0$

$g_5^{BOP} = (\frac{\lambda_{0\prime} + \alpha_1 h}{\Phi}) sh > 0$

Deriving u_4^* with respect to h, we find the demand regime's condition. That is:

$$\frac{du_4^*}{dh} = \frac{1}{\Phi}[\alpha_1 - \lambda_1 \frac{\partial IF}{\partial u} - \lambda_1 a_1 hK + \frac{\partial S_e(h,u)}{\partial h} - u_4^*(s - \gamma_1 K + \lambda_2)] \lesseqgtr 0 \quad (31)$$

If the resulting sign is positive (negative), the economy is profit-led (wage-led).

As in the previous case, the underlying paradox of debt case, $\partial IF/\partial u > 0$, makes the economy more wage-led compared with the FIH framework. In order to analyze the downward phase and the economic cycle under the paradox of debt hypothesis conditions, we derive u_5^* with respect to h:

$$\frac{du_5^*}{dh} = \frac{1}{\phi}[\alpha_1 + \frac{\partial S_e(h,u)}{\partial h} - u_5^*(s - \gamma_1 K + \lambda_2)] \lesseqgtr 0 \quad (32)$$

As in our previous model, the paradox of debt scenario presents, in its upward phase, always more wage-ledness due to $u_4^* > u_5^*$ and $\partial IF/\partial u > 0$, and a higher amount of internal finance resulting from underestimated profits. In addition, the FIH scenario also presents an ambiguous effect with respect to income distribution movements. We have:

$-\lambda_1 \left(\frac{\partial IF}{\partial u} + a_1 hK\right) - (u_4^* - u_5^*)(s - \gamma_1 + \lambda_2) \lesseqgtr 0$

If the resulting sign is positive (negative), the upward phase is characterized by more profit-ledness (wage-ledness), followed by more wage-ledness (profit-ledness) in the downward (upward) phase. In economic terms, once the impact of decreasing internal funds is significant, requiring additional external credit demand, the economy tends to be more profit-led in an economic upturn. This happens even with higher capacity utilization degrees ($u_4^* > u_5^*$) due to the loss of consumption responses in intense FIH situations. If the effect with respect to internal funds is not very significant, the latter effect overcompensates the former, allowing for a more wage-led situation. The results are summarized in table 2.

Table 2 – *Periphery model results*

Hypotheses	Cycle	Demand-regime	Necessary condition
Paradox of debt	Upward phase	More wage-led	
	Downward phase	More profit-led	
FIH	Upward phase	More profit-led	$-\lambda_1(\partial IF/\partial u + a_1 hK) > (u_4^* - u_5^*)(s - \gamma_1 K + \lambda_2)$
	Downward phase	More wage-led	$-\lambda_1(\partial IF/\partial u - a_1 hK) < (u_4^* - u_5^*)(s - \gamma_1 K + \lambda_2)$
Paradox of debt vs. FIH	Upward phase	More wage-led	

Summarizing, once we include some other effects in the periphery case, specifically the behavior of financial capital and external vulnerability, we highlight a reflection cycle, in a more robust and indirect manner than the literature considers. The underdeveloped economies reflect the capital movements in the center economies; in other words, growth cycles in the peripheral countries are positively correlated with the liquidity preference in the center economies due to external vulnerability.

4. Conclusions

We propose a synthesis between neo-Kaleckian models and models of financial cycles including both the financial instability hypothesis (FIH) and the paradox of debt. We focused on how demand regimes behave in two different phases of the economic cycle, allowing for both profit-led and wage-led regimes. In the paradox of debt scenario, the economy may always become more wage-led in the upward phase of the cycle if one compares it with the FIH scenario.

Moreover, we present a center-periphery framework to analyze financial cycles. The main assumption is that a financial understanding of underdeveloped economies is inseparably associated with external vulnerability. Therefore, trade elasticities emerge as a reflection of the external vulnerability of these countries in a non-neutral international credit market. As a result, connections with respect to demand regimes become less direct. Nevertheless, most of the results in our closed-economy case still hold, thus leading to a reflex-cycle of periphery countries in comparison to advanced ones.

These results allow us to infer some aspects regarding public policies and functional income distribution. On the one hand, if the economy is in a paradox of debt situation, the upward phase of the cycle may present higher possibilities for income redistribution towards the workers' class compared to the FIH framework. In these circumstances, more wage-ledness in these scenarios may induce both a higher profit rate for capitalists and an increase in effective demand, enabling a more 'cooperative' capitalism. However, the downward phase of the cycle is characterized by a more conflictual scenario, where capitalists aim to protect their profit margins by cutting costs, thus highlighting a more profit-led regime. Policymakers may try to seek a more harmonious environment by increasing public expenditure counter-

cyclically (e.g., increasing capitalists' subsidies in the short run). In that way, economic structures may rapidly recover without prejudicing the wage share.

On the other hand, if the economy is in a FIH scenario, some features of the system may differ. In order for the economy to present a more profit-led scenario in the expansion, the negative response of internal funds with respect to capacity utilization must be extremely large. Otherwise, the scenario described above generally holds, although in smaller relative magnitudes.

If one specifically takes into account our center-periphery model, other aspects become relevant. As now we are appraising an open economy's situation, BOP constraints and their relationship with the NSI structure are one of the main features. Regardless of the financial scenario adopted, if we take equation (23) as a valid assumption for 'backward' countries, income redistribution towards workers always improves both trade elasticities and the external trade situation. One may justify this assumption by highlighting capitalists' higher propensity to import in these "backward" societies, as argued by Nurkse (1952) and most of the economists of the Economic Commission for Latin American Countries and the Caribbean (ECLAC). Another possible explanation is provided by Storm and Naastepad (2013), who present an "Arrow parameter" according to which higher wage increases induce capitalists to innovate, thus favoring catch-up processes. In contrast, Lima (2004) argues that the innovation process relates with the wage share in a non-linear way. Besides, NSIs actually require more robust public and private investment to overcome the external vulnerability structure of these economies, combining infrastructural investment, deliberate innovation programs, and trade export policies. Therefore, income redistribution may only partially improve this picture, though it is still an important aspect of the discussion.

In historical terms, a center-periphery framework may partially justify different international economic trends regarding functional income distributions and economic cycles. While in the first eight years of the century, South American countries achieved high growth rates combined with wage-led policies, the center countries presented positive, although short, economic growth accompanied by profit-led and financial-led policies (Lavoie and Stockhammer, 2013). Different financial cycles (i.e., FIH or the paradox of debt) or different magnitudes of the parameters may represent possible and valuable explanations of this recent experience.

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