Effective demand and growth: an analysis of the alternative closures of Keynesian models*

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Abstract

This paper presents a one-sector model where investment and autonomous expenditures determine the growth rate of income. The analysis starts with the dynamics of demand-led growth and the interaction between investment and autonomous expenditures. Since by definition investment determines the growth rate of capital, the paper then uses the relation between demand-led growth, multifactor productivity growth, and labor-force growth to analyze the alternative closures of the supply side. After discussing how a partially endogenous labor force and multifactor productivity may relax supply constraints, the paper shows how changes in the average propensity to save may accommodate investment and autonomous expenditures when the economy reaches its maximum growth rate. Since nothing prevents the functional distribution of income from changing before that happens, the paper concludes with a two-species model (for the labor share of income and the income-capital ratio) to illustrate how demand-led growth can generate business fluctuations while remaining below supply constraints.

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1 Introduction

According to mainstream economic theory growth is fundamentally a supply phenomenon. Little or no attention is paid to demand on the assumption that effective income always converge to its potential level, which in its turn is defined as the long-run trend of effective income with the aid of some ad hoc specification of the "natural" rate of employment, the "normal" rate of capacity utilization, and the "long-run" rate of multifactor productivity growth.[1] Given the growth rate of the labor force and the optimal propensity to save, variations in growth rates are explained by technological change and, since the seminal work of Romer (1986), the so-called "new growth theory" has developed into a series of models that make productivity growth endogenous. Fair but not enough.

The history of capitalist economies indicates that demand has an important role in explaining growth. For instance, how can one explain the Great Depression and World War II boom in the US just from the supply side? How can one explain the postwar growth of East Asian economies without mentioning export promotion? How can one explain the postwar growth of Latin America without mentioning import substitution? The list goes on and although in each case one can always map income to input and productivity indexes ex-post, this does not explain what caused growth in the first place. In capitalist economies one does not necessarily produce what one can, but actually what one expects to sell and make a profit. Mainstream growth theory offers us a good analysis of how inputs can be combined to attend demand but to understand the latter we have to look elsewhere.

Economists working on Keynes's ideas usually put demand on the center of their growth theories. The labels and models vary across authors but the unifying principle is that aggregate demand determines aggregate income in capitalist economies, both in nominal and real terms. The crucial question is thus: what drives aggregate demand and how does it interact with supply constraints and income distribution? The answers vary across authors and the objective of this paper is to analyze these answers in a common framework. In the jargon of Structuralist Macroeconomics, the aim is to analyze the alternative "closures" of Keynesian models through a one-sector model of capitalist economies.[2]

[1] For the assumptions implicit in estimates of potential income, see Clark (1979) and Congressional Budget Office (1995).

[2] In the words of Taylor (1991, p.41): "Formally, prescribing closures boils down to

The text is organized in four sections in addition to this introduction. Section two presents the dynamics of demand-led growth and analyze under which conditions investment and autonomous expenditures can drive income without resulting in an explosive income-capital ratio. Section three analyzes the supply constraints on demand-led growth and shows how income distribution may accommodate investment and autonomous expenditures when the economy reaches its maximum growth rate. Section four analyzes the joint dynamics of income distribution and economic activity, showing how capitalist economy may display well-defined business fluctuations around a demand-determined growth path. Section five concludes the analysis with a summary of the main points of the paper.

2 Demand-led Growth

The first step of our analysis is to define the dynamics of demand-led growth. To keep the analysis as simple as possible, consider a one-sector economy with homogeneous capital and labor. From the demand side the real income of this economy can be expressed as

$$Q = C + I + A \tag{1}$$

where Q is income, C the part of consumption induced by income, I investment, and A the other autonomous expenditures, that is, net exports plus autonomous consumption. Government expenditures are implicit in the three demand categories and imports of goods different than the domestic one do not enter in the identity because they are not produced by the economy in question. Assuming that C is a linear function of Q, we can rewrite (1) as

$$Q = \frac{I + A}{s} \tag{2}$$

where $s = 1 - C/Q$ is the marginal propensity to save. In growth terms

stating which variables are endogenous or exogenous in an equation system largely based upon macroeconomic accounting identities, and figuring out how they influence one another. When one is setting up a practical model for any economy, the closure question becomes less abstract and of much greater economic interest, transforming itself to one of empirically plausible signs of "effects" and – more important – a perception of what are the driving macroeconomic forces in the system. A sense of institutions and history necessarily enters into any serious discussion of macro causality." For an outline of Structuralist Macroeconomics, see Taylor (1983).

$$q = \theta i + (1-\theta)a - \frac{1}{s}\frac{\mathrm{d}s}{\mathrm{d}t} \tag{3}$$

where $\theta = I/(I+A)$ is the share of investment in autonomous expenditures and q, i, and a are the exponential growth rates of Q, I, and A respectively.

By definition θ is itself a function of i and a since

$$\frac{\mathrm{d}\theta}{\mathrm{d}t} = \theta(1-\theta)(i-a) \tag{4}$$

and, therefore

$$\theta = \frac{1}{1+\chi e^{-(i-a)t}} \tag{5}$$

where t represents time and χ is a constant given by the initial value of θ.[3] It is straightforward that there are three possible cases in (5), namely: $i = a$ and θ is stable, $i > a$ and θ converges to one, and $i < a$ and θ converges to zero.

Assuming for the moment that s is constant, when $i > a$ income growth eventually converges to investment growth and the economy reaches a steady state with a stable income-capital ratio. In contrast, when $i < a$ income growth eventually converges to autonomous expenditures' growth and stays permanently above investment growth. The consequence is an explosive income-capital ratio, that is, a mathematical possibility with no economic sense since capitalist economies usually display stable income-capital ratios.

The sensible economic closure is thus for i and a to fluctuate but not to drift apart permanently. What leads and what lags varies across models and there are basically three closures to demand-led growth.

First, in line with Keynes's *General Theory*, most Keynesian authors emphasize investment as the driving force of aggregate demand. The original hypothesis is that liquidity (the interest rate) and long-run expectations (the marginal efficiency of capital) determine investment and income follows residually from the multiplier. The causal chain is usually intensified by adding an accelerator mechanism of income on investment and the extensions include expressing investment as a function of the rate of profit and some key financial ratios of firms (like debt-profit or debt-equity ratios).[4]

[3] Let θ_0 be the value of θ when $t = 0$, from (5) $\chi = (1-\theta_0)/\theta_0$.

[4] The classic references on the multiplier-accelerator mechanism are Samuelson (1939)

Second, Keynesian authors working with open models tend to emphasize net exports as the driving force of aggregate demand in small economies. The common hypothesis is that no economy can have an explosive trade with the rest of the world, meaning that its export-income and import-income ratios should be stable in the long-run. The adjustment mechanism involves changes in real exchange rates and, from the assumption that the economy in consideration is small in relation to the rest of the world, the growth rate of exports determines the growth rate of income (and imports) in the long run.[5]

Third, some Keynesian authors argue that autonomous consumption can also be the driving force of aggregate demand. The inspiration is Keynes's (1936, p.220) anecdotal suggestion that digging holes in the ground may increase aggregate demand, which in practice is usually the role of military expenditures. Private consumption is also a possibility, especially when speculative bubbles result in a temporary and substantial increase in the financial wealth of households.[6]

The above closures are not mutually exclusive and one of the objectives of authors working on the integration of Keynes's and Marx's ideas is exactly to analyze how investment, consumption, and net exports feedback on each other and generate "waves" of demand expansion and capital accumulation.[7]

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and Hicks (1950), whereas the fundamental role of expectations and liquidity is usually emphasized by post Keynesian authors like Davidson (1972) and Minsky (1975). Building upon Kalecki's (1937) principle of increasing risk and Minsky's (1982) concept of financial fragility, some Keynesian authors have also included liquidity constraints in the determination of investment. For an analysis of the latter, see Fazzari, Hubbard, and Peterson (1988).

[5]The original work in this topic is Harrod's (1933) trade multiplier, which was later developed by Thirlwall (1979) into an export-led growth model. The latter has originated an extensive literature on the balance-of-payments constraint on growth, of which the main theoretical and empirical aspects can be found in McCombie and Thirlwall (1994). In Barbosa-Filho (2001a) I extended Thirlwall's trade model to allow for a sustainable accumulation of foreign debt.

[6]Historically, the emphasis on autonomous consumption is usually associated with "fiscalist" Keynesians like Hansen (1938 and 1941), who argue that an active fiscal policy is necessary to avoid a collapse of aggregate demand in face of sluggish investment. Given the current budget surpluses of the US government, the focus has recently shifted to private consumption, with special emphasis on the connection between speculative bubbles, debt-income ratios, and consumption. For an analysis of the latter see Godley (1999 and 2000).

[7]The classic references on the US experience are Baran and Sweezy (1966) and Bowles,

The result is a combination of History and Economics into the analysis of growth and transformation of capitalist economies along the lines of Schumpeter's "creative destruction."

Now, since our analysis is restricted to a one-sector model, there is limited room for creative destruction because only technology may change, the good is always the same. This does not preclude some interesting dynamics between investment and autonomous expenditures though. In fact, the crucial question in our model is how i and a interact to produce growth and a stable income-capital ratio.

To build a dynamical model of demand-led growth, let u be the income-capital ratio and k the exponential growth rate of capital. Assuming for simplicity that there is no capital depreciation, we have

$$k = su - h \tag{6}$$

where h is the ratio of autonomous expenditures to the capital stock, that is, the share of the capital stock that is "wasted" (not accumulated) to attend net exports and autonomous consumption.

In the literature on economic growth (6) is nothing more that an extension of Harrod's (1939) identity to include autonomous expenditures. Moreover, given the previous assumption that s is constant, (6) implies that u is stable as long as k and h are stable. We can thus analyze the evolution of u from the dynamics of k and h. By definition

$$\frac{\mathrm{d}k}{\mathrm{d}t} = k(i - k) \tag{7}$$

$$\frac{\mathrm{d}h}{\mathrm{d}t} = h(a - k) \tag{8}$$

where not surprisingly a non-trivial stationary solution occurs only when investment, capital, and autonomous expenditures grow at the same rate ($i = k = a$).

To move from accounting identities to theoretical relations we have to add some economic assumptions to (7) and (8). In Keynesian models it is common to assume that investment is a positive function of the level of economic activity because of the positive impact of the latter on the rate of profit. In terms of the model of this section this means that i is a positive function of u, which from (6) implies that i is a positive function of k and h.

Gordon, and Weisskopf (1984 and 1992).

Thus, given a and assuming that there exists at least one non-trivial equilibrium point (k_e, h_e), let $k_d = k - k_e$ and $h_d = h - h_e$ measure the deviation from such point.[8] In matrix notation the linearized version of (7) and (8) is simply

$$\begin{bmatrix} \mathrm{d}k_d/\mathrm{d}t \\ \mathrm{d}h_d/\mathrm{d}t \end{bmatrix} = \begin{bmatrix} -k + k\mathrm{d}i/\mathrm{d}k & k(\mathrm{d}i/\mathrm{d}h) \\ -h & 0 \end{bmatrix} \begin{bmatrix} k_d \\ h_d \end{bmatrix} \tag{9}$$

and the stability conditions are

$$k\left(\frac{\mathrm{d}i}{\mathrm{d}k} - 1\right) < 0 \tag{10}$$

and

$$kh\frac{\mathrm{d}i}{\mathrm{d}h} > 0 \tag{11}$$

Since i is a positive function of u, (11) is always satisfied and the system is locally stable about (k_e, h_e) as long as (10) is also satisfied. The intuition is that, given autonomous consumption and net exports, the impact of economic activity on investment should be smaller than its impact on savings, which is usually a stability condition imposed on Keynesian models to avoid "knife-edge" dynamics ala Harrod (1939).[9] Figures 1 and 2 show the two possible phase diagrams of k and h.

FIGURES 1 AND 2

In figure 1 (10) holds and the equilibrium is a stable node or focus. In figure 2 the opposite happens and the equilibrium is an unstable node or focus. In both figures the fluctuation around the equilibrium point is counter-clockwise, that is, k is the "predator" and h the "prey" in the dynamics of demand-led growth.

Focusing on the locally stable case, the waves of demand expansion and capital accumulation can be represented by changes in the position of the k and h "equilibrium" lines. For instance, an exogenous increase in the growth

[8] That is, an equilibrium point where k and h are positive. a is a constant to reduce the number of possible cases but it can also be a function of u without loss of generality.

[9] To see why saving enters in the picture, note that from the chain rule: $\mathrm{d}i/\mathrm{d}k = (\mathrm{d}i/\mathrm{d}u)(\mathrm{d}u/\mathrm{d}k)$. Thus, since from (6) $\mathrm{d}u/\mathrm{d}k = 1/s$, (10) holds if $\mathrm{d}i/\mathrm{d}u < s$ and vice versa.

rate of investment moves the k equilibrium line up, as shown in figure 3. The long-run result is a reduction in h with no change in the growth rate. By analogy, an increase in the growth rate of autonomous expenditures moves the h equilibrium line up, as shown in figure 4. The long-run result is an increase in both h and k.

FIGURES 3 AND 4

From figures 3 and 4 we can conclude that demand-led growth is consistent with a stable income-capital ratio, provided that investment does not show unstable dynamics ala Harrod (1939). The waves of demand expansion and capital accumulation can be represented by joint changes in the position of the equilibrium lines for k and h, with u following residually from (6). Thus, depending on the growth rate of non-investment autonomous expenditures, the economy may be at a slow-growth or fast-growth equilibrium.

3 Supply Constraints and Income Distribution

So far we analyzed demand dynamics without mentioning supply but one of the fundamental axioms of Economics is that resources are scarce. We have therefore to complement our investigation with an analysis of the supply constraints on demand-led growth.

Given its wide use in growth accounting, assume that supply can be described by a Cobb-Douglas function of degree one. The exponential potential growth rate q^* can thus be expressed as

$$q^* = m + \alpha k + (1 - \alpha)n \tag{12}$$

where m is the exponential growth rate of multifactor productivity, n the exponential growth rate of the labor force, and α a positive parameter between zero and one.

Focusing on the steady-state solution of the demand-led model of section one, we know that k equals q at the equilibrium point. So, assuming that the economy is at its maximum growth rate ($q = q^*$), the long-run constraint on demand-led growth can expressed as a function of m and n, that is

$$q = \frac{m}{1 - \alpha} + n \tag{13}$$

In words, technology (m) and demography (n) determine the potential growth rate of the one-sector economy under analysis. Not surprisingly, there are two ways to push this supply constraint up and we find variants of both in Keynesian models.

First, m can be itself a function of growth, so that a demand-led expansion ends up increasing the potential growth rate and financing itself in real terms. The inspiration are the so-called Kaldor-Verdoorn laws, according to which the faster the growth rate of manufacturing output, the faster the growth rate of labor productivity in manufacturing and outside manufacturing.[10] The basic idea is that scale and learning economies increase labor productivity in manufacturing and the gains eventually spill over to other sectors. In terms of our simplified representation, this means that m is a positive function of q in (13).

Second, n can also be a positive function of growth because a low rate of unemployment usually increases the participation ratio. The inspiration is Lewis's (1954) assumption that labor might not be a constraint on supply when there exists a non-capitalist sector from which capitalist firms can draw workers at a constant real wage. The dichotomy is usually between a capitalist industrial sector and a non-capitalist agricultural sector, but the modern variants of Lewis's work also point to disguised unemployment in informal and part-time jobs as the adjustment variable to changes in labor demand.[11] In terms of (13), this means that n is a positive function of q.

Now, it is reasonable to assume that the above closures lift but do not eliminate the supply constraints on demand-led growth. On the side of technology, innovations depend not only on demand stimulus but also on the supply of new ideas. Since the latter have a dynamics of its own, m has inevitably an exogenous component. On the side of labor, the working-age population times the maximum amount of work hours per day also imposes an inevitable constraint.

What happens when demand-led growth hits the supply constraint? The answer was given by Kaldor (1956) and it is already implicit in (3): the marginal propensity to save changes to accommodate demand. The basic idea stems from Kalecki's (1954) assumption that the marginal propensity to save out of labor income is smaller than the marginal propensity to save out

[10] For an analysis of the Kaldor-Verdoorn laws see Rowthorn (1975), Thirlwall (1983), Chatterji and Wickens (1983), and McCombie (1983).

[11] For a recent analysis of disguised unemployment, see Eatwell (1995 and 1997).

of capital income, so that s depends on the functional distribution of income. Formally

$$s = s_l l + s_k(1 - l) \tag{14}$$

where s_l and s_k are the marginal propensities to save out of labor and capital income respectively, and l is the labor share. By assumption $s_k > s_l$ with both parameters between zero and one.

Focusing on the equilibrium demand-led growth rate ($k = i = a$), consider once again the case where growth is at its maximum value ($q = q^*$). From (3), (13), and (14), it is straightforward that

$$\left(\frac{s_k - s_l}{s}\right)\frac{\mathrm{d}l}{\mathrm{d}t} = \frac{m}{1-\alpha} + n - i \tag{15}$$

so that the change in income distribution depends on the balance between the growth rate of potential income and the common growth rate of investment and autonomous expenditures.

When $i > [m/(1-\alpha)] + n$ the labor share of income falls to accommodate aggregate demand, that is, there exists a forced-saving mechanism to accommodate demand when the economy hits its supply constraint. The functional distribution of income becomes the adjusting variable on the assumption that the real wage grows slower than labor productivity when $i > q^*$.

Another way of looking at the same mechanism is to use (6) to represent the supply constraint. More specifically, if we assume for the moment that there exists a constant and maximum income-capital ratio $u_{\max}$, (6) gives us a trade-off between k and h, as shown in figure 5.

FIGURE 5

If the economy operates below the "kh" frontier given by $u_{\max}$, the labor share and the average propensity to save are stable. If the economy hits the "kh" frontier, the labor share falls and the marginal propensity to save goes up, so that the frontier itself moves up. However, the forced-saving mechanism is limited because s has an upper bound at s_k. The labor share of income cannot fall below zero and the crucial question becomes what determines the maximum income capital ratio. From the Cobb-Douglass production the change in $u_{\max}$ is given by

$$\frac{\mathrm{d}u_{\max}}{\mathrm{d}t} = u_{\max}\left[m + (1-\alpha)(n-k)\right] \tag{16}$$

In words, the change in the maximum income-capital ratio depends on technology (m), demography (n), and demand (k since $k = i = a$ at the steady-state). Moreover, if m and n are completely exogenous, an increase in demand-led growth has a negative impact on $u_{\max}$ according to (16). The reason is the that the average productivity of capital is a negative function of the capital-labor ratio in a Cobb-Douglas function.

From (16) we can also see that the maximum income-capital ratio varies in the opposite direction of the labor share when the economy reaches its potential growth level. More formally, $u_{\max}$ falls when $i > [m/(1-\alpha) + n]$ and increases when the reverse happen. The result is that the forced-saving mechanism outlined above may be compensated partially or fully by a fall in the average productivity of capital when autonomous demand growth exceeds potential income growth.

4 Business Fluctuations and Income Distribution

According to the previous section forced-saving enters in the picture only when the economy reaches its potential growth rate. However, the labor share of income may vary before that happens and not necessarily in a counter-cyclical way. In fact, the labor share of income may actually be pro-cyclical since the growth rate of the real wage is likely to be influenced by workers' bargaining power, which in its turn depends on the rate of unemployment.

Economists working on the integration of Classical and Keynesian ideas usually combine effective demand with social conflict in a model of income distribution and business fluctuations.[12] Like the issues analyzed in the previous sections, such kind of a model admits more than one closure and, therefore, the relation between the income distribution and business fluctuations is the last point of our analysis.

To simplify the exposition, let us now consider an one-sector economy with no autonomous expenditures other than investment. Since we are adding the labor share, we have to drop one variable to keep the model in just two dimensions. The obvious candidates are autonomous consumption and net exports because investment and capital accumulation are crucial to

[12] See, for instance, Marglin (1984), Dutt (1990), Taylor (1991), and Foley and Michl (1999).

understand economic growth.

Now, let the labor share of income and the income-capital ratio be our indexes of income distribution and economic activity.[13] By definition

$$\frac{\mathrm{d}l}{\mathrm{d}t} = l(w-b) \tag{17}$$
$$\frac{\mathrm{d}u}{\mathrm{d}t} = u(q-k) \tag{18}$$

where w and b are the exponential growth rates of real wage and labor productivity, respectively. From the Cobb-Douglas production function we have

$$b = \frac{m}{1-\alpha} + \frac{\alpha}{1-\alpha}(k-q) \tag{19}$$

whereas from (6) and (14) Harrod's identity is now

$$k = [s_l l + s_k(1-l)]u \tag{20}$$

Recalling that q is itself a function of the change in s, (17) and (18) can be rewritten as

$$\frac{\mathrm{d}l}{\mathrm{d}t} = l\left(w - \tilde{m} + \frac{\phi}{u}\frac{\mathrm{d}u}{\mathrm{d}t}\right) \tag{21}$$
$$\frac{\mathrm{d}u}{\mathrm{d}t} = u\left(i + \frac{\theta}{s}\frac{\mathrm{d}l}{\mathrm{d}t} - su\right) \tag{22}$$

where to simplify notation $\tilde{m} = m/(1-\alpha)$ is a linear and positive function of m and $\phi = [\alpha/(1-\alpha)]$ and $\theta = s_k - s_l$ are positive parameters. The reduced form is

$$\frac{\mathrm{d}l}{\mathrm{d}t} = xl\left[w - \tilde{m} + \phi(i - su)\right] \tag{23}$$

$$\frac{\mathrm{d}u}{\mathrm{d}t} = xu\left[i - su + \theta(l/s)(w - \tilde{m})\right] \tag{24}$$

[13] Assuming that there are just two classes (workers and capitalists), the choice of distributive variable does not matter. The choice of u to represent business fluctuations carries implicitly the assumption that capital and not labor is the scarce input in capitalist economies.

where again to simplify notation $x = [s/(s - \theta\phi l)]$ is a function of l.

Assuming that the labor share of income is close to the labor-elasticity of supply ($l \simeq 1 - \alpha$), x is positive and we can concentrate our investigation on the expressions within brackets.[14]

In economic terms, (23) and (24) form a 2x2 nonlinear system that describes the dynamics of income distribution (l) and economic activity (u) in terms of investment (i), savings (s), relative prices (w), and productivity ($\tilde{m}$). In (14) we already assumed that s is a function of l , without loss of generality, let us also assume that w is a function of u and i a function of l and u.

On the distributive side, the intuition is that real-wage growth is a function of the level of economic activity and we can find two alternative closures in Keynesian models. First, as we saw earlier, w is a negative function of u according to Kaldor's (1956) demand theory of income distribution. Second, w is a positive function of u according to the Marxian reserve-army assumption.

On the demand side, the intuition is that investment growth is a function of the rate of profit and, therefore, of the labor share of income and the income-capital ratio.[15] Notwithstanding the Capital Critique, most Keynesian models define investment as a positive function of the rate of profit, which in terms of the model of this section means that i is a positive function of u and a negative function of l.

Like we did in section one, assume that there exists at least one non-trivial equilibrium point (l_e, u_e) and let $l_d = l - l_e$ and $u_d = u - u_e$ measure the deviation from such point.[16] In matrix notation the linearized version of (23) and (24) is

$$\begin{bmatrix} \mathrm{d}l_d/\mathrm{d}t \\ \mathrm{d}u_d/\mathrm{d}t \end{bmatrix} = x \begin{bmatrix} l\beta_{11} & l\beta_{12} \\ u\beta_{21} & u\beta_{22} \end{bmatrix} \begin{bmatrix} l_d \\ u_d \end{bmatrix} \tag{25}$$

where to facilitate the exposition

$$\beta_{11} = \phi\left(\frac{\mathrm{d}i}{\mathrm{d}l} + \theta u\right) \tag{26}$$

[14] Formally, $x > 0$ if $s > \theta\phi l$. From the definitions of θ and ϕ the latter means that $s_k > (s_k - s_l)[l/(1-\alpha)]$, which is necessarily true when $l = 1 - \alpha$.

[15] By definition the rate of profit on fixed capital equals $(1 - l)u$.

[16] Once again, non-trivial means l and u positive.

$$\beta_{12} = \frac{\mathrm{d}w}{\mathrm{d}u} + \phi\left(\frac{\mathrm{d}i}{\mathrm{d}u} - s\right) \tag{27}$$

$$\beta_{21} = \theta\frac{s_k}{s^2}(w - \tilde{m}) + \frac{\mathrm{d}i}{\mathrm{d}l} + \theta u \tag{28}$$

$$\beta_{22} = \theta\frac{l}{s}\frac{\mathrm{d}w}{\mathrm{d}u} + \frac{\mathrm{d}i}{\mathrm{d}u} - s \tag{29}$$

So, even after many simplifying assumptions we still have our hands full. We cannot determine the sign of any of the above expressions a priori and, therefore, there are many possible closures to our one-sector model. To organize the analysis, let us classify these closures according to the signs of β_{11}, β_{12}, β_{21}, and β_{22}.

Starting with the dynamics of l, the distributive regime is "Kaldorian" when $\beta_{12} < 0$ because this means that an increase in the level of economic activity has a negative impact on the labor share, as proposed by Kaldor (1956). In contrast, the distributive regime is "Marxian" when $\beta_{12} > 0$ because this means that the labor share rises with the level of economic activity, as implicit in the reserve-army hypothesis. The sign of β_{11} determines whether the labor share is stable ($\beta_{11} < 0$) or unstable ($\beta_{11} > 0$) in isolation, that is, whether or not the labor share converges to a stable value in the absence of variations in the level of economic activity.

By analogy, the demand regime is "profit-led" when $\beta_{21} < 0$, because this means that the negative impact of the labor share on investment predominates over its positive impact on consumption. The result is that an increase in the labor share leads to a reduction in the level of economic activity and vice versa. The opposite happens when the demand regime is "wage-led" ($\beta_{21} > 0$) and, like in the distributive side, the sign of β_{22} determines whether or not the level of economic activity is stable in isolation.[17]

All types of distributive and demand regimes are possible a priori. Since capitalists economies do not necessarily have the same institutional and technological structure through time and space, this is ultimately an empirical question.

To illustrate the above point, consider the case where both l and u are stable in isolation. Since we still have two distributive configurations and two demand configurations, there are four distinct closures to our one-sector

[17] The terms wage-led and profit-led come from Taylor (1991) and correspond to what Marglin and Bhaduri (1990) call "stagnationist" and "exhilarationist," respectively. A similar analysis can be also found in Rowthorn (1982) and Dutt (1986).

model. Restricting the examples to locally stable ones, figures 6 to 9 show the phase diagram of each case.

FIGURES 6 TO 9

To analyze the four cases let us define the "distributive" and "demand" curves of our one-sector economy as the loci of points (l, u) for which l and u are stable, respectively.

In figures 6 and 7 the equilibrium point is a stable node and the structural difference lies on the response of the economy to distributive and demand shocks. For instance, in the Marxian wage-led case a pro-labor distributive shock (an upward change in the position of the distributive curve) or a positive demand shock (an upward change in the position of the demand curve) leads to an increase in both l and u as the economy converges to its new steady state. In the Kaldorian profit-led the exact opposite happens.

In figures 7 and 8 the equilibrium point is stable node of focus. The response to permanent distributive and demand shocks are also different, as well as the adjustment of l and u to the equilibrium point. In the Marxian profit-led case the labor share is the predator and capacity utilization the prey, whereas in the Kaldorian wage-led case the roles are reversed.[18]

In sum, even when we restrict our analysis to locally stable points and assume that l and u are stable in isolation, we still have very distinct representations of the dynamics of income distribution and economic activity. Rather than flaw, this is actually an advantage of Keynesian models because it allows one to adapt his or her theoretical model to the institutional and technological characteristics of real-world economies.

5 Conclusion

The supply emphasis of mainstream growth theory does not preclude an analysis of demand-led growth. In fact, mainstream growth theory tells us how income is generated to attend aggregate demand with little or no attention to the determinants of aggregate demand itself. The aim of Keynesian growth models is exactly to analyze the latter and, as we saw in section

[18] In Barbosa-Filho (2001b), I estimated the model of the section for the US economy in 1954-99. The results indicated a Marxian profit-led economy for the whole period, although in 1954-65 the structure seemed to be Kaldorian profit-led.

one, the three basic and non-mutually exclusive closures are investment-led growth, consumption-led growth, and export-led growth.

Under some plausible economic assumptions, demand-led growth is perfectly consistent with a stable income-capital ratio and, as long as the economy remains below its potential income level, we can determine the expansion of capitalist economies just from the demand side. Supply enters residually to attend aggregate demand and the very own supply constraints may be pushed up by aggregate demand when multifactor productivity and labor participation ratio are pro-cyclical variables.

The above obviously does not eliminate supply constraints and, if and when the economy reaches its maximum growth rate, the labor share of income becomes the residual variable along the lines of Kaldor's (1956) demand theory of income distribution. The basic ideas is that the average propensity to save increases when the economy reaches its maximum growth rate, so that a reduction in induced consumption accommodates the increase in investment and other autonomous expenditures.

There is no reason to assume that the labor share changes only under extreme conditions though. In fact, Keynesian models often adopt some variant of Marx's reserve-army hypothesis, according to which workers' bargaining power, and therefore real wages, vary pro-cyclically. The result may be well defined business fluctuations around a demand-led growth trend without the economy necessarily reaching its maximum growth rate. The business fluctuations are determined by the interaction of effective demand with social conflict, with the distributive and demand dynamics varying according to the structure of the economy in question.

Rather than imposing one structure a priori, Keynesian models of business fluctuation and social conflict admit various closures, leaving for the analyst the determination of the institutional and technological features of the case under investigation. On the distributive side the labor share of income may be stable or unstable in isolation, as well as pro-cyclical (the Marxian closure) or counter-cyclical (the Kaldorian closure). On the demand side the income-capital ratio may also be stable or unstable in isolation, as well as a positive (the wage-led closure) or negative (the profit-led closure) function of the labor share of income.

In comparison to mainstream growth theory, Keynesian models offer thus a broader and more complex analysis of economic growth where demand injections interact with institutional and technological parameters to generate waves of income expansion and capital accumulation. Although the assumptions and narrative varies a lot across authors, the main ideas can be expressed in a common and flexible framework and this paper offered precisely one way to do so.

References

[1] Baran, Paul A. and Paul M. Sweezy 1966. *Monopoly capital: and essay on the american economic and social order*, New York: Modern Reader

[2] Barbosa-Filho, Nelson H. 2001a. *The balance-of-payments constraint: from balanced trade to sustainable debt*, Center for Economic Policy Analysis, New School University.

[3] Barbosa-Filho, Nelson H. 2001b. *Income distribution and demand fluctuations in the postwar US economy: a Structuralist approach*, Center for Economic Policy Analysis, New School University.

[4] Bowles, Samuel, David M. Gordon, and Thomas E. Weisskopf 1984. *Beyond the Waste Land: a democratic alternative to economic decline*, New York: Anchor Books.

[5] Bowles, Samuel, David M. Gordon, and Thomas E. Weisskopf 1992. *After the Waste Land: a democratic Economics for the year 2000*, Armonk, NY: M.E. Sharpe.

[6] Chatterji, Monojit and Michael R. Wickens 1983. "Verdoorn's law and Kaldor's law: a revisionist interpretation?" *Journal of Post Keynesian Economics* 5(3): 397-413.

[7] Clark, Peter K. 1979. "Potential GNP in the United States: 1948-80." *Review of Wealth and Income*, 25(2): 141-165.

[8] Congressional Budget Office 1995. *CBO's Method for Estimating Potential Output*, Washington DC: Congressional Budget Office.

[9] Davidson, Paul 1972. *Money and the Real World*, London: MacMillan.

[10] Dutt, Amitava K. 1986. "Growth, Distribution, and Technological Change," *Metroeconomica* 38(2): 113-134.

[11] Dutt, Amitava K. 1990. *Growth, Distribution, and Uneven Development*, Cambridge: Cambridge University Press.

[12] Eatwell, John 1995. "Disguised Unemployment: The G-7 Experience," *UNCTAD Review* 0: 67-90.

[13] Eatwell, John 1997. "Effective Demand and Disguised Unemployment," in: J. Michie and J. Grieve-Smith (eds.), *Employment and Economic Performance: Jobs, Inflation, and Growth*, Oxford and New York: Oxford University Press.

[14] Fazzari, S.M., G. Hubbard, and B.C. Petersen 1988. "Financing Constraints and Corporate Investment," *Brookings Papers on Economic Activity* 1: 141-195.

[15] Foley, Duncan and Thomas Michl 1999. *Growth and Income Distribution*, Cambridge, MA: Harvard University Press.

[16] Godley, Wynne 1999. *Seven Unsustainable Processes: Medium-Term Prospects and Policies for the United States and the World*, Special Report, Annandale-on-Hudson, NY: The Jerome Levy Economics Institute.

[17] Godley, Wynne 2000. *Drowning in Debt*, Policy Note 2000/6, Annandale-on-Hudson, NY: The Jerome Levy Economics Institute.

[18] Hansen, Alvin 1938. *Full Recovery or Stagnation?* New York: Norton.

[19] Hansen, Alvin 1941. *Fiscal Policy and Business Cycles*, New York: Norton.

[20] Harrod, Roy 1933. *International Economics*, Cambridge: Cambridge University Press.

[21] Harrod, Roy. 1939. "An Essay on Dynamic Theory," *Economic Journal* 49: 14-33.

[22] Hicks, John R. 1950. *A Contribution to the Theory of the Trade Cycle.* Oxford and New York: Oxford University Press.

[23] Kaldor, Nicholas 1956. "Alternative Theories of Distribution," *Review of Economic Studies* 23: 83-100.

[24] Kalecki, Michal 1937. "The principle of increasing risk," *Economica*, November.

[25] Kalecki, Michal 1954. *Theory of economic dynamic: an essay on cyclical and long-run changes in a capitalist economy*, London: Allen and Unwin.

[26] Keynes, John M. 1936. *The General Theory of Employment, Interest, and Money.* San Diego and New York: Harcourt Brace & Company, 1964 edition.

[27] Lewis, W. Arthur 1954. "Economic development with unlimited supplies of labour," *Manchester School of Economics and Social Studies* 22(2): 139-91.

[28] Marglin, Stephen A. 1984. *Growth, Distribution, and Prices*, Cambridge: Harvard University Press.

[29] Marglin, Stephen A. and Amit Bhaduri 1990. "Profit Squeeze and Keynesian Theory," in: Stephen A. Marglin and Juliet Schor (eds.), *The Golden Age of Capitalism: Reinterpreting the Postwar Experience*, Oxford: Claredon.

[30] McCombie, John S.L. 1983. "Kaldor's law in retrospect," *Journal of Post Keynesian Economics* 5: 414-249.

[31] McCombie, John S.L and Anthony P. Thirlwall 1994. *Economic Growth and the Balance-of-Payments Constraint*, New York: St. Martin's Press.

[32] Minsky, Hyman P. 1975. *John Maynard Keynes*, New York: Columbia University Press.

[33] Minsky, Hyman P. 1982. *Can "It" Happen Again? Essays on Instability and Finance*, Armonk, NY: M.E. Sharpe.

[34] Romer, Paul M. 1986. "Increasing returns and long run growth," *Journal of Political Economy*, October.

[35] Rowthorn, Bob. 1975. "What Remains of Kaldor's Law?" *Economic Journal* 85(337): 10-19.

[36] Rowthorn, Bob. 1982. "Demand, Real Wages, and Economic Growth," *Studi Economici* 37(18): 3-53.

[37] Samuelson, Paul A. 1939. “Interaction between the Multiplier Analysis and Principle of Acceleration,” *Review of Economic Statistics* 21: 75-78.

[38] Taylor, Lance 1983. *Structuralist Macroeconomics*, New York: Basic Books.

[39] Taylor, Lance 1991. *Income Distribution, Inflation, and Growth: Lectures on Structuralist Macroeconomic Theory*, Cambridge: MIT Press.

[40] Thirlwall, Anthony P. 1983. “A plain man’s guide to Kaldor’s growth laws,” *Journal of Post Keynesian Economics* 5(3): 345-358.

[41] Thirlwall, Anthony P. 1979. “The Balance of Payments Constraint as an Explanation of International Growth Rate Differences,” *Banca Nazionale del Lavoro Quarterly Review* 128: 45-53.