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Abstract

The specification of the accumulation function is critical for the properties and implications of structuralist and post-Keynesian models. A large Kaleckian literature assumes that investment is relatively insensitive to variations in the utilization rate of capital, and this extension of a standard short-run "Keynesian stability condition" to the long run has been defended by Lavoie and Dutt, among others. This paper examines the theoretical and empirical arguments for and against a Kaleckian specification.

JEL classification: E12, E32
Key words: Kalecki, Harrod, investment function, stability, post keynesian theory, utilization rate, excess capacity

1 Introduction

A few years ago Steedman (1992) posed a number of "Questions for Kaleckians". This paper also raises questions for Kaleckians. The questions, however, are different.

Steedman's main concern was aggregation and the use of representative, vertically integrated firms. Steedman's point is correct - aggregates sometimes behave in ways that one might not expect on the basis of an analysis of representative agents - but complete disaggregation, like full 'generality' or 'realism', is unattainable. Aggregation is necessary: one must choose the appropriate degree of aggregation, given the questions at hand.

In this paper, I shall assume that aggregational problems do not undermine the standard one-sector assumption that characterizes Kaleckian macroeconomics (and most macroeconomic models, more generally). In other words, I shall take it for granted that we may analyze pricing, output and production decisions as if they were generated by representative firms. In fact, sectoral differences - with respect to technologies, demand conditions, labor relations, or other important characteristics - could easily undermine this assumption. A shift of consumption demand toward capital-intensive consumption goods, for instance, could increase aggregate investment, even without any change in aggregate consumption demand. The possible scenarios and complications are legion but in the absence of any information about the direction of any such effects, aggregate macroeconomic models may still provide a useful benchmark. Kaleckian models of growth and distribution, however, have other weaknesses, weaknesses that are specific to this particular branch of macro theory. The Kaleckian investment function, in particular, is hard to justify.

Contemporary mainstream macroeconomics shows little interest in investment functions, at least compared to the outpouring of work on the investment functions from the 1950s to the 1980s. In some ways this is not surprising. The earlier literature on investment failed to produce clear empirical results, and 'primitive' equations in many cases performed as well as more 'sophisticated' specifications that included cost-of-capital variables or Tobin's q. From a theoretical perspective, moreover, aggregate investment is no longer central. A traditional Keynesian approach regarded investment as a key influence on aggregate demand and employment, and as the main mover of the business cycle. Contemporary New-Classical and New-Keynesian theory has a different perspective. Employment may deviate from the natural rate (or NAIRU) in the short run but nominal and real rigidities, mainly relating to the labor market, are seen as the key to an understanding of these deviations, and business cycles are modeled in the Frisch-tradition as the result of propagation mechanisms playing on exogenous shocks, rather than as being generated endogenously by multiplier/accelerator mechanisms.[1] With the level of output and employment largely determined by the labor market - certainly in the medium run -

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[1]It is striking that Caballero (1999) discusses equilibrium interactions and lumpiness in investment, giving great attention to signalling complementaries but without even raising the question of aggregate demand.

and consumption modeled in terms of intertemporally optimizing households, there is no real need for (nor indeed, much room for) a separate aggregate investment function.

Having said this, contemporary investment theory appears to agree on a basic stock adjustment principle: investment is the result of firms trying to adjust their capital stock toward some desired level, K^*. Differences arise over the determination of the desired stock and the reasons for gradual adjustment. Firms' objectives may be profit maximization but sales or growth also enter the objective function sometimes. More important differences arise from the treatment of the constraints: simple accelerator models assume a fixed-coefficient production function and adaptive expectations; "neoclassical" theories include cost-of-capital variables to capture a choice of technique; $q-$theories look for measurable variables that capture expectations of future returns to investment relative to the cost of capital; cash-flow variables may become important as the result of credit market imperfections; profound uncertainty may render formal optimization models largely irrelevant; adjustment costs may or may not be convex.

In this paper I deliberately abstract from these and other complications. I shall assume that (i) firms try to maximize profits, (ii) there is a fixed-coefficient production function, (iii) the availability of financing does not constrain investment. Moreover, since the main focus of the paper is on the medium and long run, the nature of adjustment costs is of little importance.

The first two assumptions are almost universal in both the Kaleckian and the broader post-Keynesian literature. Post-Keynesian theories by and large ignore the choice of technique and typically assume a fixed-coefficient production function.[2] The output-capital ratio, nevertheless, need not be exogenously given. Investment is irreversible and in the short run utilization rates depend on aggregate demand.

The Kaleckian model extends the short-run variability of utilization rates to the medium and long run and implies that permanent shocks to aggregate demand - a change in saving rates, for instance - can lead to permanent and quantitatively significant changes in utilization. This paper challenges the Kaleckian approach. I shall argue (i) that there are good theoretical reasons to rule out steady-growth deviations between actual and desired utilization rates, (ii) that the theoretical case for (quantitatively significant) adaptive changes in desired utilization is weak, (iii) that the Kaleckian specification implies long-run variations in utilization rates that have no counterpart in the data, and (iv) that existing econometric studies have been badly misinterpreted.

Section 2 considers the theoretical argument. It outlines a canonical Kaleckian model and a Harrodian alternative, and then briefly summarizes some of the debates surrounding the Kaleckian accumulation function. The Kaleckian position has been defended by Lavoie (1995), Amadeo (1986) and Dutt (1997), and section 3 considers their suggestion of endogenous changes in the desired (or 'normal') rate of utilization. Section 4 turns to empirical evidence. The section argues that, weak as it is, the existing evidence cannot support the Kaleckian specification. Section 5 offers a few concluding remarks.

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[2] See Skott (1989, chapter 5) for an exception.

2 Different post-Keynesian models[3]

2.1 The Kaleckian model

Kaleckian models - as defined in this paper - are characterized by a low sensitivity of accumulation to variations in utilization and with a given markup, the utilization rate becomes an accommodating variable in both the short and the long run. Thus, the steady-growth value of the utilization rate is not, as in Harrodian or Robinsonian models, tied to a structurally determined desired rate.[4] Instead, shocks to demand (changes in saving rates, for instance) can have large, permanent effects on utilization.

The basic Kaleckian model has been extended and modified in many ways. Some extensions have introduced a government sector and an explicit analysis of policy issues (e.g. Lima and Setterfield (2008)); others add financial variables or open-economy complications (e.g. Blecker 1989, 1999; Lavoie and Godley 2001-02, Dos Santos and Zezza (2008), Hein and van Treeck 2007). The focus in this paper, however, is on the structure of the basic model and the accommodating variations in the utilization rate, and for these purposes a stripped-down model of a closed economy without public sector and without financial constraints on investment will suffice.

Algebraically, the canonical Kaleckian model is exceedingly simple:

$$\frac{I}{K} = \alpha + \beta u + \gamma r \tag{1}$$

$$\frac{S}{K} = s(\pi)u\sigma \tag{2}$$

$$\frac{I}{K} = \frac{S}{K} \tag{3}$$

$$r = \pi u\sigma \tag{4}$$

$$\pi = \bar{\pi} \tag{5}$$

$$g = \hat{K} = \frac{I}{K} - \delta \tag{6}$$

Using standard notation, equations (1)-(2) are the investment and saving functions. Investment is increasing in utilization (u) and the profit rate (r), and the saving rate out of income ($s(\pi)$) is an increasing function of the profit share (π); σ denotes the technical output-capital ratio. Equation (3) is the equilibrium condition for the product market; equation (4) defines the profit rate as the product of the profit share, the utilization rate and the technical output-capital ratio. Equation (5) is the pricing equation with the profit share fixed by a markup on marginal cost, the latter assumed constant and equal to unit labor cost. Equation (6) sets the growth rate of the capital stock ($g = \hat{K}$) equal to gross

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[3]This section draws on Skott (2008).

[4]Robinson (1962) assumes that adjustments in the markup generate a normal rate of utilization in steady growth; Steindl (1952) arguably held a similar position, see Flaschel and Skott (2006).

accumulation minus the rate of depreciation, δ. All parameters are assumed positive and the Keynesian stability condition is supposed to hold,

$$\frac{\partial(I/K)}{\partial u} = \beta + \gamma\bar{\pi}\sigma < s(\bar{\pi})\sigma = \frac{\partial(S/K)}{\partial u} \tag{7}$$

Simple manipulations of equations (1)-(6) imply that

$$u^* = \frac{\alpha}{s(\bar{\pi})\sigma - \beta - \gamma\bar{\pi}\sigma} \tag{8}$$

$$g^* = \frac{\alpha s(\bar{\pi})\sigma}{s(\bar{\pi})\sigma - \beta - \gamma\bar{\pi}\sigma} - \delta \tag{9}$$

It is readily seen that if the saving function is linear $(s(\pi) = s\pi)$, the stability condition (7) implies that

$$\frac{\partial u^*}{\partial \bar{\pi}} < 0 \tag{10}$$

$$\frac{\partial g^*}{\partial \bar{\pi}} < 0 \tag{11}$$

Thus, the economy is both 'stagnationist' (equation (10)) and 'wage led' (equation (11)) in the terminology of Marglin and Bhaduri (1990).[5]

Marglin and Bhaduri challenged these implications of the model and suggested that the investment function be recast with accumulation as a function of utilization and the profit share, rather than utilization and the profit rate,

$$\frac{I}{K} = \alpha + \beta u + \gamma\pi \tag{12}$$

Using this alternative specification of the investment function, they showed that the Keynesian stability condition need not produce stagnationist and wage-led regimes. The utilization rate remains an accommodating variable, however, and the main difference between the investment functions (1) and (12) is that the sensitivity of investment to changes in utilization has been *reduced,* relative to the sensitivity with respect to the profit share. The non-stagnationist outcomes become possible precisely because, using (12) instead of (1), we may have $\frac{\partial(I/K)}{\partial\bar{\pi}} > \frac{\partial(S/K)}{\partial\bar{\pi}}$, even when the Keynesian stability condition is satisfied, something that cannot occur when the investment function is given by (1) and the saving function is linear $(s(\pi) = s\pi)$. Equivalently, equation (12) does not exclude the possibility that, holding constant the rate of profit, an increase in utilization may reduce accumulation. This is in sharp contrast to Harrodian formulations. Thus, although both

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[5]The canonical model need not be stagnationist if the saving function is nonlinear (or just affine, $s(\pi) = s_0 + s\pi$ with $s_0 > 0$) since in this case the 'Robinsonian stability' condition $(\frac{\partial I}{\partial\pi} < \frac{\partial S}{\partial\pi})$ can be violated even if the 'Keynesian stability' condition $(\frac{\partial I}{\partial u} < \frac{\partial S}{\partial u})$ is met. This point, which may have been noted in the literature, was made by Ben Zipperer in comments on an early draft of this paper.

the Marglin-Bhaduri formulation and the Harrodian models below may produce profit-led outcomes, the behavioral assumptions are very different, and from a Harrodian perspective the Marglin-Bhaduri specification suffers from the same problems as the original Kaleckian model.

To simplify the exposition I shall set γ equal to zero. In this special case, the two investment functions (1) and (12) coincide, the Keynesian stability condition can be written $s(\bar{\pi})\sigma > \beta$, and the equilibrium solutions for u^* and g^* take the form

$$u^* = \frac{\alpha}{s(\bar{\pi})\sigma - \beta} \tag{13}$$

$$g^* = \frac{\alpha s(\bar{\pi})\sigma}{s(\bar{\pi})\sigma - \beta} - \delta \tag{14}$$

2.2 A Harrodian alternative

A Harrodian specification of the investment function makes a distinction between the short-run and the long-run sensitivity of investment to changes in aggregate demand. The insensitivity of investment is plausible in the short run, but changes in aggregate demand have lagged effects on investment, and a weak impact effect (which is required for the stability of the short-run Keynesian equilibrium) does not guarantee that the long-term effects of a sustained increase in aggregate demand and utilization will be weak as well.

In a discrete-time framework (and still assuming, for simplicity, that only utilization matters for investment), the presence of lags can be captured by a general specification,

$$(\frac{I}{K})_t = f(u_t, u_{t-1}, ..., u_{t-m}, (\frac{I}{K})_{t-1}, (\frac{I}{K})_{t-2}, ..., (\frac{I}{K})_{t-n}) \tag{15}$$

The short-run effect of utilization on accumulation is given by the partial derivative $\partial f / \partial u_t$, and the Keynesian stability condition can be written

$$s(\bar{\pi})\sigma > \frac{\partial f}{\partial u_t} \tag{16}$$

The long-run effect of changes in utilization, on the other hand, is given by

$$\hat{K} = \frac{I}{K} - \delta = \phi(u) \tag{17}$$

with

$$\phi'(u) = \frac{d\frac{I}{K}}{du}_{|u_t = u_{t-j}, \frac{I}{K}_t = \frac{I}{K}_{t-k}} = \frac{\sum_{i=0}^{m} \frac{\partial f_{u_{t-i}}}{\partial u_{t-i}}}{1 - \sum_{j=1}^{n} \frac{\partial f_{\frac{I}{K}_{t-j}}}{\partial \frac{I}{K}_{t-j}}} \tag{18}$$

The short-run condition (16) carries no implications for the relation between the long-run sensitivity, ϕ', and $s(\pi)\sigma$. The significance of this point depends on the magnitude of the

lagged effects, that is, on the magnitude of the difference between short-run and long-run effects. There are good reasons to assume, with Harrod, that the difference is large.

The behavioral story behind the Harrodian position is straightforward. For reasons given in the introduction, we are deliberately abstracting from aggregational complications, and firms have a well-defined objective (to maximize profits). Since it would be unreasonable to suppose that demand expectations were persistently and systematically falsified in steady growth, these assumptions make it hard to conceive of a steady-growth scenario in which firms are content to accumulate at a constant rate despite having significantly more (or less) excess capacity than they desire. The only real question concerns the determination of the desired rate of utilization.[6]

The desired utilization rate may deviate from unity. A firm may want to hold excess capacity to deter entry or to enable the firm to respond quickly to variations in demand; or excess capacity may exist simply as a result of indivisibilities of investment (non-convexities in adjustment costs). The desired degree of excess capacity, second, need not be constant over time; changes in the degree of product market competition or in the volatility of demand, for instance, could affect desired utilization rates. Managerial constraints or other bottlenecks, third, may make it difficult or costly to expand capacity at a rapid pace, and the desired utilization rate, consequently, may depend, inter alia, on the rate of accumulation. This case can be represented by equation (17) which specifies a long-run relation between accumulation and desired utilization. In an uncertain environment, fourth, firms may have a range of 'satisfactory' utilization rates, rather than a sharply defined optimal rate, as suggested by Dutt (1990, p. 59). The Harrodian argument, however, does not require the sharp definition. It is sufficient that the satisfactory range be small (a few percentage points), which surely it is, even in the presence of uncertainty;I shall return to this issue in section 3 below.

Simple Harrodian specifications abstract from these complications, the implicit assumption being that the (possibly time-varying) desired utilization rate is independent of the accumulation rate and that the long-run accumulation rate is highly elastic (even if not infinitely elastic) within the relevant range of steady-growth solutions for the rates of accumulation. But whether simple or more elaborate, Harrodian specifications of accumulation tend to destabilize the economy: most, but not all, Harrodian inspired models imply that the warranted growth path is locally unstable.

The instability problem has been seen as a powerful argument against a Harrodian approach. The argument may not be spelled out in detail but it is suggested, implicitly, that stability is needed for the model to make sense and/or for the steady-growth path to be empirically relevant (e.g. Lavoie 1995). These implicit claims are wrong, I believe. Harrodian models are more complex than the simple Kaleckian model, but they

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[6]Chick and Caserta (1997) suggest that although that the utilization rate must be at (or near) the desired rate in long-run steady growth, deviations could last for significant periods of time. Long-lasting deviations, however, do not justify a depiction of this medium-run scenario as a self-sustaining equilibrium without internal forces for change.

remain tractable and the complexities bring significant rewards (see Skott (2008)). The present paper leaves aside these issues and focuses on the shortcomings of the Kaleckian accumulation function.

3 Theory

A substantial literature discusses the long-run relation between actual and desired utilization rates. Kurz (1986), Committeri (1986). Dumenil and Levy (1993), and Auerbach and Skott (1988) are among those who have faulted Kaleckian models for their failure to ensure that actual utilization and desired utilization coincide in steady growth. The Kaleckian response has been articulated in contributions by Lavoie (1995, 1996), Amadeo (1986), Dutt (1997), Lavoie et al. (2004).[7]

Following Amadeo (1986), Lavoie suggests that the equalization of actual and desired utilization can be reconciled with the long-run variability of the utilization rate if the desired rate of utilization itself becomes an endogenous variable whose rate of change is proportional to the difference between actual and desired utilization.

Mathematically, the argument is set out as follows. Assuming that $\gamma = 0$, the investment function (1) can be rewritten

$$\frac{I}{K} = \alpha + \beta u \tag{19}$$

$$= \rho + \beta(u - u^d) \tag{20}$$

where $\rho = (\alpha + \beta u^d)$. When $u = u^d$ firms will want to increase their capital stock in line with demand, and the parameter ρ can be interpreted as the sum of the depreciation rate and the expected growth of demand (at the given markup). If u^d were constant (or more generally, determined independently of actual utilization rates), equation (20) would amount to nothing more than a more complicated version of (1). The Amadeo-Dutt-Lavoie argument, however, suggests that both the expected growth rate of demand and the desired utilization may change endogenously. Specifically, it is assumed that[8]

$$\dot{u}^d = \mu(u - u^d) \tag{21}$$

$$\dot{\rho} = \nu(\frac{I}{K} - \rho) \tag{22}$$

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[7]The desired rate of utilization is sometimes referred to as the 'normal' rate or the 'target' rate. The terminology itself is not important but may be indicative of underlying differences. Thus, the term 'normal' may suggest something merely conventional, rather than a rate that is determined strategically with reference to well-defined objectives. I shall use the term 'desired utilization rate'; the substantive underlying issues constitute the main topic of this paper.

[8]Some writers, including Park (1997) and Commendatore (2006), combine adaptive changes in utilization along the lines of equation (21) with endogenous changes in the markup.

Equation (21) describes the adaptive changes in desired utilization and equation (22) the changes in the expected growth rate.[9] Using (20), equation (22) can be written

$$\dot{\rho} = \nu\beta(u - u^d) \tag{23}$$

The actual utilization rate is equal to

$$u = \frac{\rho - \beta u^d}{s(\bar{\pi})\sigma - \beta} \tag{24}$$

and it follows that the set of stationary solutions to (21)-(22) is given by

$$E = \{(u^d, \rho) \mid \rho = s(\bar{\pi})\sigma u^d\} \tag{25}$$

Starting from any initial position, the economy will converge to a point in this equilibrium set iff the parameters satisfy the stability condition[10]

$$\mu s(\bar{\pi})\sigma > \nu\beta \tag{26}$$

The asymptotic rest point depends on initial conditions and in this sense the model exhibits hysteresis.

From a logical perspective this argument is correct but the authors do not provide much in the way of economic rationale. It may be useful to quote their argument extensively:

- *Lavoie 1995* starts by noting that faced with an inconsistency between actual and desired utilization, one possibility is that "firms revise their targeted normal rate of capacity utilization" (p. 805). Having explored the possibilities mathematically, he returns to the economics behind the adjustment by stating that "[f]ollowing a suggestion by Dutt, Amadeo properly described the proposed adjustment mechanism, but without a graphical illustration". This claim is followed by a long quote from Amadeo (1986, p. 155):

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[9]The second of these equations does not really capture the adjustment of growth expectations toward actual growth since $\hat{Y} = \hat{u} + I/K - \delta$. An alternative specification,

$$\dot{\rho} = \nu(\hat{u} + I/K - \rho)$$

also generates an autonomous two-dimensional system in ρ and u^d. The reduced-form expressions for $\dot{u}^d$ and $\dot{\rho}$ will be non-linear but the hysteretic properties are retained and a meaningful and stable dynamics imposes qualititatively similar restrictions on the adjustment speeds (stability now requires that $\nu < \rho + \beta x$ and $\nu(1 + \frac{\nu(\beta - \mu)}{\beta(\rho - \beta u^d - \nu)}) < \mu\frac{s(\bar{\pi})\sigma}{\beta}$).

[10]Equations (21)-(22) imply that

$$\rho = \frac{\nu\beta}{\mu}u^d + a$$

where, a, the arbitrary constant of integration is determined by initial conditions. Substituting this equation into (24) and the resulting equation for u into (21), we get a one-dimensional differential equation. This equation has a unique stationary solution and it is readily seen that the solution is asymptotically stable iff $\mu s(\bar{\pi})\sigma > \nu\beta$.

"Indeed, one may argue that if the equilibrium degree is systematically different from the planned degree of utilization, entrepreneurs will eventually revise their plans, thus altering the planned degree. If, for instance, the equilibrium degree of utilization is smaller than the planned degree ($u < u^d$), it is possible that entrepreneurs will reduce u^d."

- *Lavoie et al. 2004*, p. 133 suggest that

"Firms hold on to excess capacities to face an uncertain future (Steindl, 1952, p. 2). Firms fear losing customers if they are unable to respond quickly to changes in demand and in the composition of demand. The existence of excess capacity is thus linked to uncertain macroeconomic conditions. The rate of capacity utilization is increased by bringing into use plants that were previously idle. The normal rate of capacity utilization, in that context, is a convention, which may be influenced by historical experience or strategic considerations related to entry deterrence. Although firms may consider the normal rate of capacity utilization as a target, macroeconomic effective demand effects might hinder firms from achieving this target, unless the normal rate is itself a moving target influenced by its past values."

- *Dutt 1997* provides a little more detail. Replacing his notation with the one in this paper (u^d, ρ, β instead of u_n, x, λ), Dutt presents the following argument (p.):

"Explanations for this equation can be developed depending on what one takes to be the determinant of u^d at any point in time. If it is taken to be determined simply by the actual experience of firms, if actual utilization exceeds (is less than) what firms previously considered normal, they will adjust what they consider normal upwards (downwards). Alternatively, if it is taken to be determined be strategic considerations, so that firms may reduce their normal (or desired) capacity utilization if they expect a higher rate of entry than at present, and we take entry to be proportional to investment rates, then we obtain an equation such as

$$du^d/dt = -\mu'(\rho - \frac{I}{K})$$

This equation, using (17) [the investment function (20) in this paper, PS] and the short-run equilibrium condition implies equation (23) [equation (21) in this paper, PS] where $\mu = -\mu'\beta$."

The argument in Lavoie (1995) and Amadeo (1986), first, does not go beyond stating the formal possibility of an adjustment. Amadeo may seem to provide an argument, and it is hard to take issue with his statement that "if the equilibrium degree is systematically

different from the planned degree of utilization, entrepreneurs will eventually revise their plans". But why not adjust the rate of accumulation - the Harrodian argument - rather than the target? Adjustments in the target would only be justified if the experience of low actual utilization make firms think that low utilization has now become optimal, and neither Amadeo nor Lavoie presents an argument for this causal link.

Lavoie et al. (2004) suggest that in the presence of uncertainty, the desired degree of utilization must be conventional, and since conventions are rooted in history, the adaptive formulation therefore seems appropriate. One can only agree that uncertainty is a fact of life and that firms cannot maximize profits in a strict and rigorous sense of the word. In their pursuit of profit firms follow routines and have perceived constraints that contain a conventional element. But the presence of uncertainty and conventional elements does not mean that the desired utilization rate is a purely conventional variable. I may not know exactly how long it will take me to get to work in the morning since weather, traffic and many other variables may influence the commuting time. Still, uncertainty of this kind and the fact that I may not have a rigorously derived optimal departure time do not imply that my planned arrival time adjusts adaptively toward the actual arrival time. Imagine that over a period I am late for class every day because of a series of minor mishaps (a flat tire one day, followed by a snow storm the next day, road works, a traffic accident at a key intersection, ...). I do not respond to this unfortunate string of events by adjusting my planned arrival time in the way suggested by Lavoie: I may have been late for class (have had too little actual 'commuting capacity') because of unforeseen shocks but that does not make being late seem desirable. In this simple example, nothing prevents me from adjusting my departure time in the direction that I consider optimal (disregarding random shocks; the phone may ring just as I'm about to leave or ...), and by leaving earlier I should get to class on time. In this respect there might seem to be a difference compared with firms' investment decisions. As all firms try to increase their utilization rates by reducing investment, the macroeconomic impact is a decline in aggregate demand which aggravates the original problem.

Lavoie et al. use the instability problem as a second argument (the last sentence in the above quotation). They imply that the endogenous adjustment of target to realized value is necessary if any reconciliation between the two is to be achieved. This there-is-no-alternative argument is unwarranted as many other mechanisms can produce a long-run consistency between average and desired utilization (Skott (2008) takes up this issue). Moreover, even if this were not the case, a purely functional argument carries little weight. The stability argument for adaptation presumes that individual firms will (i) be aware of the demand externalities associated with their investment decisions, (ii) act upon this insight, even if it goes against their narrow self-interest, and (iii) with this insight and the willingness to act on it, choose to adjust their planned utilization rate to the actual, rather than adjust their actual accumulation rate so as to generate a level of aggregate demand that will adjust their actual utilization rate to their desired rate. These behavioral assumptions seem peculiar.

Disregarding his pure inertia possibility, Dutt (1997) suggests that firms reduce their desired rate of utilization when the threat of entry is high. The formal equation uses the difference between the expected growth rate (ρ) and the accumulation rate as an indicator of the threat of entry and, thereby, the need for deterrence. But instead of having the threat and the level of the desired utilization rate depend on $\rho - \frac{I}{K}$, Dutt has moved up a derivative: the dependent variable is the change in desired utilization, not the level of the desired utilization. This change is crucial. Without it, we would be left with a single differential equation (with an unstable stationary solution), and there would be neither adaptation nor hysteresis. No argument is provided for why the threat of new entry and the desired degree of excess capacity should be *increasing* – without bounds – whenever actual accumulation exceeds expected accumulation.

A relationship between the level of desired utilization and an indicator of the need for deterrence is plausible and quite standard in the literature. The sensitivity of u^d to variations in the threat of entry is likely to be low, however, and one may question the use of $\rho - \frac{I}{K}$ as an indicator of the need for deterrence.[11] More importantly, it is not obvious how a deterrence argument can justify the dynamic equation (21). Habits and conventions undoubtedly play a role in firms' perceptions of the optimal degree of excess capacity, and it would be churlish to deny any adaptive influence of actual on desired utilization. The Amadeo-Dutt-Lavoie formulation, however, requires not just the existence of some element of adaptation but the presence of adaptation that is both quantitatively fast and unbounded. The unboundedness is embedded in the functional form (21), which implies that if utilization were to remain at, say, fifty percent then firms would eventually come to view fifty percent as the desired utilization rate; the need for fast adjustment in u^d (relative to the adjustment speed for expected demand growth) is an implication of the stability condition (26). A priori these assumptions are not, I would suggest, reasonable, and the specification cannot be seen as just a local approximation that is acceptable within a relevant range of 'satisfactory' utilization rates. As argued in section 4 below, the theory needs a range of potential u^d−values that is much larger than any plausible range of demand-induced variations, and there is no empirical evidence to support the assumption of fast adjustments in u^d.

Adaptive behavior is used widely in economic models and often makes good sense. Adaptive inflation expectations, for instance, perform well for most advanced countries in most of the second half of the 20th century (but not necessarily for other periods and countries), and one can tell a persuasive story: the adaptive mechanism concerns a variable - inflation - which is outside the control of the individuals forming the expectation and which in this period had neither a clear long-term trend nor obvious tendencies to

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[11] Other variables than the ones included by Dutt may also influence the threat of entry. An increase in the profit share, for instance, makes entry more attractive and gives existing firms an increased incentive to create extra capacity as a deterrence. But again, the effect on u^d is likely to be modest. Certainly, it would be hard to explain why firms should want to reduce their utilization to such an extent that the profit rate (evaluated at desired utilization) declines as a result of the increase in the profit share. Yet, this is the implication of the Kaleckian 'paradox of cost'.

revert to some well-defined fundamental value. As another example, adaptive changes have been used to explain employment hysteresis. In insider-outsider models the story is straightforward: the set of insiders itself may change adaptively as a result of shocks to employment, and these changes naturally feed into wage demands and employment (Blanchard and Summers 1987). Alternatively, wage aspirations (fairness norms with respect to wages) may change adaptively. Workers who have grown accustomed to three percent real-wage increases during a period with high productivity growth may only gradually adjust their aspirations if real-wage increases drop to one percent a year, and adaptive changes in aspirations may generate employment hysteresis (Skott 1999, 2005). As in the inflation example, the adaptive process relates to a variable - real wage increases - that cannot be controlled by the workers who form the aspirations: workers may demand a particular increase in money wages but have no control over inflation; they have no direct way of getting reliable evidence on the prospects of their own firm; they cannot know the future overall pace of technical progress or even gauge its recent pace accurately, and they have no way of knowing whether the range of feasible real wage increases have changed.

Utilization is a very different category. It is not about what others will do or about what is possible. A firm controls its own investment and is under no obligation to keep investing if it finds itself with lots of unwanted excess capacity.[12] Nor is there any reason why a negative demand shock and a decline in sales should make the firm think that the optimal degree of excess capacity has changed permanently. Indeed, the asymmetry in the treatment of labor and capital in the Kaleckian model is striking in this respect. It is usually assumed that the desired output-labor ratio is simply equal to the maximum determined by the fixed coefficient production function and that this maximum is continuously maintained. In reality, adjustment of the labor input is neither costless nor instantaneous, and firms may want to engage in labor hoarding, at least temporarily. Moreover, labor hoarding may be explained partly by the same arguments that account for excess capital capacity (fluctuating demand, for instance, and the difficulties and costs of finding skilled labor quickly in case of increasing demand). Yet, no Kaleckian model (to my knowledge) has made a case for adaptive changes in the optimal degree of labor hoarding. The optimal degree of excess labor capacity is taken to be exogenously given and for simplicity is set equal to zero (whether it is zero or some other constant makes no substantive difference). This simplifying assumption about the demand for labor is perfectly reasonable but the implicit motivation for the assumption - profit maximizing behavior and a well–defined desired rate of labor utilization - suggests that capital utilization be treated in a similar way. Profit maximizing firms do not keep workers that they do not need; why would they want to maintain undesired excess capacity?

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[12]The availability of financing and other external constraints may come into play for a firm that wants to expand capacity but are irrelevant for the stripped-down model and have not been invoked in defence of the basic Kaleckian specification.

4 Evidence

4.1 Stylized facts

Stable versions of the adaptive model based on (21)-(22) imply that the long-run outcomes can be described using equations that are qualitatively identical to the ones for the simple Kaleckian model. In steady growth, we have

$$u \;=\; u^d \tag{27}$$

$$g \;=\; \rho \tag{28}$$

$$s(\bar{\pi})\sigma u \;=\; \frac{S}{K} \tag{29}$$

$$\frac{I}{K} \;=\; a + \frac{\beta\nu}{\mu}u = a + bu \tag{30}$$

Equations (27)-(28) describe the stationarity conditions for (21)-(22) and equation (29) is the saving function. Equation (30) follows from (20)-(22) upon integration (see footnote 9).

The model is illustrated graphically in Figure 1. Unlike most illustrations, which focus on the qualitative properties, figure 1 is based on Kaleckian benchmark values. Empirically, the gross saving rate $s(\pi)$ typically falls in the range 0.15-0.3 and the technical output-capital ratio in the range 1-3. Figure 1 uses $s(\pi)\sigma = 0.12, b = 0.08$ and $a = 0.03$, yielding an equilibrium utilization rate of $u^* = a/(s(\bar{\pi})\sigma - b) = 0.75$.

Figure 1 and the numerical example illustrate one of the main weaknesses of the Kaleckian analysis. Assume that the saving rate drops slightly, with $s(\bar{\pi})\sigma$ falling from 0.12 to 0.11. As a result, the growth rate increases by 2 percentage points while the utilization rate jumps from 75% to 100%. This strong sensitivity of utilization to variations in parameters is an intrinsic property of the Kaleckian model. For any reasonable specification of the saving function, the Kaleckian stability condition puts a very low ceiling on the maximum value of b (about 0.1). Shocks to the saving function therefore give rise to fluctuations in utilization rates that are at least about ten times larger than those in accumulation. Shocks to the accumulation function (changes in a) produce movements along the saving function and (given the stability condition) the ratio of variations in utilization to variations in the growth rate is slightly larger, but still unlikely to be much below ten. These implications do not fit the data.

$$\frac{S}{K} = 0.12u$$

$$\frac{S}{K} = 0.11u$$

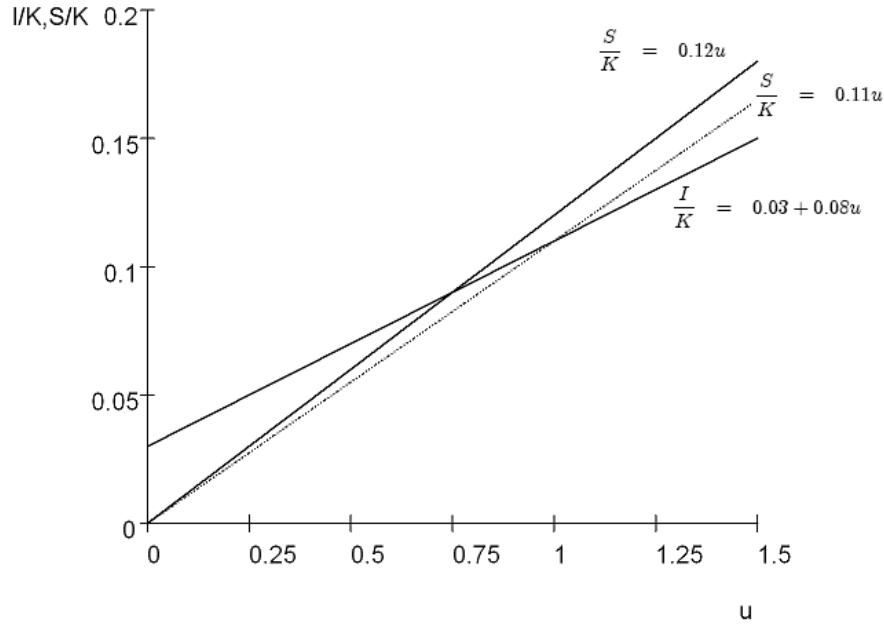$$\frac{I}{K} = 0.03 + 0.08u$$

Figure 1

Figures 2a-2j show the movements in total capacity and in the rate of capacity utilization for US manufacturing as a whole as well as for some individual industries that have experienced turbulent demand conditions and therefore may be of particular interest. Capacity utilization exhibits significant short-run variation - as one would expect - but the long-run variation is modest. Thus, the stylized facts on utilization and growth do not appear to have the characteristics implied by the Kaleckian assumptions. In order for the Kaleckian model to generate long-run variations in u that are of the same order of magnitude or smaller than those in accumulation, one would need a strong positive correlation between the shocks to investment and to saving (or at the industry level, a strong correlation between shocks to the industry specific investment function and shocks to industry demand). To my knowledge no reasons have been offered for this kind of positive correlation between the shocks.[13]

The measurement of productive capacity raises both conceptual and practical problems and one may question the data on utilization. (Shapiro 1989). The Federal Reserve data for the US are based on a combination of different surveys and other information, and the Fed adjusts its measure of capacity in various ways to get a measure that it considers reasonable. The data problems are both real and serious but one would need a strong argument to believe that biases in measured utilization explain the discrepancy between Kaleckian predictions and stylized facts.

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[13]Dallery (2007) addresses similar questions from a different angle. Looking at the predictions of different models for a range of plausible parameter values, he suggests that the most plausible models are unstable.

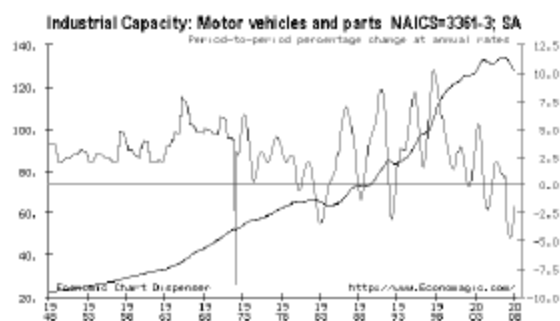**Industrial Capacity: Manufacturing (SIC); SA**

Figure 2a

Capacity Utilization: Manufacturing (SIC); SA

Figure 2b

Industrial Capacity: Motor vehicles and parts NAICS=3361-3; SA

Figure 2c

Capacity Utilization: Motor vehicles and parts NAICS=3361-3; SA

Figure 2d

Industrial Capacity: Textiles and products NAICS=313,4; SA

Figure 2e

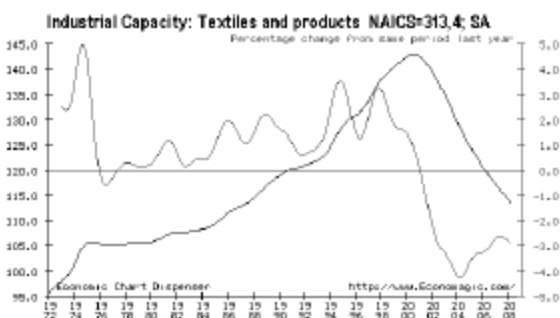**Capacity Utilization: Textiles and products NAICS=313,4; SA**

Figure 2f

15

Figure 2g

Figure 2h

Figure 2i

Figure 2j

4.2 Econometric evidence

Investment functions are notoriously ill-behaved and the econometric evidence is mixed and relatively weak. Moreover, the implications of econometric results for the Kaleckian position can be unclear since some variables in the estimated equations may be influenced by or strongly correlated with the utilization rate, which itself does not even appear in many econometric specifications.[14]

A careful and detailed examination of the econometric literature and its implications

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[14]Stockhammer et al. (2007), for instance, estimate the following investment function on data for the Euro-area:

$$\Delta \log I = -0.59 + 1.59 \Delta \log Y + 0.84 \Delta \log Y_{-1} + 0.38 \Delta \log R - 0.18 \Delta \log R_{-1} - 0.21 \log \frac{I_{-1}}{Y_{-1}} + 0.03 \log R_{-1}$$

where R is profits. The appearance of $\log R_{-1}$ seems peculiar, given that all other variables are in growth rates or expressed as ratios (and in fact the coefficient on $\log R_{-1}$ is statistically insignificant). Disregarding this problem, Stockhammer et al see this equation as part of - and consistent with - a Kaleckian model. In steady growth, however, $\Delta \log I = \Delta \log Y = \Delta \log Y_{-1} = \Delta \log R = \Delta \log R_{-1} = g$, and we get a long-run relation

$$1.63g = 0.59 + 0.21 \log \frac{I_{-1}}{Y_{-1}} - 0.03 \log R_{-1}$$

16

for the Kaleckian model is beyond the scope of the present paper and will be left for future research. A recent paper by Lavoie et al. (2004), however, sets out to test the Kaleckian specification against some competing specifications. Having acknowledged that a number of variables - including financial variables - have been found to influence investment, Lavoie et al. note that "the crucial distinctive features of the post-Keynesian and Marxist investment models ... are located in the role of the rate of capacity utilization" (p.129). Using Canadian data, they proceed to estimate stripped-down versions of four different specifications, two "Marxist" specifications, a "naive Kaleckian" version (equation (1) with $\gamma = 0$), and a sophisticated "hysteresis-Kaleckian" version (based on equations (20)-(22) above). In the conclusion (p. 146) they summarize their results as follows:

> "our regression results show that the (HK) equation [the "hysteresis Kaleckian" specification; PS] performs better than the other three specifications stipulated above, using standard indicators such as R^2, F-statistics, and t-ratios. It also performed better when various comparative diagnostic tests, information criteria, and encompassing tests were applied, whatever the precise test being applied. These statistical tests allow us to conclude that the sophisticated Kaleckian investment function (HK) is the preferred investment function."

There are two problems with this conclusion. The estimated empirical HK equation, first, bears no relation to the theoretical model. In order to derive a discrete-time, empirical version of the HK investment function, Lavoie et al. subtract an equation for $(I/K)_{t-1}$ from the equation for $(I/K)_t$ to get

$$
\begin{aligned}
\frac{I_t}{K_t} - \frac{I_{t-1}}{K_{t-1}} &= \rho_t - \rho_{t-1} - \beta(u_t^d - u_{t-1}^d) + \beta(u_t - u_{t-1}) \\
&= \nu(\frac{I_{t-1}}{K_{t-1}} - \rho_{t-1}) - \beta\mu(u_{t-1} - u_{t-1}^d) + \beta(u_t - u_{t-1}) \quad (31)
\end{aligned}
$$

Since $\frac{I}{Y} = \frac{I}{K}/\frac{Y}{K} = (g+\delta)/(u\sigma)$ and leaving out the insignificant and hard-to-interpret term $\log R_{-1}$, we can rewrite this equation as

$$1.63g - 0.21\log(g+\delta) = 0.59 - 0.21\log u - 0.21\log \sigma$$

The implied long-run effect of changes in utilization on accumulation can now be found. Assuming a constant technical coefficient, σ, and taking total derivatives we get

$$(1.63 - \frac{0.21}{g+\delta})dg = -.21\frac{du}{u}$$

and hence

$$\frac{dg}{du} = \frac{0.21}{\frac{0.21}{g+\delta} - 1.63} = \frac{g+\delta}{1 - 7.76(g+\delta)}$$

The expression on the right hand side is negative if $g+\delta > 0.13$ and increasing in $g+\delta$ when $g+\delta < 0.13$ with an asymptote at $g+\delta = 0.13$. To get a plausible Kaleckian value for the long-run sensitivity of accumulation to utilization - a value in the range between zero and 0.15 - the value of $g+\delta$ would have to be less than 0.07.

where the second equality uses a discrete-time version of (21)-(22). Noting, then, that the variables ρ and u^d are unobservable they proceed as follows:

> "in the sophisticated Kaleckian view, the rate of utilization, which is considered to be normal, is influenced by its past values. ... For our purposes, we shall use an established, simple and direct approach for the two Kaleckian equations that consists of applying the HP filter ... to u_t. This procedure allows us to identify an estimate of the permanent component in the series u_t, which we denote as the series u_n [corresponding to u^d; PS]."

A Hodrick-Prescott filter does not capture the adaptive formulation in (20)-(22). It simply smooths the time series, attaching as much weight to future observations as to past. Figure 3 shows the actual and filtered series for utilization, using Lavoie et al.'s Canadian data for the manufacturing sector. The filtered series clearly does not increase whenever actual utilization exceeds the smoothed value and fall whenever actual utilization is below. As one would expect, a regression of the change in the smoothed series on the difference between to two series gives a parameter estimate that is statistically insignificant.
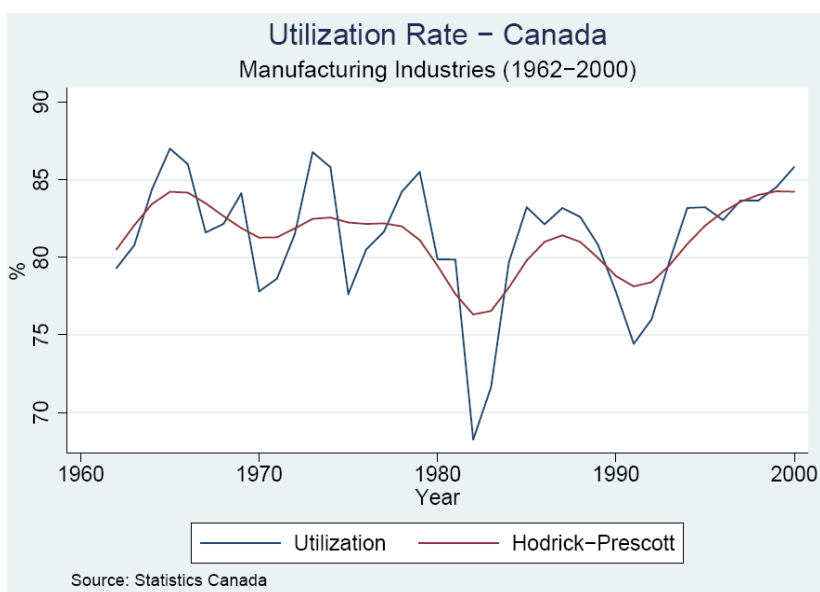

Figure 3

Although the Hodrick-Prescott filter does not capture the hysteresis argument, a smoothed version of actual utilization rates could be a useful approximation for a structurally determined, desired utilization rate: as argued above, the desired utilization rate may be time-varying and if the actual rate fluctuates around the desired rate, the Hodrick-Prescott filter may provide a good estimate. Thus, paradoxically, while the empirical HK equation is inconsistent with the adaptive model, this type of equation could represent

an empirical version of the Harrodian argument. The interpretation of the coefficients in the estimated equation, however, is unclear because of the inclusion of both $I/K - \rho$ and $u - u^d$ as explanatory variables (if, in fact, (20)-(22) had held, the two variables would have been proportional, except perhaps for a stochastic disturbance term). Table 1 presents the results of OLS regressions that leave out the $I/K - \rho$ term (using the same Canadian data for manufacturing as Lavoie et al.). Column 3 leaves out the change in utilization rates as an explanatory variable; columns 1 and 2 follow Lavoie et al. and retain this variable. The Harrodian rationale for this would be that changes in accumulation take into account not just the discrepancy between actual and desired utilization but also whether current accumulation rates are already generating changes in the right direction. It is unclear whether, from this perspective, the change in utilization should be lagged, and columns 1 and 2 differ in this respect. Column 1 clearly outperforms the other two specifications but all three specifications give the expected positive coefficient on $u - u^{HP}$, and in columns 1 and 3 the coefficient is significant at the 1 percent level.

<div align="center">

"HK" Equation Estimation

Dependent variable: $\Delta g_{k,t} = \Delta(\log K_t - \log K_{t-1})$

</div>

	(1)	(2)	(3)
$u_{t-1} - u_{t-1}^{HP}$	0.3400***	0.0757	0.1753***
	[0.0499]	[0.0624]	[0.0529]
Δu_t	0.1961***		
	[0.0353]		
Δu_{t-1}		0.1177**	
		[0.0442]	
$Constant$	-0.1341	-0.1252	-0.1164
	[0.1049]	[0.1306]	[0.1374]
Observations	39	39	40
R^2	0.58	0.35	0.22

<div align="center">

Standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

Table 1

</div>

Returning to the "hysteresis equation" (31), there is a standard procedure for dealing with the unobservability of ρ and u^d: Koyck transformations. Note first that using (21)-(22) we have

$$\rho_t - \rho_{t-1} = \frac{\nu\beta}{\mu}(u_t^d - u_{t-1}^d) \tag{32}$$

and hence

$$\rho_t = \frac{\nu\beta}{\mu}u_t^d + A \tag{33}$$

where A is an arbitrary constant.[15] Using (20)-(22) and (33), the accumulation function can now be written

$$\begin{aligned}
\frac{I_t}{K_t} &= A + \beta(\frac{\nu}{\mu} - 1)u_t^d + \beta u_t \\
&= A + \beta(\frac{\nu}{\mu} - 1)[\mu u_{t-1} + (1-\mu)u_{t-1}^d] + \beta u_t \tag{34}
\end{aligned}$$

Subtracting $(1-\mu)\frac{I_{t-1}}{K_{t-1}}$ from both sides we get

$$\frac{I_t}{K_t} - (1-\mu)\frac{I_{t-1}}{K_{t-1}} = \mu A + \beta(\nu-1)u_{t-1} + \beta u_t \tag{35}$$

or

$$\frac{I_t}{K_t} - \frac{I_{t-1}}{K_{t-1}} = \mu A - \mu\frac{I_{t-1}}{K_{t-1}} + \beta\nu u_{t-1} + \beta(u_t - u_{t-1}) \tag{36}$$

This estimation contains no unobservable variables and, using the same Canadian data as Lavoie et al., a standard OLS regression yields the results in Table 2. The implied estimates of the parameters are $\beta = 0.11$, $\mu = 0.11$, $\nu = 1.40$. Thus, the stability condition - $\frac{\beta\nu}{\mu} < s(\bar{\pi})\sigma \approx 0.1$ - is not even close to being satisfied.

To avoid misunderstanding, the econometric results in this section are highly preliminary and clearly do not settle the issue. They do show that some of the claims that have been made in favor of Kaleckian specifications are unfounded, but much more work needs to be done.

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[15] If one or both of the equations (21) and (22) include an additive stochastic term, the constant A will itself become a stochastic variable, and if the disturbance terms are iid, A would be a random walk. I shall take A to be a constant.

Investment Equation Estimation
Dependent variable: $\Delta g_{k,t}$)

$g_{k,t-1}$	-0.1118
	[0.0838]
u_{t-1}	0.1577***
	[0.0372]
Δu_t	0.1133**
	[0.0416]
$Constant$	-12.6283***
	[3.0234]
Observations	39
R^2	0.38

Notes: Standard errors in brackets.
*** p<0.01, ** p<0.05.

Table 2

5   Conclusion

The canonical Kaleckian model largely ignores or assumes away stability issues. It is not controversial to assume that a short-run investment function (where all the effects of lagged variables can be thought of as being part of the constant) will satisfy a Keynesian stability condition, but the Kaleckian model leaves out lags and assumes that the short-run specification applies in the long run as well. This elimination of lags and dynamics simplifies the analytics enormously, with obvious pedagogical benefits, and the static equations of the Kaleckian model provide a flexible platform for extensions in many directions. The specification of the accumulation function, however, is critical for almost all properties of the model, including the comparative statics, and at a methodological level the basic model sends the wrong message if in fact lags, dynamics and instabilities are essential for an understanding of capitalist economies.

The significance of these concerns clearly hinges on whether there is theoretical and empirical evidence to support the Kaleckian specification. If there is, then the simplicity of the framework is a strength rather than a weakness. This paper suggests that the evidence is weak, both on the theoretical and empirical side.

The empirical analysis in section 4 is sketchy and incomplete. There are significant data issues, the estimation of investment functions is notoriously difficult, and a much

more careful analysis is needed to allow decisive conclusions. Still, the evidence, such as it is, fails to support the Kaleckian position.

The theoretical argument, it seems to me, is clearer. Most contributors accept that a steady-growth path should be characterized by a consistency between actual and desired utilization rates, and if the economy tends to fluctuate around a steady growth path, this steady-growth property implies that average utilization rates will be close to the desired rate.[16] The real question concerns the determination of the desired rate.

Mathematically it is not difficult to set up a model that generates Kaleckian results. The desired rate may adapt to the actual rate, and assuming certain conditions with respect to adjustment speeds, we may get a model that generalizes the canonical model; the key properties of the simple model are retained but, because of the non-uniqueness of the stationary solution, the possibility of hysteresis effects are present. The behavioral story behind the equations does not, however, seem plausible.

"Plausibility" is a matter of judgement and there are no hard and universal rules. Most of contemporary economics remains committed to an optimization paradigm which requires that all equations be derived from some strict optimization problem. This requirement, often misleadingly sold as "microfoundations", glosses over aggregational issues, imposes unreasonable powers of foresight and cognition on all economic actors, and tops it all by then analyzing only grossly simplified decision problems since more complex problems defy solution. These shortcomings of mainstream methodology do not, however, imply that macroeconomic equations should be posited without consideration of how they relate to the behavior of firms and households, taking into account as best one can both the diversity of behaviors and the influence of institutional structures. In fact, Keynes along with some of the old Keynesians seem to have it just about right in this respect (see, for example, Tobin 1986). Macroeconomists need to tell a convincing behavioral story, drawing on whatever evidence seems relevant, and to my mind, the Kaleckians have yet to do that with respect to investment.

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