Methodological, internal and ontological inconsistencies in the conventional microfoundations of post-Keynesian theory
Methodological, internal and ontological inconsistencies in the conventional micro-foundation of post-Keynesian theory.∗

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Abstract

By the aid of a simple but widely accepted model, the conventional micro-foundation of behavioral hypothesis postulated in post-Keynesian theory in the Kaleckian tradition is critically reviewed. Inconsistencies are identified along three dimensions: A methodological inconsistency arises from presenting macroeconomic arguments formally and microeconomic arguments verbally. An internal inconsistency prevails when the micro-considerations for different behavioral rules are mutually inconsistent. An ontological inconsistency arises since the postulated behavioral rules are invariant to endogenous changes in the micro-environment whereas the micro-considerations imply them to adjust endogenously. We arrive at two conclusions: First, re-visiting the issue of micro-foundation within the post-Keynesian framework may be a rewarding line of research. Second, the post-Keynesian research paradigm should be open to various forms of consistent micro-foundations as long as the economic mechanism characterized by the model are post-Keynesian.

Keywords: Post-Keynesian economics, micro-foundations, economic methodology, ontology

JEL Classification: B41, B50, E12

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1 Introduction

To study the business cycle as well as economic growth, much of the Keynesian literature employs aggregative models in the Cambridge tradition of Kalecki (1971), Robinson (1956, 1962) and Kaldor (1982) which shall be referred to as post-Keynesian (PK). Models in this vein feature a rich set of economic dynamics and perceive fluctuations as a demand-side phenomenon generated by the interaction of distribution, financial leverage and aggregate demand (cf. Taylor 1985, 2012, Flaschel 2009 and Schoder 2014a). The core feature of the PK model class is the principle of effective demand according to which output is determined by aggregate demand. It implies that the labor market exhibits Keynesian unemployment resulting from insufficient aggregate spending (Taylor 2004 and Hein and Stockhammer 2010).\footnote{PK models have been applied to study issues related to the growth effects of the re-distribution of income (cf. Bhaduri and Marglin 1990, Naastepad and Storm 2007, Carvalho and Rezai 2014), of monetary policy (cf. Lavoie 1995a and Hein 2007) and of institutional changes on financial markets referred to as financialization (cf. Stockhammer 2006, Lima and Meirelles 2007 and Hein and Schoder 2011). The nexus between growth and distribution has also been discussed extensively in an open-economy context (cf. Blecker 1989 and Araujo and Lima 2007). PK theory is also at the core of the literature on stock-flow consistent models (cf. Godley and Cripps 1983 and Godley and Lavoie 2012).}

Regarding the micro-structure, behavioral hypotheses are typically anchored in stylized empirical observations such as the Keynesian consumption function and not explicitly derived from goal-oriented behavior of economic agents. In seminal contributions, Lavoie (1992, 2014) argues that behavioral relations postulated in PK models are well-anchored in consistent micro-foundations which, in contrast to orthodox economics, do not rely on inter-temporal optimization or rational expectations.

Despite these efforts, the following observations may suggest that re-visiting the micro-foundation of PK theory may be a rewarding line of research. First, PK models have (implicitly and explicitly) been criticized for deficits in providing a consistent set of micro-foundations for the postulated behavioral hypotheses (cf. Lucas 1976, Yellen 1980, Skott 1989a,b, 2014, Foley and Michl 1999, Farmer and Foley 2009, Murota and Ono 2010 and Tavani 2015). Second, economists sympathetic to Keynesian ideas such as, to name a few, Joseph Stiglitz, Paul Krugman and Simon Wren-Lewis who Lavoie (2014) refers to as Mainstream Dissenters do not seem to be convinced by traditional PK micro-foundations. Third, after the financial crisis, when the standard new-Keynesian (NK) Dynamic Stochastic General Equilibrium framework became subject to severe criticism, PK theory was not seen as a viable alternative. The question arises if this marginalization may be, to some extent, due to home-grown shortcomings in the foundation of the theory.

Motivated by these observations, the purpose of the present paper is to initiate a self-critical process of reflecting on PK micro-foundations. We will critically review the micro-foundation of PK behavioral rules under special consideration of seminal contributions within the Kaleckian paradigm including Rowthorn (1981), Dutt (1984), Taylor (1985), Bhaduri and Marglin (1990), Lavoie (1995a), Godley and Lavoie (2012, ch.11), Hein (2007) and Hein and Stockhammer (2010). For pedagogical reasons, we will sketch a simple but broadly accepted PK model in the Kaleckian tradition which will be used to assess the transparency, consistency and completeness of the micro-foundation in the PK literature.

The review will identify inconsistencies along three dimensions: First, PKs adhere to the idea of formal modeling when it comes to the interaction of macroeconomic variables such as growth and distribution. Yet, behavioral hypotheses postulated on the micro-level, e.g. in order to establish a causal relation between consumption and income, are anchored in verbal considerations rather...
than formal modeling. This may be perceived as a methodological inconsistency. Second, internal inconsistencies may arise from the fact that different micro-considerations provided for different behavioral rules within the very same model tend to be mutually inconsistent. For instance, in many models fixed costs are assumed away in order to motivate a simple Kaleckian type of pricing equation. Yet, the justification for the target rate of capacity utilization not being too low relies on the very presence of fix costs. Finally, we identify ontological inconsistencies between the behavioral rules postulated and the micro-considerations provided to back them up. The micro-considerations typically imply the agents to exhibit goal-oriented behavior, i.e. to pursue objectives, e.g. choosing the target utilization rate to optimize market-expansion prospects. Goal-oriented behavior implies rules of behavior to adjust to possibly endogenous variations in the economic environment. For instance, the target utilization rate will respond to changes in the degree of monopoly. Yet, changes in the micro-environment are not taken into account by the postulated rules which implicitly take agents to be lethargic, i.e. unable or unwilling to adapt their behavior to a changing environment.

Two further observations will be made which suggest that both NK and PK models rely on strong assumptions: First, the assumption of agents to be representative prevails in almost any of the popular PK models. Hence, the use of representative agents is not only a feature of orthodox economics but also popular in PK models. Second, both NK and PK models emphasize the significance of expectations while making strong assumptions regarding the expectation formation, yet on opposite extremes. Whereas NKs take expectations as rational, i.e. forward-looking and model-consistent, PKs assume expectations to be purely backward-looking. This is despite the emphasis on the forward-looking but non-rational nature of expectations in much of Keynes’ work.

From this analysis we will draw the following conclusions for a possible new foundation of PK economic theory: First, if one decides to characterize the micro-structure of the economic model used, economic behavior should be modeled rather than justified verbally in order to be methodologically as well as internally consistent. This is for the very same reasons why PKs find it beneficiary to model the interaction of aggregate variables: transparency, consistency and completeness of the argument. Second, in line with the assumptions on economic behavior underlying current micro-considerations choices could be modeled as the result of goal-oriented rather than lethargic behavior. An evolutionary process of finding a locally optimal rule of behavior under constraints a posteriori referred to as passive choice would be highly consistent with PK principles of fundamental uncertainty as well as procedural rationality. Further, while a weak interpretation of fundamental uncertainty excludes rational expectations, it would still allow for active choice, i.e. finding the optimal rule of behavior a priori by solving an optimization problem for given expectations. Finally, the core difference between NK and PK models is the acceptance and rejection, respectively, of the notion of a general equilibrium, in particular related to the labor market. Hence the PK research paradigm should be open to various forms of transparent, consistent and complete sets of micro-foundations as well as various assumptions regarding expectation formation as long as the model features the principle of effective demand.

Should the behavioral hypotheses postulated in the PK models be motivated by micro-considerations or micro-foundations at all? On the one hand, it could be argued that macroeconomic theory should also include a consistent theory of economic behavior. Yet, on the other hand, the view that economic behavior is too complex to be modeled and better approximated by stylized empirical observations without seeking to explain them may also be legitimate. In the present paper, we

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2 As shown by Schoder (2014b), a Kaleckian economy featuring the principle of effective demand is consistent even with inter-temporal optimization and rational expectations.
choose not to address this question as it would go far beyond its scope. Rather than that, the paper merely challenges the wide-held view that the micro-considerations provided in much of the PK literature to justify the postulated behavioral hypotheses constitute a transparent, consistent and complete set of micro-foundations.

The remainder of the paper proceeds as follows. Section 2 discusses the concept of micro-foundation and proposes a classification scheme of different conventions in the literature. It will also assess these types of micro-foundations from an economic theory perspective. Section 3 then presents a PK model and evaluates the transparency, consistency and completeness of the micro-considerations typically provided to back up the postulated behavioral assumptions. Section 4 discusses the assumption made regarding agent heterogeneity and expectation formation required for aggregation and model solution. Section 5 concludes the paper.

2 Methodological considerations on micro-foundation

Micro-foundation addresses the behavior of economic as-if agents underlying a macroeconomic model. Let us briefly explore on the concept of as-if agents. Obviously, not any two real agents behave in exactly the same way in reality and the interaction of all agents with their economic environment gives rise to macroeconomic patterns which we would like to explain by macroeconomic theory. To do so, making simplifying assumptions regarding the heterogeneity of behavior across agents cannot be avoided. Regardless of the degree of heterogeneity allowed for, any micro-founded macroeconomic model assumes highly stylized economic agents. Yet, the question how any stylized agent relates to the agents in the real world whose behavior it should characterize is highly delicate. One approach may be to select a single agent of the real world, study their behavior and model the stylized agent accordingly. Yet, the stylized agent may not be very representative for the other agents of the real world. Rather than the behavior of a single real agent, the stylized agent should characterize the average behavior over all relevant real agents even though nobody may behave exactly like that in reality. Hence, any micro-founded model assumes economic decisions to be made as if agents exhibited a certain pattern of economic behavior. The issue for economic theory then is to model the as-if agent such that the behavioral hypotheses are as representative as possible.

We loosely define micro-foundations of an economic model as the consistent and complete explanation of a set of behavioral relations characterizing economic choice of as-if agents with all assumptions made transparent. Explaining in economics requires providing a theory. Obviously, consistency requires that the theory is free of contradictions. The respective hypotheses for explaining any two different behavioral relations (e.g. consumption and labor supply) need to be mutually consistent. Completeness requires that the entire set of behavioral relations of the model is explained by the micro-theory. Transparency requires that all assumptions regarding the micro-theory are made explicit. In contrast to micro-foundations, we define micro-considerations as the attempt to verbally motivate a postulated behavioral hypothesis which is currently the common practice in the PK research paradigm.

We distinguish between lethargic behavior and goal-oriented behavior. The former is defined as a behavioral rule determining the realization of a choice variable with the property that endogenous changes in the economic environment do not feed back into the behavioral rule itself. For instance, the Keynesian consumption function relates consumption to current income with the marginal propensity to consume assumed to be constant. The agent is assumed to be lethargic with respect
to this rule of behavior. Whatever the agent tries to achieve by following this rule, they will not endogenously adjust it. This may have two reasons: Either the agent does not follow a purpose when making a choice or they are not able to compare the payoffs of two different choices. The possibility of two different choices having the same payoff leading to indifference of the agent is a special case of goal-oriented behavior which we will discuss below. Goal-oriented behavior implies that the agent seeks to achieve a purpose when deciding on the control variable and that they are able to compare the outcome of two different choices. The purpose can be characterized by a set of preferences or a payoff function. Within the category of goal-oriented behavior, one may distinguish between passive and active choice. The concept of passive choice stresses the evolutionary character of behavioral rules. The outcome of a decision has a feedback on the decision rule itself which then turns into a heuristic. Agents move through time with a trembling hand of choice and stay with the rule which yields locally the highest payoff. These maxima are endogenous to the economic environment. Hence, the marginal propensity to consume will change endogenously with the state of the economy. Agents do not optimize since they do not know the return function globally and do not necessarily know the payoff of their choices a priori. Active choice requires the assumption that the agent knows the full payoff function a priori. Then purposeful behavior will induce the agent to choose such as to maximize the payoff function.

Note that passive choice is consistent with the PK concepts of Knightian or fundamental uncertainty and procedural rationality. In a strong interpretation, the former postulates that “the individual is ignorant of the available courses of action or of the extent of future states of the world” (Lavoie 2014, p.74). This view implies that forward-looking behavior cannot govern economic choices (cf. Knight 1940 and Shackle 1972). The proposed evolutionary micro-foundation does not require forward-looking behavior but allows for it. Procedural rationality states that “the decision maker must search for alternatives, has egregiously incomplete and inaccurate knowledge about the consequences of actions, and chooses actions that are expected to be satisfactory” (Simon 1997, p.17). This is exactly what passive choice characterizes. The agent may look only for a local optimum which is satisfactory. They experience the payoff of the choice a posteriori but do not know it a priori.

PKs dismissive of the idea of micro-foundation like to stress the concept of sufficiency. With their choice, agents seek to achieve a certain payoff. As long as the agents stay beyond the threshold, they are indifferent to different choices and, hence, will not adjust to sufficiently low changes in the environment. Obviously, such a behavior is inconsistent with both passive and active choice but consistent with lethargic behavior as long as the agent stays beyond the payoff threshold. We would like to put forward two arguments against this view. First, such a lethargic behavior may be certainly possible in the short run with low fluctuations in the economic environment. Yet, it is not convincing that lethargic indifference is governing economic decisions globally and in the long run. Second, while lethargic indifference above a certain payoff threshold may hold for the single agent, it is implausible for the average one which is the as-if agent whose decisions micro-foundation seeks to model.

3 The behavioral anchoring of a PK model

Having developed these categories for classifying different types of micro-foundations, we will proceed with critically reviewing the relevant literature including Rowthorn (1981), Dutt (1984), Taylor (1985), Bhaduri and Marglin (1990), Lavoie (1995a), Godley and Lavoie (2012, ch.11), Hein (2007)
and Hein and Stockhammer (2010). This exercise will reveal that the behavioral relations such as the consumption function, investment function or price setting equation are typically stated as lethargic rules. The justification of these behavioral relations which is the core endeavor of Lavoie (1992, 2014) is then based on micro-considerations which suggest the agents to follow goal-oriented behavior and even engage in active, i.e. optimizing, choice.

To exemplify our critique, we sketch out a simple but broadly accepted closed-economy model which is of a Kaleckian type but still representative for much of the PK work in economic theory including models with Harrodian, Kaldorian or Marxian closures (cf. Duménil and Lévy 1999, Shaikh 2009, Skott 2010 and Setterfield 2013). We will put forward the following criticism discussed in detail along the way:

- **Methodological inconsistency**: Macroeconomic arguments are put forward formally while microeconomic arguments are presented verbally.
- **Internal inconsistency**: The micro-considerations provided for different behavioral rules within the very same model tend to be mutually inconsistent.
- **Ontological inconsistency**: The micro-considerations imply the agents to exhibit goal-oriented behavior while the postulated behavioral rules suppose agents to be lethargic.

### 3.1 The setting

PK growth models seek to characterize at least the goods market featuring real aggregate output on the supply side and real aggregate consumption and real aggregate capital investment on the demand side. The supply side is characterized by a fixed-coefficient production technology according to which non-depreciating and non-traded capital and labor are combined in order to produce a homogeneous output good used for both consumption and capital investment. Even though the output good can be stored (as capital), just-in-time production is supposed in the Kaleckian variant of the PK model. Labor has to be compensated by a nominal wage per working hour which is assumed to be a collective policy variable, constant and the same for anyone providing labor. Accounting implies that aggregate sales equal aggregate expenditures or in the IS-notation, aggregate saving equals aggregate investment. The core feature the model needs to exhibit in order to qualify as PK is the principle of effective demand, i.e. that output is driven by consumption and investment expenditures. This implies that investment precedes savings in terms of causality, i.e. saving is driven by investment through changes in income. Hence, the investment decision is necessarily independent of the saving decision. Moreover, Keynesian unemployment needs to prevail. That is, production will never be constrained by a shortage of working hours supplied at a given real wage. Overall, any PK economy has to feature at least three markets: a goods market, a labor market and a market for external finance.

Regarding the type of agents participating in the economy, we follow Hein (2007) and Hein and Stockhammer (2010) by assuming the economy to be populated by households and firms. Households split up into laborers and rentiers. In particular, our economy is populated by $N_l$ laborers each deciding on their consumption (which is constrained to equal their income) and their labor supply, $N_r$ rentiers each choosing consumption which, for a given income, implies the supply of bank deposits, and $N_f$ firms each choosing its labor demand, the price of its good, capital investment and its demand for bank loans (which implies its profit distribution policy). Hence, savers and investors are institutionally separated. The supply-side of the external finance.
market is determined by the household’s consumption choice at a given income. The demand-side is determined by the firm’s investment decision and dividend decision the latter of which pins down retained earnings and required bank loans.3

Note that despite the existence of a market for bank finance we assume the interest rate to be zero for simplicity.5 Note further that the price setting of the firms will pin down the shares of wages and profits in total income. There is no feedback of the goods market to the income distribution which turns out to be exogenous in our model. Finally, note that the state of the labor market does not feed back into the economy.

3.2 Technology

We follow the relevant literature and assume firm k to produce according to

\[ Y_k = \min(L_k, u_k K_k) \]  

where \( Y_k, L_k, K_k \) and \( u_k \) denote output, labor input, capital input and the rate of capacity utilization to be defined below, respectively. Eq. (1) is a Leontief production function excluding the possibility of substitution between capital and labor. Apart from good reasons to assume this type of production function (see Lavoie 2014), the simplifying side-effect is that one does not have to address the question of what ratio of capital and labor inputs the firm will choose.

The following observations with respect to (1) are worth to note. First, we assume labor productivity (\( Y_k/L_k \)) to be unity for all firms for simplicity. We further assume that Keynesian unemployment prevails at any time. Hence, the labor input is never the binding constraint to production. Second, we define the rate of capacity utilization (\( u_k \)) as the ratio between output (\( Y_k \)) and full-capacity output (\( Y^C_k \)). With \( u_k = 1 \), our firms produce at full capacity and, with a predetermined capital stock, the availability of capital is a binding constraint to output. Note that we have also normalized capital productivity (\( Y^C_k/K_k \)), i.e. the output produced by one unit of capital at full capacity utilization, to unity. Third, \( Y_k \) will be determined from the demand-side of

\[ A \text{ slight deviation of the previous setting is to not distinguish between laborers and rentiers and assume the households’ propensities to consume out of wage and profit income to differ (cf. Lavoie and Godley 2001, Godley and Lavoie 2012, ch.11 and Schoder 2014a). Households now choose consumption and labor supply and firms choose, as before, labor demand, prices, investment and profit distribution. This modification also institutionally separates savers from the investors. The challenge for a consistent micro-foundation arising in this setting, however, is to deal with the consumption-labor supply interaction of the household. Since the aim of the paper is to discuss the micro-considerations underlying the simplest possible PK model with an institutional separation of the investment and saving decision, we do not apply this setting here. In contrast to that, early PK models consider agents providing labor services (workers) and agents owning the means of production and managing the production process (capitalists). Workers do not save and their only decision variable is labor supply— an assumption shared in much of the NK literature. Capitalists decide on labor demand (implied by the production technology and aggregate demand), prices, investment, consumption (which implies saving, i.e. bank deposits) and implicitly bank loans.4 Note that in this setting saving accrues only out of the firm’s profits (classical saving hypothesis). In order for the investment decision of the single agent to be independent of the saving decision, the existence of a market for external finance has to be assumed implicitly. Yet, in the aggregate external finance will not be required as investment spending will generate the profit income such that savings adjust through the multiplier effect (cf. Rowthorn 1981, Dutt 1984, Taylor 1985, Bhaduri and Marglin 1990). Since the investment and saving decisions are made by the same agent providing a consistent set of micro-foundations will prove difficult. Hence, we slightly change the setting of our model by institutionally separating the investment and saving decision.

4Note the assumption of a zero interest rate is not a strong one in a PK framework. This is because the interest rate would affect the demand for and supply of finance only through the income effect and not trough the substitution effect.
the economy in our model which is one of the core implications of PK theory. Hence, the production function indicates how much labor will be demanded for given \( u_k \) and \( K_k \), i.e. \( L_k = u_j K_k \). Since, unemployment does not feed back into our model, the labor demand is irrelevant as long as it is higher than labor supply. Fourth, as can be readily seen, we allow firms to hold idle capital, i.e. unused capacity, in equilibrium. We will return to this issue when discussing the firm’s objective. Fifth, up to full capacity, the technology exhibits constant marginal costs and constant returns to scale.

3.3 The laborers’ control variables: consumption and labor supply

The laborer \( i \)’s control variables are consumption \( (C^i_l) \) and labor supply \( (N_i) \) which is consistent with most models in the PK literature (even though the labor supply choice is typically not discussed explicitly).

The laborer’s consumption. The behavioral rule for the laborer’s consumption is implied by the assumption that laborers are excluded from the financial markets. Hence they cannot save and consume all of their income. We get

\[
C^i_l = \omega \sum_{k \in N} L_{k,i}.
\]

(2)

where \( \omega = w/P \) is the real wage and \( L_{k,i} \) is the firm \( k \)’s labor demand for laborer \( i \)’s services. Note that employment is determined by the labor demand as will be become clear below. Note that the laborer’s purpose with respect to the consumption choice is irrelevant. Whatever they want to save, they will not succeed, since they do not have access to the bank. Note that a similar assumption is made in the conventional DSGE literature. A significant share of households is non-Ricardian. They consume all of their income since they are simply assumed to be excluded from the financial markets. For the purpose of this paper, we therefore refrain from discussing this hypothesis.

The laborer’s labor supply. Before discussing the micro-foundation of the PK labor supply curve, note that, in most models and also in the present one, the labor supply decision does not affect the economy at all. Maintaining the crucial assumption that there is always sufficient labor supply at the given wage the labor supply decision only affects the rate of unemployment which does not feed back into the economy (cf. Bhaduri and Marglin 1990, Lavoie 1995a, Godley and Lavoie 2012, ch.11).

The assumption made in almost all PK macro models is that the aggregate labor supply \( (N) \) is constant

\[
N = \tilde{N}
\]

(3)

which is based on the empirical observation that the aggregate labor supply responds rather inelastically to wage changes (cf. Lavoie 1992, p.224). Note that (3) violates our definition of micro-foundation since it is not located on the micro-level.

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6 We still carefully review the micro-foundation of the PK labor supply for the following reasons: First, in models which feature labor-market effects on the economy, for instance on the distribution of income such as (Taylor 2004, chs.7,9) or Schoder (2014a), the labor supply decision would be relevant after all. Second, the micro-considerations provided to justify the PK labor supply nicely illustrates the challenges conventional PK micro-foundation faces.
What micro-stories do PKs provide to justify the suggested aggregate relation in terms of economic theory? An interesting framework for deriving a PK labor supply curve is proposed by Lavoie (2014, ch.5.4.1). Applying this framework to our model, we assume laborers to seek to maintain a certain desired standard of living which may be expressed as desired consumption \( C^l_i \) in our context. The laborer will choose an \( N_i \) which is just sufficient to reach \( C^l_i \) at a given \( \omega \). Assuming that all laborers are affected by unemployment, \( v \), to the same extent, we have

\[
N_i = \frac{C^l_i}{\omega(1 - v)}
\]

which holds since it is assumed that laborers do not save. Lavoie argues further that the desired standard of living, i.e. \( C^l_i \), depends on the average income of a reference group which the household compares to. We assume the rentiers to be the laborer’s reference group. Hence, one might assume the desired standard of living to be proportional to the average rentiers consumption with factor \( \gamma \).

Note, however, that the desired standard of living will not exceed what the household could attain under full utilization of its work capacity for a given unemployment rate which we assume to be unity. Hence,

\[
C^l_i = \min \left( \omega(1 - v), \gamma \frac{1}{N^r} \sum_{j \in N^r} C^r_j \right).
\]

Eqs. (4) and (5) are the formalization of Lavoie’s argument. For a given standard of living which the laborer seeks to attain, a real wage increase will reduce the number of hours worked. Hence, the supply curve is downward-sloping for a given standard of living. Yet, the wage increase may shift the household to a higher desired consumption level (which in our model is mediated through a possibly positive wage effect on aggregate demand and, hence, the rentiers’ consumption).

So far, the micro-considerations above constitute an incomplete and intransparent argument as the assumptions regarding the presupposed household’s objective are not made explicit. What purpose, for instance expressed by a set of preferences, may justify (4)? Suppose the laborer’s purpose with respect to the labor supply choice is to maximize well-being which is assumed to depend on consumption and leisure. Recalling that the work capacity is one, we assume

\[
\begin{aligned}
\rho \\[2\text{lines}\]
\end{aligned}
\]

where \( \rho \) and \( \psi \) are parameters. With \( \rho \to -\infty \) and \( \psi \to \infty \) the utility function represents Leontief preferences with the standard of living, \( C^l_i \), being a saturation point. These are exactly the type of preferences implicitly suggested by Lavoie (cf. 2014, ch.2.3). The constraint the laborer faces when choosing \( N_i \) is

\[
C^l_i = N_i \omega(1 - v).
\]

Two strategies to obtain the optimal labor supply may be of interest. On the one hand, suppose the agent does not know (6) but experiences the payoff \textit{a posteriori}. Suppose further that the agent’s first choice of \( L_i \) is not too far away from the optimum. Every round the agent deviates a little from the choice which has proven best in the past. If the new choice turns out to be better, the reference choice is updated. Assuming \( \rho \to -\infty \) and \( \psi \to \infty \), the optimal choice will turn out
to be (4). This assumption on economic behavior is consistent with fundamental uncertainty and procedural rationality. On the other hand, the agent could be assumed to be aware of (6). Since they are non-lethargic, they will choose $N_i$ immediately so as to maximize (6) subject to (7). Again the solution will be (4).

Having formalized Lavoie’s micro-considerations put forward to justify (3) it becomes clear that the assumption of a constant labor supply is a very special case in which, after aggregation over all laborers, a rise in the real wage is associated with a supply-reducing income-substitution effect which is exactly equal to a supply increasing standard-of-living effect and, hence, leaves hours worked unchanged. Hence eq. (3) is an approximation which ignores interesting effects variations in the real wage may have on the leisure-consumption trade-off of the laborer’s household. In particular, abstracting away from the link between labor supply and income of the peer group is surprising because these peer-group effects have been emphasized as a crucial pillar of the PK theory of choice (cf. Lavoie 2014, pp.101-3).

3.4 The rentier’s control variable: consumption

The rentier household $j$ only chooses consumption ($C^r_j$) which implies saving for a given level of profit income distributed to the household. We assume a Modigliani (1986) type of consumption function relating consumption to current income, i.e. distributed profits or dividends for the rentier, and wealth (cf. Godley and Lavoie 2012),

$$C^r_j = c_{II} \Pi^d_j + c_B B_j$$  

where $c_{II}$ and $c_B$ are the marginal propensities to consume out of all profits distributed to rentier $j$ ($\Pi^d_j = \sum_{k \in N^f} \Pi^d_{k,j}$ where $\Pi^d_{k,j}$ is the profits distributed from firm $k$ to rentier $j$) and wealth ($B_j$). Both parameters are assumed to be equal across rentiers. It is easy to see that households will consume all of their current income, i.e. no saving, if we have for the wealth-profit income ratio that

$$\hat{\theta}_j = B_j/\Pi^d_j = (1 - c_{II})/c_B.$$  

7 Other justifications for (3) shall also be mentioned: One underlying most PK macro models has been provided by Lavoie (1992, p.224): “Once we realize that the aggregate supply curve of labor may take just about any shape, [...] we might as well simplify this part of the analysis and assume that the supply curve of labor is vertical in the short run.” If this argument was sufficient for assuming the labor supply to be constant, then one may ask why PKs would not be willing to conclude, for instance, that aggregate demand should better be assumed to be independent of income distribution given the observation that it is highly contested whether demand is wage or profit-led. Another argument is based on the observation that most jobs feature an institutionally determined number of working hours which do not depend on the real wage (cf. Eichner 1987). As Lavoie (2014, p.317) puts it, “the choice is simply between working the number of hours imposed by the institutional norm and turning down the employment.” One crucial question, however, is: What affects this choice? Reservation wage considerations may suggest that the participation rate increases with the real wage causing the labor supply curve to be upward-sloping instead of vertical as implied by (3). A manifold of heterodox contributions on non-standard labor markets exist some of which are discussed by Lavoie (2014). Yet, they are not implemented in PK macro models which, in fact, tend to share the labor supply function in (3).

8 Various other forms of consumption functions can be found in the literature. Many of them exclude the wealth effect (cf. Hein 2007 and Hein and Stockhammer 2010). The questionable implication of this assumption from a behavioral perspective is that saving households accumulate an infinite stock of wealth for a given level of income since they save a positive amount every period. Other consumption specifications exclude the wealth effect and add a constant which would be stock-flow consistent but prevents a steady state in a growth context (cf. Davidson 2011). Hence, stock-flow consistent variants typically assume a wealth effect on consumption (cf. Godley and Cripps 1983 and Godley and Lavoie 2012).
Substituted into the definition of saving, i.e. \( B_j = \Pi_j^d - C_j^r \), the consumption rule in (8) can be expressed as a wealth accumulation rule which characterizes the supply of new bank deposits and can be easily shown to read

\[
\dot{B}_j = (1 - \tau) \left( \Pi_j^d - \frac{c_B}{1 - \tau} B_j \right)
\]

in equilibrium-adjustment form where \( \frac{c_B}{1 - \tau} \) is the inverse of the target wealth-income ratio, \( \theta_j \), and \( 1 - \tau \) is the propensity to save out of income measuring the speed by which savings adjustment to the target. Hence, one could perceive the rentier’s consumption choice as being governed by a desired long-run wealth-income ratio \( \theta_j \) as well as by the desired speed of adjustment to that target which is implied by \( c_B \). Note that \( c_B \) will then also be determined implicitly.

What determines the desired wealth-income ratio and the desired speed of adjustment? PKs assume these variables to be constant and calibrate them according to empirical observations. One common approach to justify taking \( \theta_j \) and \( c_B \) as exogenous parameters is to argue that they are historically grown conventions. A non-zero target wealth-income ratio may be motivated by the possibility of unforeseen events such as a permanent income loss or required medical expenses inducing the reasonable household to accumulate a buffer-stock of savings. The speed of adjustment may be motivated by the notion of hierarchy of needs which implies that households fill their consumption basket first with goods of dire need (Lavoie 2014, p.100). A rising amount of saving, therefore, becomes increasingly painful in terms of well-being for a given level of income. Note that in the case of just one homogeneous consumption good as assumed in our model, a utility function with decreasing marginal returns would represent these preferences. Hence, households prefer to smooth consumption over time. For a given desired wealth-income ratio, a beneficial speed of adjustment yields a high utility given the trade-off between reaching the desired wealth-income ratio quickly and not cutting too deep into basic needs through fast wealth accumulation.

Equivalent to the labor supply choice in (3), (8) characterizes consumption of a lethargic agent since the consumption rule does not adjust to possibly endogenous changes in the economic environment. Yet, as has been shown by Carroll and Jeanne (2009) and Carroll and Toche (2009) and in detail by Schoder (2014b), (8) can be derived from goal-oriented behavior with preferences represented by a utility function taking into account the possibility of a permanent income loss which the agent seeks to hedge against through precautionary saving. The desired wealth-income ratio, then, depends on the probability of income loss. The speed of adjustment depends on the wealth-income ratio and on the preference for consumption smoothing. Note that the optimal wealth-income ratio and speed of adjustment could also be obtained by an evolutionary trembling-hand process.

3.5 The firm’s control variables: price, investment and demand for bank loans

The firm \( k \) chooses the labor demand \( (L_k) \), price \( (P_k) \), investment \( (I_k) \) and its demand for new bank loans \( (D_k) \). Note that labor demand is not a control variable since it is determined by the technology for a given level of economic activity. Even though these decisions are made by the same agent, PKs implicitly assume them to be independent from each other. While it is plausible to assume an institutional separation of the consumption choice and corporate decisions, one might...
expect that price and investment decisions are coordinated. Let us discuss the decision variables in more detail.

**Price setting.** The firm is assumed to operate under oligopolistic competition setting the price such that unit revenues exceed unit costs, which only include labor costs, by a factor \((1 + m)\) where \(m\) is the mark-up here assumed to be constant (Lavoie 1992, p.129 and Kalecki 1971, pp.44-45). Hence, we have

\[
P_k = (1 + m)w L_k / Y_k = (1 + m)w
\]

which also uses the assumption of the labor productivity to be one. Note that because of the assumption of a homogeneous mark-up and wage rate, the price is the same for all firms. The real wage is implied by the mark-up as \(\omega = \frac{1}{1+m}\).

Given a Leontief production function with idle capital and the absence of fixed costs of production, unit costs are constant up to full capacity utilization. Hence, the previous assumptions imply that variations in demand do not affect the mark-up or the price level. The only remaining issue which needs to be addressed is what determines the size of \(m\). Note that this question is not a bagatelle. It is at the core of Kaleckian theory as it determines the distribution of income between profits and wages.

Given the crucial role pricing has for the determination of the income distribution in the Kaleckian theory, it is striking that none of the popular Kaleckian contributions has attempted to model the pricing decision. Rather than modeling it, a positive and often constant mark-up is usually motivated verbally by referring to Kalecki’s (1971, p.168) *degree of monopoly* according to which the extent of market concentration is the core determinant of the mark-up. The higher the market concentration, the higher the market power of the firm and the higher the mark-up can be set without loosing market shares. Alternative micro-considerations have been provided by Kaldor (1985, pp.50-51) and Lavoie (2014, chs.3.3-3.6) arguing that firms set the mark-up within two extrema: On the one hand, the objective to grow requires high mark-ups that allow for high profits needed to finance investment. On the other, the objective to expand in market shares requires low prices in order to acquire higher sales. Thus, depending on the constraints given by finance frontiers and market power, firms choose the optimal mark-up.\(^{10}\)

As has been argued by Schoder (2014b), the Kaleckian story behind (10) can be modeled as the profit-maximizing outcome of the firm’s price decision given a Leontief production function as assumed in (1). Oligopolistic competition can consistently be generated by assuming that firms produce differentiated intermediate goods which are then bundled into a homogeneous final good by a cost-minimizing zero-profit firm given the price of the intermediate goods. The *degree of monopoly* and, hence, the mark-up is then determined by the elasticity by which the aggregator can substitute between intermediate goods to produce the final good. When choosing the price, the intermediate good firm seeks to maximize profits taking into account that a high price reduces its sales because of a lower demand by the final good firm. The lower the elasticity of substitution, the weaker demand responds to changes in the price and the higher the firm will set the optimal mark-up. This pricing behavior will give rise to (10).

\(^{10}\)One disputable feature of the suggested price formation hypothesis in the PK model considered here is that it builds on oligopolistic competition while it is assumed that firms produce a homogeneous good. The question arises, why does competition not eliminate any mark-up if all goods are the same?
**Investment.** Before discussing the PK investment theory, let us briefly summarize what our model set-up so far implies for capital. First, the investment decision is assumed to be independent of the pricing decision. Hence, the firm takes expected sales \(Y_k^e\) as an exogenous variable. Second, the capital stock is predetermined, i.e. given in the current period. Through its investment decision, the firm can affect the next period's capital stock. Third, the capital stock is firm-specific and, therefore, the investment decision is made by the firm which is institutionally separated from the rentier household choosing savings. Fourth, for a given expected level of sales \(Y_k^e\), the production function in (1) combined with the assumption of Keynesian unemployment implies the expected rate of capacity utilization \(u_k^e\) and the level of capital \(K_k\) to be inversely related. In particular, a raise in demand will increase utilization in the short run since the capital stock is predetermined. In the longer run, however, the firm can choose the evolution of its capital stock in response to the evolution of expected sales implying a long-run utilization rate. The question is what considerations drive the investment decision?

As argued by Lavoie (2014), PK firms care about their capacity utilization. In particular, so the argument goes, they want to keep \(u_k^e\) low enough to avoid future expected sales to exceed production capacities. Inflexibility in accommodating additional demand due to producing at almost full capacity may cause the firm to lose market shares to competitors and potential market entrants in case of a positive demand shock (Steindl 1952). Note that competition and market entry are not elements of the PK model economy even though they are used to motivate model-relevant behavior. Besides this inconsistency, why should our firm actually care about losing market shares? Because it is implicitly assumed that it has some form of objective. Lavoie (2014, ch.3.3) suggests the firms to be interested in increasing market shares in order to sustainably raising sales. If this was the firms objective and if market shares were primarily obtained by competitors not being able to accommodate their demand, then the lower the rate of capacity utilization the better it would be for the firm, given random shocks to demand. Since PKs would also argue that the long-run rate of capacity utilization should not be too low, they implicitly assume the firm to care about profitability, too, which is not inconsistent with the growth objective. Making the plausible assumption that idle capacity is costly, a decreasing utilization rate raises costs and reduces profits. Hence, many PKs would argue that there exists a desired rate of capacity utilization which satisfactorily balances the trade-off between fast expansion and high profits.\(^{11}\)

Investment is therefore driven by the desire to reach the target rate of capacity utilization \(\bar{u}\) which we assume to be the same across firms. If capital was traded on the spot market, the firm could simply choose \(K_k = Y_k^e/\bar{u}^e\) to immediately obtain the desired utilization rate. However, capital is firm-specific and it is also implicitly assumed, similar to Tobin's \(q\) theory, that capital adjustment is costly. Then, the change of the capital stock, i.e. investment \(I_k\), is a function in the utilization gap, \(I_k = f(u_k^e - \bar{u})\), and adjustment is continuous. Normalizing the investment function by capital, approximating it by a linear form and adding animal spirits, we get

\[
\frac{I_k}{K_k} = a_k + \beta(u_k^e - \bar{u})
\]

\(^{11}\)In contrast to that, so-called *fundamentalists* in the PK tradition argue that the investment decision in a world of *fundamental uncertainty* is too complex to be explained by observable variables, or to be modelled at all (cf. Shackle 1992, p.218). The average firm does not pursue a specific purpose significant and stable enough to explain its investment behavior over time. Not even do firms follow a lethargic rule. Investment is driven by *animal spirits*, i.e. “a spontaneous urge to action rather than inaction” (Keynes 1936, p.161). Imposing this view on our model implies \(K_k\) and hence \(u_k^e\) to evolve randomly for a given evolution of \(Y_k^e\). The individual firm as well as the overall economy will periodically hit the full capacity constraint. Most PKs, however, do not assume investment to be arbitrary.
where \( a_k = \rho + \epsilon_k \) is referred to as animal spirits and \( \beta \) indicates how a gap between the expected utilization rate and the target rate of capacity utilization translates into investment. \( \epsilon_k \) is a zero-mean random process. Note that we do not allow \( \rho \) or \( \beta \) to vary across firms.

As in standard PK models, investment is not assumed to be a non-ergodic or exogenous process even though it is taken into account that it may be subject to large shocks. As in most empirical applications on the firm or aggregate level, animal spirits are boiled down to some well-behaved random process and can be perceived as equivalent to random shocks to Tobin’s \( q \) in the conventional investment theory (cf. Schoder 2014b).

The foundation of (11) raises five issues which we would like to discuss here. First, the micro-considerations provided above imply that \( \rho = 0 \), i.e. the secular rate of growth is zero. If the target utilization rate is met at a given expected level of sales, there is no need to adjust the capital stock. Hence, the steady-state growth rate of the economy is zero. In the absence of autonomous consumption or government spending, what is the income level consistent with zero investment? Since savings have to be zero in this case and given a positive saving propensity, income will have to be zero as well. Hence, we need to assume \( \rho > 0 \) for a meaningful steady state to exist. Yet, it is not clear why firms should invest even though their target utilization rate for a given output level is met.

Second, with \( \rho > 0 \) the firms will generally not meet their target utilization rate. As it turns out the investment expenses of the firms have a feedback effect on their sales in the aggregate. As we will see below, assuming that all agents are homogeneous which is common practice in the PK literature a goods-market equilibrium rate of capacity utilization exists. This equilibrium utilization rate \( (u^*) \) will be positive under some parameter conditions. The representative firm misses the target consistently because it finds itself trapped in a situation where its own investment, induced by the attempt to reduce the utilization rate to the target, raises sales such that the utilization rate is at the same sub-optimal level as before.\(^{12}\)

Third, (11) is a lethargic rule not only because of the firm’s reluctance to change its investment behavior when failing to achieve its target utilization rate. Since the firm’s trade-off between long-term growth and short-term profitability for a given structure of capital adjustment costs is not modeled, the firms investment rule does not adjust to possibly endogenous changes in this environment. For instance, if capital adjustment costs are quadratic the firm may choose a lower

\(^{12}\)Many suggestions to deal with this inconsistency have been put forward none of which seem consistent with the underlying setting of the economy. One standard Kaleckian response to this dilemma has been to argue that firms simply settle without managing to meet their target (cf. Dutt 1997, 2009). Even though following (11) does not lead them to the target utilization rate the achievement of which was the very motivation of that investment rule, the firms are assumed not to adjust their behavior. This view has been objected to by many PKs (cf. Kurz 1986, Auerbach and Skott 1988, Skott 2012, Duménil and Lévy 1995, 1999). Duménil and Lévy (1995, 1999) have suggested that a utilization rate exceeding some threshold will cause inflationary pressures and induce the monetary authority to raise the interest rate which than cuts into investment such that \( \dot{\rho} = f(u_k^* - \bar{u}) \) with \( f(0) = 0 \) and \( f' < 0 \). It is not clear, however, why this threshold utilization rate should be consistent with the target utilization rate of the firm. Skott (2012) has argued that firms will try to accelerate investment when they realize that their investment rule does not yield the desired utilization rate. This could be introduced in our model by assuming that \( \dot{\rho} = f(u_k^* - \bar{u}) \) with \( f(0) = 0 \) and \( f' > 0 \). This modification generates instability in the aggregate since the investment rate has a positive own-feedback through the impact on the aggregate utilization rate. To obtain global stability additional negative feedback mechanisms of an expanding economy on the investment behavior, for instance via rising employment or falling profit shares, have to be introduced. Finally, Lavoie (1995b, 1996), Dutt (1997, 2009) and Schoder (2012) argue that the target utilization rate adjusts to the equilibrium utilization rate through hysteresis, i.e. \( u_k = f(u_k^* - \bar{u}) \) with \( f(0) = 0 \) and \( f' > 0 \). This interpretation, however, is obviously inconsistent with the initial PK justification of desired excess capacity based on a growth-profit trade-off.
\( \beta \), i.e. speed by which it seeks to achieve its target, if utilization and, hence, accumulation increase.

Fourth, in light of the micro-stories told to justify the pricing and investment decisions their strict conceptional separation seems to be inconsistent. At least, it is based on strong assumptions on the economic setting which are not made transparent. One example is the fact that the pricing decision assumes away fixed costs whereas the motivation of a not-too-low target utilization rate relies on them. Moreover, consider the following thought experiment illustrating the inter-relation of the pricing and investment decision: Suppose there is a shock to the degree of monopoly which is unrelated to competition raising the mark-up and, hence, prices. This does not affect the investment decision in the model. Yet, it should. At a given target utilization rate, profitability will now go up while the long-run growth prospects have not changed. Hence, the firm will find it beneficial to lower the target-utilization rate. Finally, the assumption that the pricing instrument is not used at all to deter market entry despite the importance of this strategy for long-term growth seems to be strong. The behavioral separation of the pricing and investment decisions of the firm is even more surprising in light of the strong emphasis which PKs such as Galbraith (1967) and Eichner (1976) have put on the interaction of price and investment decisions in their detailed institutional analysis of modern corporations.

Fifth, what is the origin of economic growth in the PK model? Note that (11) implies zero growth if the firms meet their utilization targets since \( \rho = 0 \). Only when firms are consistently wrong in forming sales expectations will there be steady-growth. PK models using (11), however, typically assume \( \rho > 0 \). Then, the economy grows even though the utilization targets are met. This implies, however, that the firms expand their capital even though they have already accumulated the optimal stock given their sales expectations. Hence a growing economy seems to be inconsistent with the micro-story provided.

Finally note that (11) is consistent with the conventional Tobin’s \( q \) theory of investment and, hence, with mainstream micro-foundations. As has been shown by Schoder (2014b), there is a monotonous relationship between \( q_k \) and \( u_k^u - \bar{u} \) with \( q_k = 1 \) if and only if \( u_k^u = \bar{u} \). The only difference to the current model is the interpretation of \( \bar{u} \) which is derived from cost considerations in Schoder (2014b).

Demand for bank loans. The rentier’s consumption behavior implies the supply of new bank deposits to depend on income. Any consumption function implies this type of relation. Here, we want to review what the literature implies for the demand for new bank loans. The striking finding is that PK models have not elaborated in much detail on the micro-foundation of the implicitly assumed loan demand functions.

Before turning to the literature, let us get the accounting right. Assuming that firms do not accumulate assets other than physical capital, assuming for a moment that the interest rate \( i \) is positive and recalling that our price level is one, the profits left to be distributed to the households are

\[
\Pi_k^d = Y_k - \omega L_k - I_k + D_k - iD_k
\]  

(12)

where \( D_k \) are the bank loans of firm \( k \). Defining total profits or operating surplus as \( \Pi_k = Y_k - \omega L_k \) and retained earnings as \( I_k - D_k \) has the following implications: Total profits split up into retained earnings, distributed profits and interest payments, i.e. \( \Pi_k = \Pi_k^r + \Pi_k^d + iD_k \). Investment will be financed by retained earnings and new bank loans, i.e \( I_k + iD_k = \Pi_k^r + D_k \). For given \( \Pi_k \), \( I_k \) and \( i \), the profit distribution decision \( \Pi_k^d \) implies the demand for new bank loans \( D_k \) and vice versa.
through the accounting relation in (12). Hence, the decision on the demand for bank loans is a decision on the financial structure of the firm.

Regarding the preferred financial structure of the firm two strands in the PK literature shall be mentioned here: Keynes (1936, p.144), Kalecki (1971, pp.105-109), Minsky (1976) and Fazzari and Athey (1987), Fazzari and Mott (1987), Fazzari et al. (1988) have argued that internal finance is preferred over debt finance and equity finance. This is because the latter are associated with costs exceeding the costs of internal finance and arising from information asymmetries. These considerations imply that firms set $\Pi_k^d = 0$. The optimal debt-capital ratio $(\lambda_k = D_k/K_k)$ would be zero. Yet, according to the literature on the *shareholder revolution* in corporate finance popularized by, among others, Stockhammer (5 06) an institutionally asserted rise in the relative power of rentiers vis-a-vis firms puts an upward pressure on distributed profits. Hence, the greater the rentiers’ influence, the higher $\lambda_k$ and $\lambda_k$ for given investment expenses. Hence, the target debt-capital ratio may be interpreted as a compromise between reducing the cost of finance and increasing the distributed profits.

PK models typically follow these lines loosely without modeling the underlying micro-considerations. Hein (2007) and Hein and Stockhammer (2010) pin down the profit distribution policy of the firm by assuming $\Pi_k^d = 0$ and, hence, not attributing significance to the shareholders desire for distributed profits. Substituting this into (12), the demand for loans can be written as $\_D_k = I_k + iD_k - \_I_k$. The demand for loans is determined by the shortage of profits to finance the firm’s investment and interest expenses. Consequently, the debt-capital ratio $(\lambda_k = D_k/K_k)$ will be determined endogenously and not by a conventional target.\(^\text{13}\)

In contrast to this approach, Lavoie and Godley (2001) and Sasaki and Fujita (2012) assume the firm to distribute a fixed share $(1 - \gamma)$ of the profits implying a demand for loans of the firm $\_D_k = I_k - (\gamma \_\Pi_k - iD_k)$. Again, the debt-capital ratio will be endogenous.

Another approach to be followed here is to assume the firm to maintain a certain debt-capital ratio, $\lambda_k \geq 0$. Again, we take the interest rate to be zero. Since the definition of $\lambda_k = D_k/K_k$ implies $\lambda_k = \_D_k/I_k$, it is easy to see that the demand for new loans is

$$\_D_k = \lambda_k I_k$$

(13)

if the finance decision is governed by the desire to maintain a certain debt-capital ratio. Then, a fraction $\lambda_k$ of capital investment will be financed by new loans.

4 Agent heterogeneity and expectation formation

4.1 Aggregation and equilibrium

The PK baseline model features a labor market, finance market and a goods market. The former is generally not in equilibrium. It is assumed that Keynesian unemployment prevails at a given real wage rate. In any case, the state of the labor market does not feed back into any of the model equations above. Hence, it does not affect any of the endogenous variables of interest. The latter two markets are in equilibrium due to accounting: Sales have to equal expenditures and loans have

\(^{13}\)Sasaki and Fujita (2012) have criticized the assumption of zero distributed profits as implausible. Moreover, the suggested retention policy requires the interest rate to be positive since there would be no rentiers income otherwise and, hence, no household saving. Then $\_\Pi_k = I_k$ and no bond market would exist. The saving decision would be identical to the investment decision.
to be matched by deposits as the bank has no net worth. Hence the aggregate accounting balance conditions are \( Y = C + I \) and \( D = B \).

How can we obtain aggregate variants of the behavioral relations postulated above? As it turns out, each laborer, each rentier and each firm behaves in exactly the same way once we assume that the shocks to the animal spirits in (11), i.e. \( \epsilon_k \), are equal across all firms \( k \). Our agents become representative, i.e. the average individual behavior is equal to the average aggregate behavior. Note that since capital does not depreciate, positive investment in equilibrium will render the model non-stationary. To achieve stationarity we normalize all relevant accounting and behavioral relations by the capital stock. In this case, our aggregated model consists of 11 equations,

\[
\begin{align*}
Y &= C + I, \\
D &= B, \\
I/K &= a + \beta(Y^e/K - \bar{u}), \\
C^d &= w/PL, \\
C^r &= c_l \Pi^d + c_B B, \\
C &= C^d + C^r, \\
\Pi^d &= Y - w/PL + \dot{D} - I, \\
\dot{D} &= \lambda I, \\
P &= (1 + m)w, \\
Y/L &= 1, \\
\lambda &= D/K,
\end{align*}
\]

in 13 endogenous variables, \( Y, C, I, D, B, K, Y^e, C^d, C^r, \Pi^d, P, L, \) and \( \dot{D} \). We can solve this system conditional on \( K \) and \( Y^e \). One could also normalize all non-stationary equations above by \( K \), redefine the variables and reduce the system to

\[
\begin{align*}
u &= C/K + I/K, \quad \text{(14)} \\
I/K &= a + \beta(u^e - \bar{u}), \quad \text{(15)} \\
C/K &= \frac{1}{1+m} u + c_l \Pi^d/K + c_B \lambda, \quad \text{(16)} \\
\Pi^d/K &= (1 - \frac{1}{1+m}) u - (1 - \lambda) I/K, \quad \text{(17)} \\
\end{align*}
\]

which is a system of 4 equations in 5 variables \( u, C/K, I/K, u^e \) and \( \Pi^d/K \) to be solved conditional on \( u^e \). How to deal with the expectation will be addressed in the next section.

Let us briefly stress the significance of the assumption of homogeneous, i.e. representative, agents in the PK framework. The common practice of PK models to postulate a behavioral relation on the macro level and to provide a verbal foundation of the hypothesis put forward on the micro level builds implicitly on the assumption that agents are homogeneous in their behavior. Only then is the macro-relation equal to the aggregated micro-relations. In general, however, agent heterogeneity implies that they are not equal.

17
As an illustration consider the investment function in (11) which we can aggregate over all firms to obtain

\[
\frac{I_k}{K_k} = a_k + \beta (u^e_k - \bar{u}) \\
I_k = a_k K_k + \beta (Y^e_k - \bar{u} K_k) \\
\sum_{k \in N^f} I_k = \sum_{k \in N^f} \left( a_k K_k + \beta (Y^e_k - \bar{u} K_k) \right) \\
I = \sum_{k \in N^f} a_k K_k + \beta (Y^e - \bar{u} K) \\
I \neq a K + \beta (Y^e - \bar{u} K) \\
I/K \neq a + \beta (u^e - \bar{u})
\]

since \(a K \neq \sum_{k \in N^f} a_k K_k\). Only if we additionally assume agents to be homogeneous with respect to their investment behavior, i.e. \(a_k = a\), then \(a K = \sum_{k \in N^f} a_k K_k\) and the relation of aggregated variables equals the aggregated relations of firm-level variables.

Hence, the popular view for instance expressed by Shaikh (2012) that orthodox and heterodox economics differ along the lines of agent heterogeneity does not hold necessarily.

4.2 Expectation formation and solution

As argued above, assuming homogeneous behavior allows our baseline PK economy to be represented by (14) to (17). However, the system of equations has been shown to include an expected variable, \(u^e\), arising from the firm’s investment decision. Hence, we have to make an assumption on the formation of expectations.

One way to proceed would be to assume rational expectations as in the NK literature (cf. Muth 1961 and Sargent 1987). This would be tantamount to assuming that our firms are aware of (14) to (17), believe in them and form their expectation regarding the future \(u^e\) accordingly. Despite some notorious exceptions, for instance Palley (1993, 1997), this path is typically not being followed in the PK literature since it is not consistent with the prevalence of fundamental uncertainty.

Another approach would be to assume the agent to engage in rational learning as suggested by Evans and Honkapohja (2001). In this framework, the agent knows the structure of the rational expectation solution which expresses all control variables in predetermined variables but does not know the parameters. Over time, the agent collects data and attempts to estimate these parameters. The interaction of their choices derived from these estimates and the accounting relations of the economy determines the stability properties of the rational expectation solution. This approach is inconsistent with fundamental uncertainty either and, hence, not popular among PKs.

The more conventional approach in the PK literature is to assume backward-looking expectations, in particular static expectations, i.e. \(u^e = u\), or adaptive expectations, i.e. \(u^e = f(u - u^e)\) with \(f(0) = 0\) and \(f' > 0\). The implication of non-rational, backward-looking expectations is that agents have no clue about the economic model and that all information used to predict a certain variable is taken from the past.

The assumption of rational expectations or rational learning and the assumption of backward-looking expectations have in common that they are rather strong. Since the shortcomings of

\[14\] How such a rational expectations model can be solved is discussed by Blanchard and Kahn (1980).
rational expectations are well-accepted among PKs, let us briefly reflect on the implications of the assumption of purely backward-looking expectations which will lead us to the conclusion that they exhibit problematic downsides too.

Note that purely backward-looking expectations are in conflict with Keynes’ own views: “The essence of this convention [...] lies in assuming that the existing state of affairs will continue indefinitely, except in so far as we have specific reasons to expect a change.” (Keynes 1936, p.152) The last part of this quote is a clear statement in favor of forward-looking but obviously not necessarily rational expectations. If there are specific reasons to expect a change in the state of affairs such as an announced tax cut, an announced fiscal expansion or an announced monetary policy intervention then this will affect economic behavior today. An economic model in this spirit should characterize economic behavior able to do so endogenously.

For instance, the empirical evidence that consumption is a choice which to a considerable extent takes into account expectations regarding future income now is overwhelming (cf. Parker 1999, Souleles 2002, Johnson et al. 2006, Blundell et al. 2008, Shapiro and Slemrod 2009 and Jappelli and Pistaferri 2010). Whether income shocks are anticipated or not and whether they are perceived as temporary or permanent affects their impact on consumption enormously. This is not to say that this evidence supports the permanent income hypothesis, quite the contrary. Yet, it is sufficient to claim that the assumption of backward-looking expectations prevalent in PK models omits behavioral aspects which are crucial for the evaluation of monetary and fiscal policy effects. How to introduce forward-looking but non-rational expectations as proposed, for instance, by Hommes and Zhu (2014) should to be a crucial challenge for the PK research paradigm in the future.

5 Concluding remarks

The present paper has critically reviewed the current state of micro-foundations of post-Keynesian (PK) economic theory focusing on seminal contributions within the Kaleckian paradigm including Rowthorn (1981), Dutt (1984), Taylor (1985), Bhaduri and Marglin (1990), Lavoie (1995a), Godley and Lavoie (2012, ch.11), Hein (2007) and Hein and Stockhammer (2010). To illustrate our points, we presented a simple but broadly accepted PK model in the Kaleckian tradition.

We have identified the following challenges: First, PKs apply formal models when studying the interaction of macroeconomic variables. Yet, behavioral hypotheses postulated on the micro-level are anchored in verbal considerations, which we perceive as a methodological inconsistency. Second, internal inconsistencies arise when different micro-considerations provided for different behavioral rules within the very same model are mutually inconsistent. Finally, we identify ontological inconsistencies between the behavioral rules postulated and the micro-considerations provided to back them up. The micro-considerations typically imply the agents to exhibit goal-oriented and sometimes even optimizing behavior which implies rules of behavior to adjust to variations in the economic environment. Yet, changes in the micro-environment are not taken into account by the postulated rules which implicitly take agents to be lethargic.

We have also argued that NK and PK models share strong assumptions: First, the assumption of agents to be representative prevails in almost any of the popular PK models. Hence, the use of representative agents is not only a feature of orthodox economics. Second, both NK and PK models make strong assumptions regarding the formation of expectations. Whereas NKS take expectations as rational, i.e. forward-looking and model-consistent, PKs assume expectations to be purely backward-looking.
We therefore conclude for a possible new foundation of PK economic theory: First, if one decides to elicit the underlying micro-structure, economic behavior should be modeled rather than justified verbally in order to be methodologically consistent as well as internally consistent. Second, in line with the assumptions on economic behavior underlying current micro-considerations choices could be modeled as the result of goal-oriented rather than lethargic behavior. An evolutionary process of finding a locally optimal rule of behavior under constraints a posteriori (passive choice) would be highly consistent with PK principles of fundamental uncertainty as well as procedural rationality. A weak interpretation of fundamental uncertainty excludes rational expectations but would still allow for finding the optimal rule of behavior a priori by solving an optimization problem for given expectations (active choice). Finally, the core difference between NK and PK models is the acceptance and rejection, respectively, of the notion of a general equilibrium, in particular related to the labor market. Hence the PK research paradigm should be open to various forms of transparent, consistent and complete sets of micro-foundations as well as various assumptions regarding expectation formation as long as the model features the principle of effective demand.

References


