ROUTLEDGE FRONTIERS OF POLITICAL ECONOMY

Reconstructing Keynesian Macroeconomics Volume 1

Partial perspectives

Carl Chiarella, Peter Flaschel and Willi Semmler

ROUTLEDGE

Reconstructing Keynesian Macroeconomics Volume 1

Reconstructing Keynesian Macroeconomics lives up to its title. The authors present an up-to-date, technically sophisticated version of truly Keynesian macrodynamics along with a trenchant critique of mainstream modeling. The book represents the state of the art in an exciting area of macroeconomics.

This book represents the first of three volumes offering a complete reinterpretation and restructuring of Keynesian macroeconomics and a detailed investigation of the disequilibrium adjustment processes characterizing the financial, the goods and the labor markets and their interaction. It questions in a radical way the evolution of Keynesian macroeconomics after World War II and focuses on the limitations of the traditional Keynesian approach until it fell apart in the early 1970s, as well as the inadequacy of the new consensus in macroeconomics that emerged from the Monetarist critique of Keynesianism.

Professors Chiarella, Flaschel and Semmler investigate basic methodological issues, the pitfalls of the Rational Expectations School, important feedback channels in the tradition of Tobin's work, and theories of the wage–price spiral and the evidences for them. The book uses primarily partial approaches, the integration of which will be the subject of subsequent volumes. With its focus on Keynesian propagation mechanisms, the research in this book provides a unique alternative to the black-box shock-absorber approaches that dominate modern macroeconomics.

Reconstructing Keynesian Macroeconomics should be of interest to students and researchers who want to look at alternatives to the mainstream macrodynamics that emerged from the Monetarist critique of Keynesianism.

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Notation

Steady state or trend values are indicated by a sub- or superscript "o" (sometimes also by an "*"). When no confusion arises, letters F, G, H may also define certain functional expressions in a specific context. A dot over a variable $x = x(t)$ denotes the time derivative, a caret its growth rate; $\dot{x} = dx/dt$, $\hat{x} = \dot{x}/x$. In the numerical simulations, flow variables are measured at annual rates.

As far as possible, the notation tries to follow the logic of using capital letters for level variables and lower case letters for variables in intensive form, or for constant (steady state) ratios. Greek letters are most often constant coefficients in behavioral equations (with, however, the notable exceptions being π^c, ω). We use the abreviation "NAIRU" for the Non-Accelerating-Inflation Rate of Unemployment, but use this acronym also in the case of "Utilization" (of labor or capital) in the place of "Unemployment". And the acronym "RE (S)" stands for the "Rational Expectations (School)". Further acronyms are of a local nature only and will be explained in the sections where they are used. There will also be some chapter-specific (local) notation in some of the chapters.

B	outstanding government fixed-price bonds (priced at $p_b = 1$)
C	real private consumption (demand is generally realized)
E	number of equities
F	neoclassical production function
G	real government expenditure (demand is always realized)
I	net investment in fixed capital
I	desired real inventory investment
J	Jacobian matrix in the mathematical analysis
K	stock of fixed capital
L^d	total working hours (labor demand is always realized)
L^w	Employed workforce, i.e., number of employed people
L or N	labor supply, i.e., supply of total working hours per year
M	stock of money supply
N	inventories of finished goods
N^d	desired stock of inventories
S_f	real saving of firms
S_g	real government saving

S_p	real saving of private households
S	total real saving
T	total real tax collections
$T_w\,(t_w)$	real taxes of workers (per unit of capital)
$T_c\,(t_c)$	real taxes of asset holders (per unit of capital)
W	real wealth of private households
Y	real output
Y^p	potential real output
Y^f	full employment real output
Y^d	real aggregate demand
Y^e	expected real aggregate demand
c	marginal propensity to consume
e	employment rate
$U = 1 - e$	unemployment rate
$f_x = f_1$, etc.	partial derivative
r, i	nominal rate of interest on government bonds;
k	capital intensity K/L (or parameter in money demand)
$\sigma = 1/y$	capital coefficient K/Y
l	labor intensity (in efficiency units)
m	real balances relative to the capital stock; $m = M/pK$
n	inventory–capital ratio; $n = N/K$
p	price level
p_e	price of equities
q	return differential; $q = r - (i - \pi)$ or Tobin's q
r, ρ	rate of return on fixed capital: $r = (pY - wL - \delta pK)/pK$
s_c	propensity to save out of capital income, asset owners
u, u^w, e^w	rate of capacity utilization $u = Y/Y^n = y/y^n$
v	wage share (in gross product); $v = wL/pY$
w	nominal wage rate per hour
y	output–capital ratio; $y = Y/K$;
y^d	ratio of aggregate demand to capital stock; $y^d = Y^d/K$
y^e	ratio of expected demand to capital stock; $y^e = Y^e/K$
z or x	labor productivity, i.e., output per worker; $z = Y/L^d$
α	symbol for policy parameters in Taylor rule
α_i	interest rate smoothing coefficient in the Taylor rule
α_p	coefficient on inflation gap in the Taylor rule
α_u	coefficient on output gap in the Taylor rule
β_x	reaction coefficient in an equation determining x, $\dot{x}$ or $\hat{x}$
β_y	adjustment speed in adaptive sales expectations
β_π	general adjustment speed in revisions of the inflation climate
β_{xy}	reaction coefficient related to the determination of variable x, $\dot{x}$ or $\hat{x}$ with respect to changes in the variable y
α_q	responsiveness of investment to changes in q
α_u	responsiveness of investment to changes in u
β_n	stock adjustment speed

α_{n^d}	desired ratio of inventories over expected sales
β_{pu}	reaction coefficient of u in price Phillips curve
β_{pv}	reaction coefficient of $(1 + \mu)v - 1$ in price Phillips curve
β_{we}	reaction coefficient of e in wage Phillips curve
β_{wv}	reaction coefficient of $(v - v^o)/v^o$ in wage Phillips curve
γ	government expenditures per unit of fixed capital; $\gamma = G/K$ (a constant)
τ	lump sum taxes per unit of fixed capital; $\tau = T/K$ (a constant)
δ	rate of depreciation of fixed capital (a constant)
$\eta_{m,i}$	interest elasticity of money demand (a positive number)
κ	coefficient in reduced-form wage-price equations $= \dfrac{1}{1 - \kappa_p \kappa_w}$
κ_p	parameter weighting $\hat{w}$ vs. π in price Phillips curve
κ_w	parameter weighting $\hat{p}$ vs. π in wage Phillips curve
κ_{wp}	same as κ_w
κ_{wz}	parameter weighting $\hat{z}$ vs. $\hat{z}^o$ in wage Phillips curve
κ_π	parameter weighting adaptive vs. regressive expectations
π^c	general inflation climate;
θ	log of real wages
$\tau_c = T_c/K$	tax parameter for T^c (net of interest per capital); $T^c - iB/p$
ω	real wage rate w/p

Contributors

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Introduction

Keynesian macroeconomics

The disarray in Keynesian macroeconomics

> So here's what I think economists have to do. First, they have to face up to the inconvenient reality that financial markets fall far short of perfection, that they are subject to extraordinary delusions and the madness of crowds. Second, they have to admit – and this will be very hard for the people who giggled and whispered over Keynes – that Keynesian economics remains the best framework we have for making sense of recessions and depressions. Third, they'll have to do their best to incorporate the realities of finance into macroeconomics. Many economists will find these changes deeply disturbing.
>
> (Paul Krugman, *New York Times*, September 6, 2009)

As the Nobel laureate Paul Krugman states in the above quotation the financial market meltdown of the years 2007–2009, and the subsequent world-wide great recession, has posed a great challenge for macroeconomics. This concerns not only the now dominant modern macroeconomic modeling framework, such as the Dynamic Stochastic General Equilibrium (DSGE) Model, but also traditional macroeconomics based on the Keynesian paradigm. This book takes the above statement as point of departure by critically evaluating not only the DSGE models but also the evolution of Keynesian macroeconomics after World War II.

Macroeconomics in the 1960s and 1970s was viewed as part of the old Neoclassical synthesis of Patinkin and others, with the Classical version of this synthesis on the one hand and the Keynesian variant of it on the other hand. From this traditional consensus the Neoclassical Synthesis was however transformed towards a new and extremely different one, the so-called New Neoclassical Synthesis, with Real Business Cycle theory now representing the Classical variant and New Keynesian theory now as the Keynesian variant.

This New Consensus in macroeconomics and its two basic variants could be summarized under the general heading of DSGE model building. There is from a general perspective much to be said for the first three letters in this acronym. Yet, the fulfillment of them is heavily biased towards a stochastic explanation of the business cycle, in particular in the Real Business Cycle (RBC) tradition. The DSGE

model variants also see the shocks as the main driving force for the business cycle, but they allow for other shocks than technology shocks, for example preference shocks, monetary and fiscal policy shocks. The equilibrium part of the DSGE acronym is generally constrained by the postulates that it has to be microfounded, to be operated under continual market clearing, and reflect forward looking behavior in its extreme case, namely as rational expectations versions.

Again there is nothing wrong with the demand for microfoundations and forward-looking behavior (attempts at this can already be found in Keynes), however there is a lot doubt, if this task is to be performed by means of market clearing representative agent models, where undifferentiated households make economy wide decisions and there is no heterogeneity such as workers, asset owners and others. Capitalist market economies are at the minimum characterized by a principal–agent relationship and thus modeled in a misleading way by such a single household type. This is a crucial misrepresentation of the complexity of market economies. Yet more extreme is the the rational expectations assumption, which assumes forward-looking behavior of a truly omnipotent type. This assumption as well as the proposition that decision making households can make smooth and continuous adjustments are essential, so that:

- the marginal conditions, describing the balance between current cost and future benefits, are instantaneously established,[1]
- actual market constraints such as income, liquidity and credit constraints are not operative and binding when decisions are made,
- there are no spillover and externality effects and no contagion effects,
- there are no macroeconomic feedback effects that significantly disturb the intertemporal arbitrage decisions,
- the impact of macroeconomy wide shocks can be sufficiently well studied by local linearizations and local impulse response functions, and
- there are no non-linear macroeconomic propagation effects.

In the purely forward-looking variant of the baseline DSGE model those assumptions for example imply that the economy would always be mean reverting and move back to its steady state position if unanticipated shocks are occurring over time. In higher dimensions there may be damped oscillations around the steady state position in the deterministic core of DSGE models, but persistent business fluctuations remain excluded by the very solution method of the rational expectations approach which generally only allows movements along the stable manifold of the full phase space representation.

The data generating process on the macro-level of an economy is from a modeling perspective by and large of a continuous type, though it is in fact discrete with very high, and in general non-synchronized, frequencies. This basic observation implies in our view that continuous time modeling (augmented by specific delays if necessary) is the more appropriate approach as compared to completely synchronized period modeling for the macro-level of whole economies. But in continuous time, the assumption of continual market clearing is very hard

to accept implying that it is better then to describe macrodynamics in terms of adjustment processes towards a moving market equilibrium, which – even when convergent – may never be reached in situations of such moving temporary equilibria, in particular if stochastic elements are also added to the structural equations of the considered macrodynamic model under consideration.

The more appropriate model building philosophy in macrodynamics is therefore of a DSGD (disequilibrium) type where the "Dynamics" is given by the set of macroeconomic adjustment processes that drive the economy in its attempts to establish interacting real and financial market equilibria. The macroeconomic adjustment processes can be stabilizing or destabilizing. The interaction of these adjustment processes on the labor markets, the goods markets and the markets for financial assets may then well be of a nature that allows for endogenously generated persistent business fluctuations – not possible under DSGE modeling – which of course could be further enhanced by stochastic processes that surround these dynamics. This in our view in sum provides the foundations for an alternative paradigm, the DSGD approach to (Keynesian) macroeconomic theory, where a system of feedback adjustment channels – well known from the history of macroeconomics – is driving the macroeconomy. We hereby can allow for a microstructure of principal–agent relationships which is characterized by heterogeneous expectations formation which can range from very naive to very sophisticated.

Microfoundations – whenever possible – are of course highly desirable, but they are of a subordinate nature as compared to the macrofoundations underlying the DSGD approach towards which this book is directed. This book as well as two planned companion volumes on integrated Keynesian macromodels, highlight coherent real and financial asset accumulation, stock-flow consistency as well as advanced stock-flow interactions. The DSGD scenario describes the foundations of the approach to macroeconomic model-building that is pursued in the three volumes of integrated Keynesian approaches to the real and the financial markets of the macroeconomy. This approach is pursued on the basis of the assumption – in line with the above statement of Krugman – that Keynes' theory of effective goods demand is in principle the correct approach to the modeling of the short- and medium-run relationship between the goods and the financial markets. In order to motivate this further we can go back to the roots, that is to Keynes' (1936) own views on the working of the trade cycle, from which we shall start our understanding of the processes of fluctuating growth that characterize the evolution of complex market economies.

Keynes' Business Cycle Analysis

> Since we claim to have shown in the preceding chapters what determines the volume of employment at any time, it follows, if we are right, that our theory must be capable of explaining the phenomena of the trade cycle.
>
> (Keynes 1936, p.313)

Following this introductory remark of Keynes in his chapter *Notes on the Trade Cycle* we shall here briefly recapitulate his observations on the main sources and the pattern of the cyclical fluctuations which characterize the evolution of market economies, with owners of assets, workers and so on, in order to describe an important perspective for the application of the temporary (dis-)equilibrium analysis of the IS–LM type. We however only sketch here some basic medium-run implications of temporary equilibria of the kind envisaged by Keynes. We will therefore not provide a detailed and thorough presentation or even elaboration of Keynes' ideas on the causes that drive the business cycle.

Yet, since in particular most macroeconomics textbooks usually introduce IS–LM analysis without properly discussing its medium-run dynamic implications, which instead of being Keynesian in nature are often in fact of monetarist type. We hope that this brief overview may help to stimulate renewed interest in Keynes' particular approach to the analysis of the trade cycle – and the role that the future and expectations play in his arguments. Moreover, this brief section also provides the framework for this book as well as its companion volumes, a framework which we will try to follow from partial, integrated and financial models of a Keynesian variety.

There are three main elements of conventional approaches to IS–LM models – and their more elaborate forms – that can be used for an analysis of the phenomenon of the business cycle:

- the marginal propensity to consume (c),
- the marginal efficiency of (new) capital (i), and
- the state of liquidity preference (l).

The marginal propensity to consume out of disposable income is too well-known to need further explanation here. Elements which may explain shifts in this propensity (and thus shifts in the IS-curve) are, among others:

- changes in income distribution,
- changes in perceived wealth and perceived disposable income, and
- changes in the rate of time-discounting.

See Keynes (1936, Chs.8,9) for a discussion of the last three points. Moreover, the marginal propensity to consume can be depressed if expectations about the future become pessimistic, due to rising unemployment, tighter labor market policies and also expectations of a crisis in the financial sector of the economy. Keynes knew pretty well that the decision makers are constrained by the regimes of the business cycle. Shifts in the marginal propensity to consume are regime dependent. They decrease or increase the Keynesian multiplier and thus have expansionary or contractionary effects on the level of activity of the economy.[2]

The role of the future is also important for the marginal efficiency of capital (cf. Keynes 1936, Ch.11). It is defined in reference to certain time series $Q_1,...,Q_n$ of prospective returns or yields of investment projects. Without going into the details

of its definition,[3] it can be seen that such an approach makes investment heavily dependent on expectations of future cash flows over a considerable amount of time that are complex in nature, hard to control and may be more of an animal spirit type than of a proper discounting of the future.

> The social object of skilled investment should be to defeat the dark forces of time and ignorance which envelop our future.
>
> (Keynes 1936, p.155)

It follows that investment demand can be very volatile and consequently may be of central importance for an explanation of the trade cycle. Multiplier effects (including changes in the multiplier as discussed before) may add to this volatility and its consequences. Nevertheless, in Keynes' view, they mainly transmit fluctuations in investment to ones in income and employment, but do not by themselves explain the business cycle (though they may explain certain phases of it).

Changes in liquidity preference (cf. Keynes 1936, Ch.15), refer to the stock of accumulated savings and are – as investment demand – highly dependent on the "state of confidence". This, of course, is particularly true for the speculative motive for holding cash balances, which through sudden changes in expectations may give rise to "discontinuous" changes in the rate of interest.

> Speculators may do no harm as bubbles on a steady stream of entreprise. But the position is serious when entreprise becomes the bubble on a whirl-pool of speculation. When the capital development of a country becomes a by-product of the activities of a casino, the job is likely to be ill-done.
>
> (Keynes 1936, p.159)

This quotation suggests that investment may drive the cycle via a time varying multiplier effect, but that investment may itself be dependent on forces that have little to do with the social function of financial markets to channel private savings, the additions to the financial assets of the household sector, into private investment and the proper evolution of the capital stock of a country.

We may provisionally summarize the above by means of the three fundamental parameters c, i and l and the three central behavioral relationships which underlie Keynes' (1936) General Theory and also the conventional IS–LM model namely consumption (C), investment (I) and real money demand (M^d/p) that satisfy

$$\underset{+\ -\ +}{C(Y, r, c)}, \quad \underset{-\ +}{I(r, i)}, \quad \underset{+\ -+}{\frac{M^d}{p}(Y, r, l)}. \tag{0.1}$$

These parameters express the fact that the behavioral relationships may be subject to slow build ups, but also to sudden changes which are not explained by the IS–LM model (which on the basis of these parameters explains the temporary position of income Y and the rate of interest r). These parameters are here added from the outside in an *ad hoc* fashion – due to the fact that an endogenous treatment

in particular of the marginal efficiency of investment, is at the very least a quite demanding task.

> By a cyclical movement we mean that as the system progresses in, e.g. the upward direction, the forces propelling it upwards at first gather force and have a cumulative effect on one another but gradually lose their strength until at a certain point they tend to be replaced by forces operating in the opposite direction; which in turn gather force for a time and accentuate one another, until they too, having reached their maximum development, wane and give place to their opposite. We do not, however, merely mean by a cyclical movement that upward and downward tendencies, once started, do not persist for ever in the same direction but are ultimately reversed. We mean also that there is some recognizable degree of regularity in the time-sequence and duration of the upward and downward movements.
>
> (Keynes 1936, pp.313–314)

We would characterize this sketch of a description of the phases of the business cycle and their further development by the expression "Keynes Paradigm", in order to distinguish it from the so-called "Frisch Paradigm". The latter offers an explanation of persistent business cycles on the basis of at most damped oscillations which are turned into persistent ones through the addition of sufficiently pronounced stochastic processes. This latter approach – underlying the current macromodels – does not interpret the business cycle as being composed of accelerating forces into a boom situation as well into the establishment of a bust, which are subject to turning points through the systematic establishment of counteracting forces. Such forces – when agents realize these thwarting tendencies – can turn the boom more or less suddenly into a bust and which – if sufficient cost-reductions have occurred in the real as well as in the financial markets in the bust – can lead to renewed optimism of investors and from there back into an upswing of the economy. Such accelerating forces, setting in motion synchronized behavior and cumulative effects are simply not a topic in the DSGE or New Keynesian approach to macrodynamics which therefore do not appear as Keynesian in their core structure.

Keynes, by contrast, starts his discussion of fluctuations in investment, income and employment in the late stage of a boom period. In this stage of the boom, it may have become apparent to investors – due to the past effects of capital accumulation on the abundance of physical capital and the costs of production – that their views on the marginal efficiency of capital needs to be significant revised downwards($i \downarrow$). Such a revision of cash flow expectations – when it becomes sufficiently generalized – may lead to a significant change in i and thus a fall in effective demand (via the multiplier process), which in turn may aggravate the pessimism that has started to become established so that the marginal efficiency of capital goes down even further($i \downarrow\downarrow$). The cumulative upward trends of the boom may thereby become reversed and turned into cumulative downward trends in income and employment and so generating recessions.

It appears intuitively plausible that this decline (or even collapse) in the marginal efficiency of capital (i) will give rise to an increase (or upward jump) in the liquidity preference parameter l, that is to a (sudden) increase in the demand for money. IS–LM analysis implies that this will lead to a (sharp) increase in the rate of interest r and consequently to a further decrease in investment and income. The existing negative expectations are thereby confirmed and further strengthened. It follows that the parameters i and l may interact in such a way that this results in a collapse in economic activity. Of course, milder forms – such as the recessions of the 1960s or the 1990s are also conceivable in the above framework.

The upper turning point for economic activity is thus explained by the interaction of the three basic parameters of the IS–LM model which bring to an end a boom that is gradually losing force – since the gradual change in i and l has endogenous consequences (on I, Y, and r) that confirm the opinions which are responsible for this change in behavior. Finally, one effect of the boom may also have been that the marginal propensity to consume has risen (due for instance to an increase of the share of wages in national income).Yet, the parameter c may also contribute to the decline in economic activity due to its own decline and a rise of savings in downturns.

Let us assume for the following discussion of the lower turning point in economic activity, that there has been a long period of economic prosperity, so that the movements described above have all worked with sufficient force and therefore induce a depression of considerable strength. Economic activity now being low means that the rapid accumulation of ''capital'' in the past has created a significant amount of idle capital-goods. It is obvious that this excess capacity in production must disappear before there can be any recovery in the parameter that characterizes the marginal efficiency of capital. A considerable amount of time will elapse therefore during which now unprofitable investments of the past are eliminated in physical or in value form.

Such a process of capital depreciation will not in general accelerate, since there is a floor to the level of gross investment (above zero) that helps to maintain a low level of economic activity. Once the capital stock has been reduced so far as to be in line again with the prevailing level of activity, a return to a more optimistic view on investment profitability becomes possible and may come about. The forces that operated downwards in the development of the depression may now allow a spreading optimism to gather force. Rising investment and thus rising income and economic activity confirm the positive change in the parameter i, eventually leading to its further increase. An improving state of confidence may then also give rise to a decline in l, the liquidity preference parameter and thus to a decline in the rate of interest, giving further force to the spreading investment optimism. The resulting cumulative upward effects may, of course, in some cases be weak and thus only lead to a minor recovery, but may in other cases be strong enough to generate once again a boom of significant duration and strength.

This brief sketch of the cumulative upward or downward forces at work and the gradual appearance of counteracting elements which bring an end to such upward or downward tendencies must suffice here as an outline of the potential of basic

IS–LM analysis (or more advanced Keynesian model building) to explain observed regularities in business fluctuations. The central role of the parameter *i* (in comparison to the other two parameters)[4] in the explanation of such fluctuations should be obvious from the statements made above. What is also obvious is that there are macroeconomic feedback mechanisms at work generating externality effects and synchronized behavior with huge macroeconomic impacts that are rarely captured in the unconstrained[5] behavior of the optimizing agents in DSGE models.

Indeed, no such an analysis is possible when current modern macromodels are used (because of their reliance on Say's Law in the main). Business fluctuations in the market clearing approach are then, for example, explained by introducing local markets and misperceptions of information into such a setup, see Barro (1994, Ch.19), Sargent (1987, Ch.18),or by introducing misperceived technology shocks in the so-called "real" business cycle model, see Blanchard and Fisher (1989, Ch.7).

Keynes' (1936) approach to explaining the trade cycle has not received much attention in the discussion on growth and instability that developed after the appearance of the ''General Theory''. This may in particular be due to the strong psychological influences that appear in his explanation of the cycle as, for example in the following statement (p.317):

> ... it is not so easy to revive the marginal efficiency of capital, determined, as it is, by the uncontrollable and disobedient psychology of the business world.

Instead of the above speculative type of interaction of largely psychologically determined magnitudes (the parameters *i*, *c*, *l*), Keynesian dynamic economic analysis has unfortunately turned to the analysis of interactions of a more mechanical type in the sequel: the multiplier and accelerator – approaches and the like, later on replaced by models of inflation and stagflation when the monetarist critique of Keynesianism was impacting its evolution. Keynes' (1936) original approach to macrodynamics was therefore not taken seriously, neither by Neoclassical theory nor really the Keynesian approaches within the old Neoclassical synthesis that was developed by Patinkin and others from Hicksian IS–LM analysis. Those insights are also neglected by the New Keynesian reformulation of the building blocks of macrodynamic analysis. This topical issue will be considered in detail in the now following section.

Keynes or Frisch Paradigm? Some further thoughts

We now discuss in more detail the methodological foundations of mainstream macroeconomics, and Keynesian alternatives. These foundations, in particular for models of DSGE type, often act in our view like an intellectual straight jacket for the further evolution of Keynesian macroeconomics. They enforce a research program for macroeconomics which in the words of Keynes (1936, p.3) maybe characterized as follows:

> I have called this book the General Theory of Employment, Interest and Money, placing the emphasis on the prefix general. ... I shall argue that the postulates of the classical theory are applicable to a special case only and not to the general case, the situation which it assumes being a limiting point of the possible positions of equilibrium. Moreover, the characteristics of the special case assumed by the classical theory happen not to be those of the economic society in which we actually live, with the result that its teaching is misleading and disastrous if we attempt to apply it to the facts of experience.

We would add to this quotation from today's perspective that DSGE model building is in fact even no longer really a special, limiting case – as was the classical variant of the old Neoclassical synthesis with its assumption of market clearing prices. It represents in its present form a structurally unstable prototype model of the Wicksellian variety, with no neighboring Keynesian demand rationed situations and with little common ground with more traditional types of Keynesian theories. The following considerations will attempt to shed some light on the reasons behind such a statement.

Today's mainstream macroeconomics generally insists on the following three methodological principles in order to judge whether a macrodynamic model makes sense or not:

- Micro-foundations based on smoothly operating and unconstrained optimizing behavior of agents (however it could be disaggregated with respect to age structure in so-called Overlapping Generations (OLG) models).
- Market clearing on all markets (which in general results in the use of algebraic equations in place of dynamic adjustment equations).
- Extremely informed forward-looking agents and rational expectations (which ensure that the economy is always on its stable submanifold with all the marginal conditions fulfilled).

We will collect in this section some arguments which we believe show that such a methodological approach to the study of macrodynamic systems is much too narrow and one-sided to allow for a fruitful analysis of actual behavioral possibilities for economic agents, the stock-flow interactions that they imply, and the complex dynamics that such behavior may generate when cumulative processes and macroeconomic feedback mechanisms become effective in non-market clearing situations.

Indeed, as the *assumption* of the extremely well informed forward-looking agents and rational expectations by now have become an undeniable "truth" for many macroeconomists, the stability of the economy (and the well behaved impulse-response functions generated after anticipated and unanticipated shocks) implied by its mathematically very demanding structure has become a "goes without saying" matter in the current macroeconomics literature. Hand in hand with this development, the study of accelerating processes or divergent paths of the economy has by and large become superfluous or a pathological situation for

the majority of the profession. However, as for example the recent financial crisis, and in fact common sense would suggest, not all agents *have the capability* to be fully "rational" or are sufficiently knowledgeable with respect to the future economic evolution, so that the modeling and study of "*non-rational*" and that means behaviorally founded macroeconomic dynamics is just as, if not more, important as the study of dynamics generated under the assumption of an omnipotent forward-looking and perfectly rational economic agents in a situation where markets clear at each moment in time.

By contrast, a topic that must be and is common to *all* thorough economic theorizing is the assumption of a complete set of budget restrictions which, when all debt financing is properly specified, must be fulfilled at all moments in time.[6] The type of behavior that takes place within given budget equations (or *restrictions* if credit rationing takes place) is however open to discussion, since there is no unique way to rationalize the behavior of economic agents taking place within these constraints (who may in particular use different optimization routines when solving problems of differing complexity). Furthermore, coordination between the plans of agents acting on a specific market may be very different, not only depending on the specific form of the market, but also on the restrictions economic agents experience – or have experienced – when operating on it. In the following subsections we will consider each of the above items in isolation before we come to a general evaluation of the importance of these topics in their interaction.

Omnipotent forward-looking agents as microfoundation?

In our view the basic objection to the omnipotent forward-looking agent is given by the simple observation that for complex market economies it is the interaction of multiple agents (or at least at the minimum the interaction of two representative agents – workers and the owners of assets) that is relevant for economic outcomes. A very relevant aspect of the market interaction of the agents in market economies are therefore distributional issues.

Thus, the conflict over income and asset distribution (and over new techniques of production) is a very fundamental conflict in an economy where there is an uneven distribution of capital assets. It may even be claimed, as for example Richard Goodwin testifies with his work, that this is a core element in the explanation of the dynamics of capitalism, shaping distribution driven Keynesian goods market dynamics (based on the wage-led/profit-led distinction) as well as Schumpeterian innovation waves in the economic and the social structure of accumulation in significant ways. The nature of this distributive conflict is exemplified in detail with respect to the short- and long-phase cycles it implies for the case of the US economy in Chapter 16. It cannot be analyzed by means of so-called Overlapping Generations (OLG) models, since distribution of income and capital assets is not a matter of age. Instead, if the distinction between worker households and pure asset holders is made, we would get four types of economic agents, since social affiliations tend to be stable over time and are thus quite the opposite of the case considered in the single agent OLG framework.

There are of course more than just the two considered social classes, but our argument is not directed towards finding the most appropriate representation for a given economy, but to establish what should be assumed at a minimum level for an investigation of the dynamics of capitalist market economies. On the basis of such a minimum framework, one should then consider a situation which is more general than the case of classical saving habits where only savings out of profits are allowed for. In modern economies both asset owners and workers save so that personal income distribution will be different from functional income distribution[7] and there will be wealth accumulation also on the side of workers, though of a more basic type as compared to pure asset holders, the long-run effects of which have to be investigated.

Of course, there is the evolution of workers with different skill groups, the evolution of unions, public sector and fiscal policy, pension funds and more. Furthermore workers' preferences may also change in the course of wealth accumulation. Yet, these are issues that should be kept apart from the baseline version of the model that attempts to investigate the dynamics of wages, profits and wealth in a society where interests differ about the evolution of those groups, sectors and magnitudes.

There is however a second argument which questions the validity of the positions put forth by those who insist on the omnipotent forward-looking agent framework. Households in this approach are often modeled in a Walrasian manner, as not only price takers, but also as seeing no restrictions on the choice of jobs and the supply of labor they are offering as the result of their isolated single agent optimizing procedure. With respect to the Walrasian framework we know however from theorems proved by Sonnenschein, Mantel and Debreu[8] that nearly everything can be microfounded, once enough heterogeneity is assumed between economic agents. What therefore is the value of a microfoundation of consumption and labor supply schedules, which necessarily result in very special demand and supply behavior? The answer is that nothing can be proved in this way as being superior to well-specified macroeconomic supply and demand relationship that are formulated within well-specified budget restrictions. As mentioned above, this is not to say that forward-looking behavior should be irrelevant for macroeconomics. Already in Keynes the future plays an important role in decision making concerning the marginal efficiency of capital and the liquidity preference. Yet, in dynamic optimization models it is frequently overdone by assuming unrestricted optimizing behavior – usually with too much micro, and not enough macro, foundation.

Our basic methodological requirement is to exclude situations where economic behavior is introduced by assuming supply and demand relationships that are inconsistent with the stock-flow interactions generated by the budget restrictions of the various agents. This implies that these latter restrictions should always be carefully specified, but that the matter of what agents actually optimize within these constraints, for example given by the regimes of business cycles, should at the least be a matter of discussion, if not even be a matter of empirical investigation that cannot be subjected to theoretical analysis alone. All this also holds outside

the counterfactual general equilibrium analysis of Walrasian production economies. It should be used to demand rigor on the side of stock-flow specifications of the considered economy, but – in the interests of research diversity – not be used to just refuse coherent models of this type simply because they are not based on the omnipotent agent assumption or related modeling devices.

We conclude that the starting point of the macroeconomic study of advanced market economies with uneven distribution of capital assets should be based on a principal–agent relationship which can explain differentiated wealth and income positions and the resulting saving propensities. Thus a long-phased demand driven distributive cycle can be generated from this situation as we have observed it in the form of prosperity phases and subsequent stagnant developments since World War II.

Continual Walrasian market clearing?

Viewed from the perspective of the Non-Walrasian macroeconomics of the 1970s it is fairly perplexing to see that most currently fashionable New Keynesian models aimed at helping to understand observed business fluctuations are again being built on Walrasian household theory in particular. Consuming households may be price-takers on many markets for consumption goods, but the assumption that they choose their optimal consumption plans on the basis of their notional labor supply and resulting wage income plans is fairly far from what households actually do – or, given the constraints, can do – when optimizing the use of their resources.

One need not be convinced by the microeconomic dual decision hypothesis in the Non-Walrasian reformulation of household decision making, but may simply assume on the macroeconomic level as point of departure that households consider as their wage income what they receive from their current actual employment position (or – if unemployed – from their unemployment insurance). A great fraction of the households are thus constrained in consumption decisions by job opportunities, labor income and credit constraints, which in some of the New Keynesian literature have become known as "rule of thumb" consumers.[9] Compared to the Walrasian notional wage income concept, according to which the participants in the labor market assume that they can always realize the optimal consumption/labor supply decision they derive from given wages, prices and intertemporal choice given by the Euler equation, in complete isolation from all other economic information and macroeconomic feedback effects affecting next period's economic outcome, the hypothesis that we have sketched above is to be preferred. The great macroeconomists in the past knew this and it in fact was already part of the pre-Keynesian Neoclassical analysis of Pigou and others when they studied the causes of unemployment in the macroeconomy.

Whatever the microeconomic underpinnings of the macroeconomic analysis of (mass, non-frictional) unemployment may be, they cannot be of an omnipotent forward-looking agent type, but have to be derived from a different set of assumptions about the constrained behavior of households in the presence of

the conditions of the labor market and in particular unemployment. Be that as it may, there is still another methodologically oriented argument that deeply questions the assumption of a universal market clearing, of Walrasian or any other type.

A basic empirical fact of macroeconomics is that the actual data generating process on the macroeconomic level concerning annualized data, like the inflation rate over a yearly period, is by and large a daily one, since the annual inflation rate is updated by the actual economic processes at least every day. This suggests that empirically oriented discrete time macromodels mirroring the actual data generating process should be iterated with a short period length and will then in general provide the same answer as their continuous time analogs.

Concerning expectations, the (slower) data collection process may however be of importance and may give rise to certain (smaller) delays in the revision of expectations, which however is overcome by the formulation of extrapolating expectation mechanisms and other ways by which agents smooth their expectation formation process. We do not expect here that this implies a major difference between period and continuous time analysis if appropriately modeled, a situation which may however radically change if proper delays – as for example gestation lags in investment – are introduced. Yet even this situation may only lead to continuous time systems involving time delays and not to the conventional period models with a uniform period and the corresponding totally synchronized actions over all the markets in the economy, as is also standard for example in some of the New Keynesian approaches to macrodynamics.[10]

Sims (1998, p.318) states in this regard:

> The next several sections examine the behavior of a variety of models that differ mainly in how they model real and nominal stickiness ... They are formulated in continuous time to avoid the need to use the uninterpretable "one period" delays that plague the discrete time models in this literature.

We completely agree with such a statement. We conclude from it that the use of temporary or intertemporal general equilibrium approaches with market clearing on all markets in an economic model that is operated in a continuous time framework is very unlikely to represent a reasonable approach at least for the real markets of the economy. Instead, there are gradual adjustment processes towards moving equilibrium positions at work that respond for example to disappointed sales expectations and unintended inventory changes experienced by firms in the manufacturing sector. We thus claim here that continuous time disequilibrium dynamics is much more relevant for the study of actual market economies than macrodynamic period models with their artificial synchronization of all economic activities (their virtual bunching at, for example, four points during the year). This is directly obvious for macrodynamic models of dimension one when situations of convergence in continuous time can lead to chaotic dynamics in period versions of the model when the period length becomes sufficiently large. The same also applies to statements of Erceg et al. (2000, p.302) when uniformly synchronized

period lengths of two years are considered with respect to their economic implications.

Of course, there exist processes that are synchronized with certain calendar dates, like monthly wage payments or the data collection snapshots of the economy mentioned above, which are often taken at given points in time. The question however is whether these synchronized activities are so important that they challenge the use of continuous time models with their compelling implication of using non-market clearing formulations at least for the real markets of the economy rather than the assumption of perpetual equilibrium at all moments in time. Moreover the use of such non-market clearing adjustment processes is indeed the basis for the consideration of the various Keynesian macroeconomic feedback channels, like the impact of nominal changes on the real side, the Fisher debt deflation effect, the Pigou real balance effect, the Tobin price expectation effect (where an expected price fall will trigger instabilities) and the Keynes-effect in the context of a dynamic multiplier model: they all have been a characteristic in the traditional Keynesian approaches to macrodynamics but have mostly been forgotten in modern market clearing macroeconomics.

We conclude that period models that give different answers as compared to their corresponding continuous time analogs should be viewed with suspicion if it is claimed that they are applicable to the explanation of the observed behavior of actual economies. Such model types may be very misleading, in particular if we attempt to use them for macroeconomic policy advice.

Hyper-perfect expectations?

We consider the rational expectations methodology here only with respect to continuous time deterministic models. The existence of uniquely determined rational expectations solutions for the forward-looking variables (called determinacy) is based on eigen-value calculations and the local search for a stable submanifold, as in Woodford's (2003) appendices, such that a one-to-one correspondence between the forward-looking variables and the number of unstable roots can be established. This guarantees determinacy in the reaction of the non-predetermined variables by means of the so-called jump-variable technique, which by assumption then allows the economy, after some change, to be put on a unique path back onto the stable submanifold of the full phase space of the dynamics. This is postulated to occur after unanticipated shocks. Rational expectations are therefore much more than just model-consistent expectations, since they select – by jumps of the forward-looking variables – from the set of all future paths with model-consistent expectations the single path that converges to the steady state of the economy as time goes to infinity. This type of an omniscient forward-looking agent is assumed to characterize the representative household's behavior as well as the decision making for firms and the results of their interactions.

Our basic objections to such a solution of the local stabilization of an in general (saddlepoint) unstable economy through a schematic application of a mathematical