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0521850258 - Foundations for a Disequilibrium Theory of the Business Cycle: Qualitative Analysis and Quantitative Assessment

Carl Chiarella, Peter Flaschel and Reiner Franke

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Foundations for a Disequilibrium Theory of the Business Cycle

Building on *The Dynamics of Keynesian Monetary Growth* by Chiarella and Flaschel (2000), this book is a key contribution to business cycle theory, setting out a disequilibrium approach with gradual adjustments of the key macroeconomic variables. Its analytic study of a deterministic model of economic activity, inflation and income distribution integrates elements in the tradition of Keynes, Metzler and Goodwin (KMG). After a qualitative analysis of the basic feedback mechanisms, the authors calibrate the KMG model to the stylized facts of the business cycle in the US economy, and then undertake a detailed numerical investigation of the local and global dynamics generated by the model. Finally, topical issues in monetary policy are studied in small macro-models as well as for the KMG model by incorporating an estimated Taylor-type interest rate reaction function. The stability features of this enhanced model are also compared to those of the original KMG model.

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Foundations for a Disequilibrium Theory of the Business Cycle

*Qualitative Analysis and Quantitative
Assessment*

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Foreword

The authors of this book, Carl Chiarella, Peter Flaschel and Reiner Franke, have been engaged in a major research programme in macroeconomic analysis for an extended period of time, arguably dating from the mid-1980s if not earlier. This has resulted in a series of papers and books by them and several others in various combinations, including Willi Semmler, Toichiro Asada, Gang Gong, and still more. This group is scattered in various parts of the globe, principally in the cities of Bielefeld, Beijing, New York, Sydney and Tokyo. While the output of this group is the result of visits to each other's institutions (particularly those of Flaschel to the University of Technology, Sydney) and meetings at various international conferences, the intellectual centre of their enterprise has been the Faculty of Economics at Bielefeld University. It is here that Flaschel, Franke and Semmler are, or have been at various times, located, and where the group has held an almost annual workshop on their developing research agenda over the last decade. Hence I feel it is appropriate to neologize here and dub the results of their collective efforts to constitute an emerging school of macroeconomic thought 'the Bielefeld School'. This book can then be characterized as representing a significant phase in the development of this Bielefeld School.

The authors themselves have in earlier work provided their own label for the core model they have developed and studied: the 'Keynes–Metzler–Goodwin' (KMG) model. This book more directly compares this model to other macroeconomic approaches, both those of a more New-Classical orientation as well as most substantially with those of various New-Keynesian formulations, especially the recently emerging synthesis due to Michael Woodford along with Glenn Rudebusch and Lars Svensson. At one point, in reference to James Tobin's later work, they suggest that their model could be considered to be derived from an 'Old-Keynesian' perspective, and it does draw on the basic IS-LM framework still used by many policymakers, with an added aggregate supply component. However, they generally stick to their use of the KMG label in describing it.

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The basic elements in this approach involve allowing for substantial real effects to arise from financial markets, which they argue is the Keynes part. The Metzler part involves allowing an important role for inventory adjustments, something that is much less common in many current macroeconomic models. Finally, the Goodwin part emphasizes the importance of income distribution, particularly wage dynamics operating through a modified Phillips curve setup. In sharp contrast to both the New-Classical and New-Keynesian approaches they abjure the rational expectations assumption in modelling inflationary expectations. They do allow inflation expectations to play a central role in their model, but view them as operating in a more generalized ‘inflation climate’ that gradually adjusts over time. Rather than just a trend-chasing adaptive expectations mechanism they also assume a tendency for reversion to a normal level over time, a pattern they label ‘regressive expectations’. These are models fundamentally of disequilibrium dynamics with gradually adapting processes.

Another central element that distinguishes their approach from many others is the assumption of nonlinearity in the investment function. While this may further separate them from many of the New-Classical and Keynesian modellers, this draws upon the influence of earlier economists who worked at the time of Keynes, such as Kalecki or – in his aftermath – such as Kaldor and Hicks, with both Metzler and Goodwin part of that group as well. This links them with the more general literature on models of complex dynamics arising from nonlinear models, which both Chiarella and Franke have separately contributed to in the past. In this KMG approach, instability arises from the nonlinearities being sufficiently great to trigger Hopf bifurcations and resulting endogenous limit cycle behaviour. However, these nonlinearities also provide bounds to the dynamics of the system.

There are two principal extensions that this book presents. The first is an effort to reach out more directly to policymakers by an effort to calibrate their model to fit parameter values relevant to the US economy. The second (in the final two chapters) is the introduction of a Taylor rule to endogenize policy feedback and the determination of interest rates. In this they are directly confronting the efforts of Woodford, and also of Rudebusch and Svensson, who have seen the Taylor rule as a way to eliminate indeterminacy in their models. They label this extension of their basic model the KMGT model.

Their final chapter examines the stability characteristics of this KMGT model. There they de-emphasize the nonlinearity of the investment function, which allows for endogenous cycles no longer to arise from a Hopf bifurcation. They even consider the matter of cycles due to

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exogenous shocks on an otherwise stable system in a Frischian manner. A final curious implication from this model is a heightened importance of the Metzlerian aspect of the system in determining the pattern of its dynamics.

At this point I would like to raise a point about a lacuna in this otherwise generally comprehensive book. This is the relationship of this Bielefeld School to those of the various branches of Post-Keynesian macroeconomics. They do not directly draw upon or cite any of the current prominent Post-Keynesian economists. However, it can be argued that their approach can be viewed as a sophisticated formulation of certain Post-Keynesian elements or trends. Certainly, Goodwin as well as Kalecki have been much admired by many Post-Keynesians, and the idea that money has real effects is an idea accepted by most Post-Keynesians. However, they do not obviously focus on endogenous money per se as do Paul Davidson and Basil Moore, even though their use of a Taylor rule effectively makes money endogenous. Also, they have been more precisely mathematical than have been many of the Post-Keynesians. Nevertheless, certain Post-Keynesians have developed models that have some definite similarities to what this school does, with Philip Arestis and Peter Skott coming to mind most particularly, notably in combining financial models with real effects with distributional shares dynamics that can generate endogenous cycles. Thus, I have no problem describing the Bielefeld School as representing effectively a highly sophisticated Post-Keynesian approach. Certainly, there is no doubt that they belong to the more general Keynesian approach, arguably much more so than the New-Keynesians, who use the questionable rational expectations assumption.

Thus the authors of this book should be applauded. They have moved a distinctive and policy-relevant approach to macroeconomic analysis forward decisively. Their careful synthesis of realistic dynamic elements and their careful analysis of the sensitivity and stability characteristics of their model in a policy context is much to be admired. In this book the Bielefeld School achieves a genuine culmination of great depth and breadth.

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Carl Chiarella, Peter Flaschel and Reiner Franke

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Preface

In this book we build on a theoretical approach the foundations for which were laid in the work *The Dynamics of Keynesian Monetary Growth: Macrofoundations* by two of the present authors. In that work we considered a hierarchically structured sequence of macrodynamic models, starting from Tobinian neoclassical monetary growth and its historical counterpart, the Keynes–Wicksell monetary growth models, leading then via Keynesian IS–LM growth dynamics to a model type that has been labelled the Keynes–Metzler–Goodwin (KMG) growth dynamics. In the present book we will extend the baseline KMG model in various directions, analysing it in a much more detailed way than in previous work and, most importantly, studying it also from the empirical and the numerical point of view. Special emphasis is placed on the dynamic feedback relationships and on endogenously generated business cycle fluctuations in a growth context. In the initial stages the study concentrates here on the private sector and, essentially, abstracts from policy issues. Gaining thereby basic insights into the stabilizing and destabilizing forces in the economy, modern discussions of monetary policy are also integrated later.

As shown in the work by Chiarella and Flaschel, the KMG model type manages to avoid a variety of problems associated with the traditional IS–LM growth model, such as the boundedness in the responsiveness of aggregate demand, multiple IS–LM equilibria, or discontinuities in phase space dynamics. The model achieves this by allowing for disequilibrium on the goods market, taking the implied inventory changes into account and introducing gradual adjustments towards desired inventories as well as the concept of expected sales. All this is formulated along Metzlerian lines and so constitutes the M-component of the KMG approach. From the higher-dimensional viewpoint of the Metzlerian disequilibrium adjustment process, the problems that many advanced IS–LM models are facing appear, in fact, rather misleading. Our model's Metzlerian component can thus be regarded as a useful or even indispensable device

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for the general modelling architecture, though its mechanisms are not at the heart of the economy.

The outstanding theoretical features of the KMG approach to macrodynamics are the relationships to Keynes' (1936) *General Theory* and to Goodwin's (1967) seminal paper on the interaction of growth and income distribution; these are the K- and G-components in the model. Concerning the K-component, the present book is still close to traditional macroeconomics in its description of consumption and investment behaviour. In a first stage, the interest rate is also determined by a familiar LM equilibrium condition, where the money supply is assumed to grow at a constant rate. It can in this respect be said that, while government and a central bank are present in the model, they conduct a neutral policy, so that the private sector can be studied in a kind of vacuum. In a second stage, we take up the recent New-Keynesian research agenda and follow the modern practice of studying monetary policy rules – i.e. interest rate rules of a Taylor type.

The real innovation of our modelling framework lies, nevertheless, in a new approach to the wage-price spiral as an extension of both Keynes' and Goodwin's views on this matter. As it is formulated and combined with aggregate demand, this building block can be usefully compared to the traditional Keynesian AS-AD dynamics (Old Neoclassical Synthesis) as well as to the currently fashionable New-Keynesian theory of staggered wage and price settings (New Neoclassical Synthesis). Underlining the agents' gradual reactions to the disequilibria they perceive, the wage-price dynamics in our model are, however, radically different from the Neoclassical Syntheses (Old and New), with respect to modes of operation and the implications for the macrodynamic system into which it is embedded. The role of an elaborate wage-price spiral in the course of the business cycle is thus one major focus of interest in this book, from the theoretical point of view as well as empirically, where in our numerical simulations we seek to calibrate the model's cyclical behaviour to the stylized facts of the business cycle fluctuations observed in the world's major economy, namely the US economy.

In sum, the book takes up the work begun in Chiarella and Flaschel (2000a) and provides detailed qualitative, quantitative and empirical studies of a mature version of the traditional Keynesian approach, which were then still out of reach. As an alternative to the New-Keynesian macroeconomics, it puts forward an approach to disequilibrium dynamics that aims to shed light on the study of demand-constrained modern market economies that, in particular, are subject to sometimes more and sometimes less virulent adjustments in wages and prices.

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A number of professional colleagues deserve special thanks. There are, first of all, our co-authors in several related published and unpublished works, Toichiro Asada, Willi Semmler and Peter Skott, who in many ways have contributed to the present project through stimulating discussions on various aspects of the subject matter of this book as well as on related research projects. We furthermore thank Richard Day, Duncan Foley and Reinhard Neck for a variety of stimulating comments at various stages in the development of the present work and related topics. We are grateful for comments and criticisms we have received from numerous participants at presentations of aspects of the material of this book at international conferences and research seminars. Of course, none of the aforementioned is responsible for the remaining errors in this work, neither with respect to form nor substance. We are indebted to three anonymous referees who read the original version of the manuscript (chapters 2 to 6) and offered many, even detailed, suggestions for its improvement. We also wish to acknowledge the sustained financial support for this project from the School of Finance and Economics at the University of Technology, Sydney. Finally, we would like to thank Chris Harrison and Lynn Dunlop of CUP for all that they have done to make the publication process go as smoothly as it has.

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Notation

Steady-state or trend values are indicated by a superscript ‘ o ’. 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 behavioural equations (with, however, the notable exceptions being π, ω, ξ and ϕ).

- 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 in chapter 2; otherwise generic symbol for functions defined in a local context
- G real government expenditure (demand is always realized)
- I real net investment of fixed capital (demand is always realized)
- I_N^d desired real inventory investment
- \mathcal{J} Jacobian matrix in the mathematical analysis
- K stock of fixed capital
- L employment – i.e. total working hours per year (labour demand is always realized)
- L^s labour 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 total real saving: $S = S_f + S_g + S_h$
- S_f real saving of firms (unintended inventory changes)
- S_g real government saving
- S_p real saving of private households
- T total real tax collections

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- T^c real taxes of asset holders
 W real wealth of private households
 Y real output
 Y^d real aggregate demand
 Y^e expected real aggregate demand
 Y^n output at normal use of capacity: $Y^n = y^n K$
 a_y abbreviates a sum of coefficients in chapter 6, section 3, subsection 3: $a_y = c_p + \gamma + s_c \delta - (1 - s_c) \theta_c$
 c_p consumption coefficient of agents without income from economic activities; see chapter 4, section 2, subsection 1, eq. (4.4)
 e employment rate (w.r.t. hours): $e = L/L^s$
 f_x functional relationship representing the determination of variable x , \dot{x} or \hat{x}
 f_{xy} partial derivative of function f_x with respect to variable y
 g^o steady-state growth rate of real variables
 g_ℓ growth rate of labour supply: $g_\ell = \hat{L}^s$ (a constant)
 g_m growth rate of money supply: $g_m = \hat{M}$ (a constant)
 g_z growth rate of trend labour productivity: $g_z = \hat{z}^o$ (a constant)
 i nominal rate of interest on government bonds; federal funds rate in chapters 8 and 9
 k^s fixed capital per (efficiency units of) labour supply: $k^s = K/z^o L^s$
 ℓ labour intensity (in efficiency units): $\ell = z^o L/K = 1/k^s$
 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: $q = r - (i - \pi)$
 r rate of return on fixed capital, specified as $r = (pY - wL - \delta pK)/pK$
 s_c propensity to save out of capital income on the part of asset owners
 s_h households' propensity to save out of total income (in chapters 2 and 3)
 u 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
 x_m auxiliary variable in chapter 2: $x_m = z^o M/wK$
 y output–capital ratio: $y = Y/K$; except in chapter 1, section 3, where y denotes the output gap
 y^d ratio of aggregate demand to capital stock: $y^d = Y^d/K$
 y^e ratio of expected demand to capital stock: $y^e = Y^e/K$

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y^n	normal output–capital ratio (a constant; no recourse to a neoclassical production function)
z	labour productivity – i.e. output per working hour: $z = Y/L$
z^o	trend value, or ‘normal’ level, of labour productivity
α	marginal product of capital in chapter 2: $\alpha = \alpha(y) = F_K(K, z^o L)$; symbol for policy parameters in Taylor rule in chapters 8 and 9
α_i	coefficient measuring interest rate smoothing 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	generically, 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}	generically, reaction coefficient related to the determination of variable x , \dot{x} or \hat{x} with respect to changes in the exogenous variable y
β_{Iq}	responsiveness of investment (capital growth rate) to changes in q
β_{Iu}	responsiveness of investment to changes in u
β_{Im}	stock adjustment speed
β_{ny}	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_{ve}	reaction coefficient of e in wage Phillips curve
β_{vv}	reaction coefficient of $(v - v^o)/v^o$ in wage Phillips curve
β_{zu}	responsiveness of (procyclical) labour productivity to changes in u
γ	government expenditures per unit of fixed capital: $\gamma = G/K$ (a constant, except for chapter 7, section 6, subsection 3)
δ	rate of depreciation of fixed capital (a constant)
$\eta_{m,i}$	interest elasticity of money demand (expressed as a positive number)
κ	coefficient in reduced-form wage–price equations: $\kappa = 1/(1 - \kappa_p \kappa_w)$
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 , in chapter 5
κ_{wz}	parameter weighting \hat{z} vs. \hat{z}^o in wage Phillips curve (only chapter 5)

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- κ_π parameter weighting adaptive expectations vs. regressive expectations in revisions of the inflation climate
- μ actual markup rate in chapter 5; same as μ^o otherwise
- μ^o target markup rate over unit labour costs
- ξ relative excess demand: $\xi = (Y^d - Y)/Y$
- π general inflation climate; except in chapter 1, section 3, where π denotes inflation
- θ same as θ_c (in chapters 2 and 3)
- θ_c tax parameter for T^c (net of interest): $T^c - iB/p = \theta_c K$
- τ_w tax rate on wages
- ϕ flexibility term in the nonlinear investment function in chapters 6 and 8: $\phi = \phi(u, q)$
- ω real wage rate, deflated by trend productivity: $\omega = (w/p)/z^o$