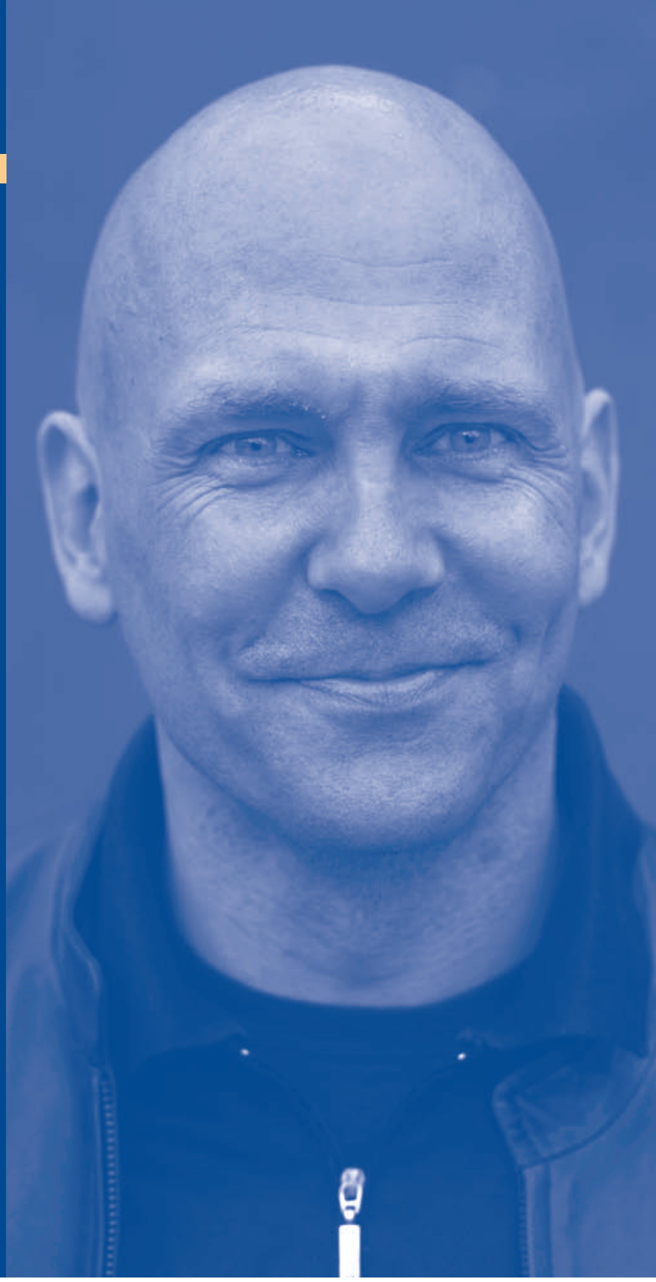
Macroeconomic equilibrium models without the Walrasian auctioneer



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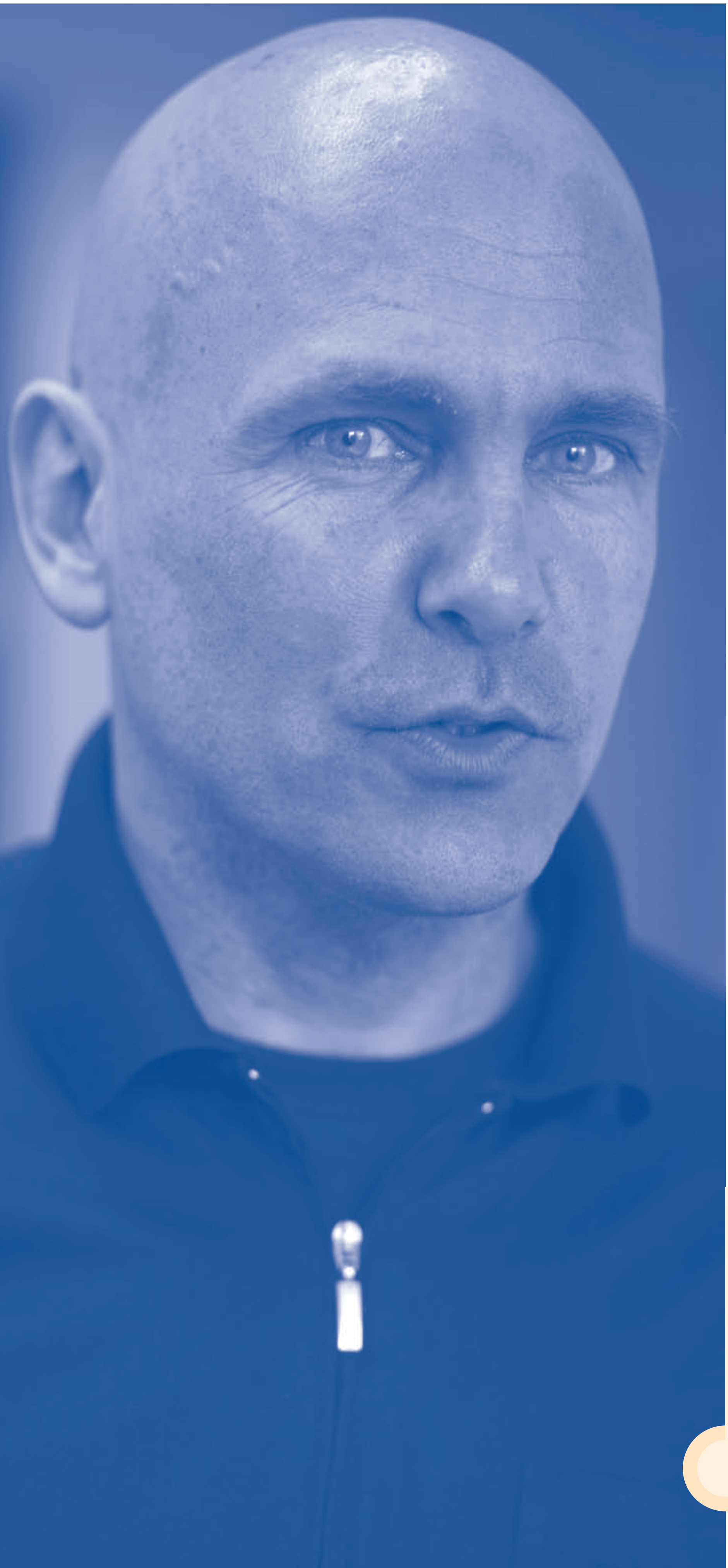
Macroeconomics has changed considerably in the last few decades. Modern macro is based on neoclassical economics and microeconomic foundations. It started in the 1970s, and is constructed on two important building blocks. The first is the rational expectations approach of Nobel Prize winner Robert Lucas. The second is the dynamic stochastic general equilibrium (DSGE) model. Although DSGE models are often referred to as Real Business Cycle (RBC) models, because in earlier versions aggregate productivity was the sole exogenous random variable, many other shocks have since been considered. Finn Kydland and Ed Prescott received their Nobel Prize for developing this type of model. All three laureates did much of their path-breaking work at Carnegie Mellon University. When I was a student at Carnegie Mellon, economists from the "salt water" schools were still very critical of the new approach promoted by the "fresh water" schools.[1] These days, DSGE models are taught to PhD students across the world. The current generation of DSGE models, however, looks quite different from the first one.

Modifications to first-generation DSGE models

DSGE models are more difficult to analyse than their predecessors, i.e., large Keynesian computer models. If agents are forward looking, and current economic behaviour depends on expectations about the uncertain future, then solving the model requires solving for agents' decisions for all possible realisations, not just the ones that are realised. Instead of solving for a time path, one must therefore find a solution in a function space.

As computational and mathematical challenges were met, the models were modified in many different ways. For example, robust control and rational inattention are recent developments that provide alternatives to rational expectations. With robust control, agents are forward looking, but do not know the complete structure that is generating economic outcomes.[2] With rational inattention, agents cannot costlessly form rational expectations, and are limited in the amount of information they can process.[3]



Another important modification involved allowing for heterogeneous agents– for example, by relaxing the complete market structure, which leads to the representative-agent paradigm. My more recent research incorporates matching and contracting frictions in macroeconomic models with heterogeneous agents.

Matching and contracting frictions

The matching paradigm, developed by Mortensen and Pissarides (1990), allows a much more realistic description of the way in which market participants find each other and what contracts they can write. The classic way to model competitive markets is to use the concept of a fictional Walrasian auctioneer who collects information from the demand- and supply sides and then calls out the price at which no further trades are desirable. This modelling technique, however, does not seem appropriate for the labour market or the market to obtain firm financing, for example. Why? It is costly to find trading partners, information asymmetries are important, and there are benefits to long-term relationships. In the spring issue of *TI Magazine,* Pieter Gautier pointed out that the presence of the matching friction is useful in explaining several market outcomes– for example, that seemingly identical workers receive different wages. Because of the cost of searching, workers that receive a low wage may choose not to enter the matching market to find a better match (and thus a higher wage).

Models about information asymmetries and contracting problems are well developed when only two trading partners are involved. Problems with multiple agents, however, are more difficult. The beauty of the matching friction is that– at least within one period– it "locks" two trading partners into a relationship, turning the problem into one that is tractable. Negotiating with other market participants is still possible, but is part of the outside option (i.e., part of the alternative to continuing with your current transactions partner).

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Macro models with frictions

Incorporating the matching framework into macro models leads to several key insights, illustrated below.

Magnification and propagation

Observed economic fluctuations are large relative to the observed fluctuations in external shocks such as changes in productivity, monetary policy and fiscal policy. The model itself must therefore magnify and propagate shocks. Den Haan, Ramey and Watson (2000) show that a macroeconomic model that incorporates a labour-market matching framework does exactly that. The idea is the following. A bad economic shock leads to the destruction of productive relationships. The lower employment levels reduce the resources available to households, which implies lower savings levels. Lower savings levels have an upward effect on the interest rate, which in turn lowers profits. Lower profit levels have an upward effect on the destruction of existing jobs and reduce the number of new firms entering the market. This reduces savings even further. We build a computer model to quantify these feedback effects and show that they are quite substantial. Whereas the standard real business cycle model magnifies shocks by 55%, the model that we develop magnifies them by 185%.

Inefficient economic fluctuations

The result that a fairly simple model with no frictions and only technology shocks could generate business cycle patterns came as a big surprise to the profession.[4] An even bigger break with conventional thinking was that in standard RBC models, economic downturns are optimal responses to reductions in productivity. The idea that it is "optimal" for so many more workers to suddenly stay at home does seem implausible and has been quite controversial.

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In matching models, economic fluctuations may not be efficient. In the model described above, households do not take into account the fact that a reduction in savings leads– through an increase in the interest rate– to more job destruction. Similarly, changes in the tax burden are not taken into account when job creation- and destruction decisions are made.[5]

Although there may be important inefficiencies in matching models, the decision itself to create or destroy a job is ceteris paribus typically efficient. In Den Haan, Ramey and Watson (2003), this is not the case. The relationship between the borrower and the lender is characterised by a moral hazard problem in which the borrower can choose for a good or a bad implementation of the project. The bad implementation is more attractive to the entrepreneur (consider the example of a more risky implementation). The entrepreneur's choice, however, is not contractible. The entrepreneur will consequently choose the good implementation only if he is rewarded by getting a high enough share of the proceeds. If the lender does not have enough liquidity, however, such a reward is not feasible, and a bad implementation is unavoidable. In that case, the lender is better off ending the relationship. Both the entrepreneur and the lender would be better off if the relationship would continue and the entrepreneur would choose the good implementation. Separation is thus inefficient. Continuance cannot happen, however, because the entrepreneur deviates from his promises as soon as the relationship continues.

Den Haan, Ramey and Watson (2003) show that this standard moral hazard problem leads to interesting insights when it is combined with matching friction and is incorporated into a macro model. The saving decision in our model is standard and depends simply on the rate of return earned. The process through which savings are allocated among intermediaries is subject to frictions. That is, funds may not necessarily go to the intermediary that has the most productive use for them. These frictions are less severe, however, if more intermediaries are in a relationship with entrepreneurs (that is, if the financial network is healthier).

Suppose that the financial network becomes damaged, due to a financial crisis. A number of relationships thus break up. This destruction in the financial network exacerbates the inefficiency of the allocation process, which in turn lowers savings. If intermediaries receive fewer funds, then a greater number of intermediaries will not have enough funds to overcome the moral

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hazard problem. Consequently, even more relationships will be destroyed and the story continues.

Our study analyses whether the economy will eventually recover or collapse. If the matching probability is not sufficiently high, then the economy collapses. Consequently, this model suggests a clear role for the government during a crisis in providing enough liquidity to maintain the network of relationships.

Concluding comments

Macroeconomic models with frictions and heterogeneity have been used to better understand macroeconomic fluctuations. Moreover, because of the heterogeneity, this type of model has a much richer set of predictions and can therefore be much better used to distinguish between competing specifications. For example, Covas and Den Haan (2006) use US data to show that equity issuance is procyclical for most firms, but countercyclical for the largest firms. Because the largest firms are really large, aggregate equity issuance is roughly acyclical. If one would ignore the heterogeneity in the data, then one would try to build a model with acyclical equity issuance, while in reality equity issuance is very cyclical, but differs for different firm categories.

Computational difficulties still compel us to be creative and parsimonious in modelling heterogeneity and frictions. The integration of microeconomic theories into fully developed macroeconomic models, however, is likely to continue and to accelerate as computational constraints are relaxed and more cross-sectional datasets become available.

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Notes

1 Harvard, MIT, and Penn were called “salt water”, because they are close to the eastern sea border, while Carnegie Mellon, Chicago, Minneapolis, and Rochester are located inland.

2 See, for example, Hansen and Sargent (2001).

3 See, for example, Mankiw and Reiss (2002) and Sims (2003, 2005).

4 It also came as a surprise to Kydland and Prescott. They started out with models that included policy shocks, but they discovered they did not “need” them.

5 Den Haan (2006) shows that this externality could be the reason behind the persistently high unemployment rate in several European countries.