

REPORT ON THE CONFERENCE ON ECONOMIC MODELLING\*

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OVERVIEW

The Conference on Economic Modelling was designed to provide an overview of the development of modelling techniques since their introduction in the Netherlands in 1936. Participants were able to assess the current state of modelling, the challenges which forecasters face and the possibilities for future development in this area. Participants were drawn from all the major centres of econometric modelling in Europe and the United States. They included Prof. Jan Tinbergen, the originator of the technique of econometric modelling. There were also a number of central bankers present, including three of our colleagues from the Caribbean.

On the level of theory there were three items which seemed to offer good promise of further development. One was to represent people's anticipations and ideas about the future and how they affect behaviour in the present - the so-called question of "expectations." No econometric model handles this question very well at present; however, there are techniques which have improved our ability to deal with anticipated events. Current models suggest what the outcome of a particular policy might be if the reactions of the public followed trends which are consistent with the model

itself. This still leaves a considerable area of doubt because we have no means of knowing in advance whether people's expectations will be "model consistent".

A second area of development has been in the explanation of employment and unemployment. The Dutch model now allows for the fact that, as machines become out of date, they are replaced by others which are more advanced. The amount of employment that is generated by a given amount of work depends on the vintage of the machines in operation. This means that we may get different levels of employment for the same output depending on how recently we have put down the machinery which is used to produce that output.

The third area of development is still the subject of intense controversy. It is the effects of banks and money on the level of output. All the models now make specific provision for the effects of the money supply and of the availability of credit on the level of output, but very few have been able to demonstrate a significant impact.

The Conference also highlighted significant advances in the techniques of econometric modelling. Perhaps the most exciting was the newest technique, used only by the Netherlands Central Bank, for representing economic processes by means of computer aided design on personal computer screens. Such a visual model is now available for the

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\* Copies of the Conference Papers are available in the Library

Central Bank of the Netherlands econometric model. By adjusting the interest rate, for example, using the PC keyboard, one can see by means of levers and switches appearing on the screen, the effect on the supply of money, on the current account of the balance of payments and on the exchange rate for Dutch guilders in terms of German marks.

Another exciting development is the emergence of facilities for comparing performance among models of various economies. At the University of Warwick in England there is a project which allows for the comparison of the major models of the UK economy. All the equations for these models and the data associated with them have been loaded onto the University of Warwick computer and anyone may run them for any particular change to see what outcomes they give and to compare. A comparison exercise for models for a number of countries has been run by the Brookings Institution in the United States. It has also been suggested that by testing a single model for many countries richer insights into the behaviour of economic processes might be obtained.

The latest techniques for making sure that the relationships detected by the statistics are not merely the result of similar trends in the data have been incorporated into all the major European economic models. They include so-called 'error correction mechanisms and cointegration.

The Conference was very optimistic about the future of econometric modelling, as might be expected from the roster of those attending. Participants did stress that there is much less enthusiasm for large econometric models than there was in the 1970s, particularly among corporate users in the United States. Most of the big banks and other financial institutions which maintained significant economic models of their own in the late 1970's have now downgraded or eliminated that activity. Substantial difficulties of theory and practice remain the field of modelling. However, these disadvantages are no greater or less than for any alternative way of dealing with economic issues. The general feeling therefore seemed to be that models must continue to play an important role in decision-making.

#### SESSION 1

##### The Dutch Econometric Heritage

Professor Barten presented a paper on the history of macroeconomic modelling in the Netherlands. The story begins with the 1936 model of the Netherlands economy which used eleven years of data, from 1923-33, with 24 equations, all parameters being estimated with hand calculators. The database had to be specially constructed for the purpose. It was followed by a model constructed by Tinbergen and Polak for the US in 1939 and a model for the UK which also appeared in 1939.

The bases of modern estimation techniques were laid by Koopmans at the Cowles Commission who initiated the maximum likelihood estimator and by Thiel who introduced the method of least squares.

The first model used for official policy guidance was the Dutch model introduced in 1955. Subsequent Dutch efforts modified the model so that it reacted differently when the economy was close to full capacity than when there was the possibility of expanding output without further investment. Also introduced were reactions between the real and financial markets. In the late 1970's the capacity limitation was represented by specifying different vintages of capital. Capital had to be replaced and old vintages taken out of use as their cost became prohibitively high given new technologies.

Apart from the model which Tinbergen originated at the Central Planning Bureau the other models of importance in Holland are maintained by the Central Bank and by Amsterdam University.

Although all the models have been constantly refined over time; the tradition has been inward looking and there has been little influence of error correction mechanisms, the dualism featured in Swedish models supply side effects or rational expectations.

In his commentary Prof. de Marchi argued that the refinement of the Netherlands model reflected the continuing dissatisfaction with the performance of each of its incarnations. He mentioned that the increasing number and styles of models in the Netherlands in recent years is in marked contrast to the growing skepticism about model building in the United States.

In his comments Mr. Polak mentioned that the technical limitations of the original model in a sense forced a better understanding of the series on which they were based. Each series had to be examined and evaluated carefully to determine whether it was likely to add to the explanation of the model because to incorporate an additional series involved a considerable expense of time and manpower.

Polak argued that the advantage of the IMF type models in contrast to the very much larger national models was the transparency in understanding the effects of simulations. He argued that models should be as small as they might be for the essential purposes they were required to serve.

Polak also posed but did not attempt to take sides on the question of whether one should give primacy to plausibility of estimation or whether one should depend on simulation or on forecast results in choosing one's model.

### Macroeconomic Modelling for Economic Policy

Prof. Siebrand presented a paper on this topic. He first dealt with the question whether Government could effectively compensate for economic instability. He argued that it was possible for Government policy to smooth the path of the economy over a medium to long term horizon. He also suggested that chances of success might be enhanced by using what he calls "scarcity conformed policies" instead of policies which conform to market conditions. An example would be to tax high priced labour in order to subsidize the employment of labour.

Siebrand pointed out a number of conspicuous defects of econometric models including their incompleteness, the inadequacy of the theory on which they are based, the problems of aggregation, the weaknesses of econometric theory, the fact that the parameters of the model may be affected by policy, the problem of uncertainty and the fact that model specification may arbitrarily narrow the range of options. He gave examples under each category; for example, he suggested that the Netherlands may have neglected the consequences of exchange rate policy to some extent because the econometric models in common use assume a fixed exchange rate.

He argued that the indirect effect of the Netherlands model has been substantial. The Central Planning Bureau models

have been used in arbitrating between different approaches to economic policy and the Bureau has carried out simulations for trades union and for the Opposition as well as for Government.

He argued that the advantages of model building were that it allowed one to learn by doing and that it provided for accountability. He suggested that models should be supplemented by other formal devices in policy formulation.

In his commentary, Prof. Buitter argued that the US economists' reactions to the inadequacies of old macro models has been most unfortunate. The neo-classical reaction ignores agency problems, inadequacy of information, assymetry and the inherent instability of the private sector. He pointed out that even the incorporation of reactions, which apparently is the procedure that he prefers, is fraught with insuperable difficulties. He also pointed out limitations in the suggested use of optimization techniques. They run up against the problem of credibility and once the policy package on which they are premised is known then that alters the parameters which ought to be used in the policy making exercise. Buitter still recommends the use of econometrics quoting Churchill that it is "the worst possible approach except for all the others".

### Comparative Analysis of Dutch Macroeconomic Models

Prof. d'Alcantara suggested that the Dutch macroeconomic models all exhibited common features. They were primarily demand determined with only a few supply equations. The labour requirements were subject to capacity. The production function embodied capital which contained a given technology and de facto proportions embedded in that technology could not be changed. Wages are indexed to prices and there are dynamic effects. Expectations are modelled in a simple ad hoc manner. There are no elaborate international linkages.

In his contribution Mouet pointed two peculiarities of the Dutch model: the fact that the production function embodied a fixed coefficient for each vintage of capital and that the real wage rate was determined by productivity considerations.

In a comment on the inadequacy of theoretical foundations for macro models Bodkin pointed out that the microtheoretic foundation was also inadequate. He suggested that it should be superseded by theoretical foundations which are not based in classical auction markets. For labour markets, he suggested contract theories and for product markets, theories based on custom. He suggested that a fruitful source of ideas might be Okun's work.

### European Macroeconomic Models

Prof. Bodkin gave an overview of European models. He identified the following trends: towards increasing size of models, the use of team approaches, the fact that models were characterized by institution rather than by a particular individual, increase in technical sophistication and greater use of models for forecasting and policy.

In his contribution Prof. Wallace reported that the British Economic and Social Research Council supported a project at Warwick University which brought together seven macroeconomic models of the UK economy. The equations and the data are all loaded on the Warwick computer and are made available to any researcher. The performance of the models is reviewed annually and the evaluations published.

Wallace pointed out that the models do not use rational expectations but what he calls "model consistent" expectations. He argues that this is a useful exploratory device which can tell us at least if the model is consistent with its own assumptions, provided that it were understood on its own terms. He points out that the UK models now incorporate new improved econometric technique including tests which try to identify whether the preferred model explains the widest possible universe, error correction mechanisms, cointegration and so forth. He disaggregated reported errors into the effect of add factors, the effect of model errors, i.e. estimation errors and the effects of errors in projecting the

exogenous variables. This seems a useful procedure for evaluation.

In his contribution, Mr. Richardson wanted to see the use of a summary way of describing economic model structures and the presentation of model responses to a set of standardized tests or shocks. This would provide for uniformity in making comparisons between them. He pointed out that joint exercises in model evaluation had been organised by the Brookings Institute which brought together international models produced by the OECD, the US Federal Reserve, the IMF, Wharton Econometrics and others.

Ms. Ostry wondered somewhat rhetorically whether the quality of data was keeping up with the sophistication of econometric techniques. The panellists rather tended to sidestep the issue.

#### Panel Discussion on a Research Agenda for Macroeconomic Models

Mr. Lamfalussy suggested the following areas that needed to be put on the research agenda: the nature of linkages between countries and financial sector behaviour, in particular the behaviour of interest rates.

Prof. Tinbergen argued that models are useful for orderly discussion, enabling us to identify differences between the

theoretical departures of different researchers. Models may also enable us to specify the simplest form in which a new phenomenon occurs. He suggested that the new phenomena with which we have recently become concerned are pollution, the welfare differences between continents and security. His own recent research has been on the optimum amount of aid transfers which would maximize world welfare. He has been using models of 3 to 20 countries. He has also taken account of the implications of security transfers from the first to the second world.

Prof. Barro reviewed the history of the neo-classical challenge. He argued that their first task was to explain the importance of money and they thought to have done so by exploring the confusion between relative prices and absolute prices. Money would have short-term effects but these effects would vanish in the long run. Fully anticipated monetary policy would have no effect and only shocks would be effective. However, observation suggested that the information lag did not seem to matter very much and that the causation might very well be from income to money rather than the reverse. This suggested that money was not that important after all. If so, then the economy must be fluctuating in response to real shocks. This has led to concern with stochastic disturbances arising from such factors as changes in technology and has led to investigation of "propagation mechanisms". Other sources of disturbance are

fiscal shocks and banking panics. The policy implications are "predominantly non-activist" except distortions are introduced.

Prof. Cramer reminded the audience that the distinction between exogenous and endogenous variables was always arbitrary and depended on the purposes of the researcher. For many models it was desirable to reduce to a minimum the number of exogenous variables in the search for a better understanding of reality.

He also dealt with the question of paring down big models in order to illustrate their workings. He suggested that the equivalence of a smaller comparable model might be established in terms of similarity of outcomes. He also suggested using reduced forms of larger models. However, it seems to me that a reduced form would not necessarily produce the same outcome as the full model, at least in quantitative terms.

Prof. Dreze commented on the danger that we might become infatuated with the models themselves to the detriment of the economic objectives which they are meant to serve. The objective really is to get quantitative estimates of the effects of policy decisions. He suggested that the research agenda be directed to the following shortcomings in our current knowledge: the nature of supply responses, the

estimation of capacity and the short run dynamics of wages and prices. He also suggested the value of using data for several countries to run each model. This would yield richer intuition. He recommended probabilistic forecasts and suggested a link between econometrics and decision theory.

Prof. Flemming suggested that our data for modelling was inadequate and was getting worse. He commended the use of model consistent expectations to introduce dynamics into models although he admitted that they did not always help. Aggregation was a serious problem and modellers were forced to put together people whose expectations were inevitably different. He thought there was a need to improve on the performance of equations such as those for wages and exchange rates in UK models which inevitably had to be overridden because they made nonsense of the reality. He argued for better explanations of supply responses. The Heliwell line of capacity limitations was the only available methodology but was far from adequate. He exhorted modellers to use their models as a means of analysing the real world rather than as an opportunity to quarrel with other schools of modelling.

In a rejoinder Barro pointed that the introduction of knowledge as private property acted as a constraint in the introduction of increasing returns on models, preventing expansion without limit.

Dreze in a further comment pointed out that uncertainty about incomes is a justification for wage rigidity. He also pointed to the possibility of evaluating the structural sensitivity of large models importing methods from hydrology and electrical distribution.

#### Applied General Equilibrium Models

Prof. Ginsberg outlined the structure of AGE models which included goods, agents such as Governments, consumers and producers, signals (mainly prices), rational behaviour and institutional rules such as perfect competition, imperfect competition and price constraints. The models made outcomes the result of behaviour, data and institutions only, using Pareto optimality.

The limitations of AGE were that the numerical specification had to be arbitrarily and eclectically drawn from secondary sources and that there was no money and therefore no prices and no exchange rates.

The main areas to which AGE have been applied are tax reforms and tariffs and non-Walrasian equilibrium, particularly wage rigidities.

Prof. Kooiman suggested that one usefulness of micro theory was as an inspiration for macro theory. However, micro theory is itself a highly stylized abstraction from reality.

#### Econometric Theory

Prof. Kloek touched on examples of some of the issues in his paper on Econometric Methodology and dealt with them. He pointed out first of all that they were many styles of models which could be distinguished as to their size and the role of theory. He gave examples of models ranging from those with very large numbers of equations and very considerable role theory to the Simms model with very little theory and one or two equations.

A second area of concern was the interpretation of an economic variable and economic relationship. He illustrated this by reference to a dependent variable which was explained by two exogenous variables one of which contained an autonomous element and an element which was related to the other autonomous variable.

He expanded on problems of theory but in his oral presentation illustrated only by his contention that no micro theory can be properly estimated. To put together an estimate you must have a homogenous product and it is impossible to disaggregate to a sufficiency a fine level to actually test products which might reasonably be considered homogenous in real life.

He commented on data problems, suggesting that the separation of the collection of data and the research is a peculiarity

of economics, not shared with physical sciences. He pleaded for a better understanding of the meaning of data and suggested that universities should recruit faculty whose particular expertise is in the interpretation of data.

He commented on model selection procedures and also on tests for the evaluation of models. The most powerful techniques are for single equations and they rapidly run out of steam if one has to apply them to systems. To cope with simultaneous equations using evaluation techniques one has to resort to limited likelihood methods and the use of ad hoc variables. Even these factors are of little assistance unless we have five to ten times more observations than we have variables.

He made a plea for comparison among models using one or more of the following techniques: mimicking data generating processes, explaining the behaviour of other models with one's own model, prediction tests, generalizing old models and the use of non-nested models.

Among other things, Prof. Kmenta in his comment suggested that causality is a term not much liked by econometricians. They preferred to use exogeneity and he thought that it was important for economists to clarify the distinction between these terms.

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