Evaluating Macroeconometric Modelling with Regard to Usefulness: a Survey

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Macroeconometric models have during the last 40 years played an important role as a tool to guide decision making in public as well as private macroeconomic institutions. However, such models have not been much used in academic circles. We argue that macroeconometric models have problems both with regard to internal and external validity. Although the science of econometrics has partly answered the problem of internal validity, macroeconometric modelling is still dismissed by theorists as inappropriate for theoretical development. We find that the argument over how to evaluate macroeconometric modelling can be viewed as a result of the relationship between observed economic variables and economic theory.

JEL Classifications: B23, B4, C5
Keywords: econometric models, theory of science

The starting point for empirical modelling must always be some theoretical model. Theory is by definition an assumption about causal relationships that can be empirically tested (Troye, 1994). An important role of the researcher is to make decisions about how much of the theoretical model to impose on the estimation. In a structural model the theory is tightly entrenched. But one can also formulate a system so general that the numbers of imposed theoretical restrictions are minimal. Estimating the system, one can use statistical measures to evaluate whether the variables in the estimated system do indeed show a causal relationship.

The ultimate example of a structural model would be a calibrated theory model. In such a model all relationships follow directly from theoretical derivations, and parameter values are not based on esti-

mations of the system. On the other end we find models where the system is fully determined by statistical tests. However, most applied models will stand in between these two extreme alternatives. Macroeconometric models used for policy analysis tend to be structural in the sense that the equations have theoretical interpretation, and that one as far as possible identify the relationship between endogenous variables. However, they are estimated on actual data, and the form of the model is to a large extent determined by these estimations.

The purpose of this paper is to provide a survey on the discussion about the use of macroeconometric models. Although the developers of such models have worked hard to make their models more consistent with theory, i.e., more structural, the perception seems to persist among theoretical economists that macroeconometric models are of little importance for theoretical development. We discuss the main points of critique against this type of models, and how one has tried to solve these problems.

In this process we identify a paradox. Macroeconometric models are used by politicians, bureaucrats and analysts for policy analysis, not least based on their ability to forecast economic variables. However, such models are dismissed by a large part of academic economists. This dismissal is not so much based on a scepticism to methodology – with regard to estimation procedure considerable improvements have been made over the last two decades. Rather academic economists seem to disregard structural models because they *lack forecasting abilities*. This becomes even more paradoxical given that theoretical models rarely are evaluated based on their forecasting ability.

The paradox that structural models are both supported and dismissed because of their forecasting abilities can be explained by

what we define as economically interesting variables. Macroeconometric models can, to some extent, forecast variables. However, they can only forecast variables where there exist collected time-series. Such variables are not necessarily the same variables that are of interest for economic theorists. We find that the argument over how to evaluate macroeconometric modelling can be viewed as a result of the relationship between observed economic variables and economic theory.

In the next section of this paper we give an introduction to econometric modelling. In the following section we evaluate macroeconometric models from the criteria of usefulness with regard to two different aspects: policy analysis and development of theory. We argue that the ability to forecast is essential for policy analysis, and that ability to identify the true relationship between variables is essential for making contributions to development of theory. We will see that the critique against macroeconometric modelling using these criteria has resulted in the development of two new research strategies. However, in the fourth section of the paper we find that although the science of econometrics has partly answered the problem of internal validity, macroeconometric modelling is still dismissed by theorists as inappropriate for theoretical development.

Econometric modelling

Most economic theories build on a system of forces that interdependently decide an equilibrium outcome. However, when econometrics was first developed in the early 1930's, research was concentrated on solving problems concerning single equations. Hence, one soon discovered that this was not sufficient to gain understanding of many economic relationships. To apply statistical methods to economic theory in an appropri-

ate way, one must be able to handle structural equation systems.

Structural equations are equations were the relationships between the variables are a product of existing theory. Each equation in the system should also have an independent, economic interpretation. Econometric methods are used to find reasonable parameters for the variables, and to establish the uncertainty of the parameters and fit of the model.

An example of a structural equation model in economics is a supply and demand system. Equilibrium price and quantity are determined by the interaction between supply and demand. However, a single equation that explains the relationship between price and quantity will not be able to distinguish between the factors of supply and demand. If we observe a change in the equilibrium price, we can not distinguish to which extent this change is due to a change in supply, in demand or in both. Different theories will be observationally equivalent. The identification of both the supply and demand relationship are necessary to understand the movements in price and quantity.

Research on solving simultaneous equation models was mainly conducted in the "Cowles Commission for Research in Economics", a foundation funded by the investment banker Alfred Cowles 3rd, who also funded Econometrica [Niehans, 1990]. The research director of the Cowles Commission was Tjalling Koopmans.[1]

Koopmans and his collaborators, of whom Trygve Haavelmo probably was the most important on this issue, showed that the solution to the problem was to be found in economic theory. The necessary condition for identification was found to be that the number of exogenous variables in the system but excluded from equation j, have to be at least as large as the number of endogenous variables included in equation j minus 1. In other words: all predetermined variables can not be included in every equation. One has to use economic theory to construct the structural equation model in a way that this condition is fulfilled.

Structural equation systems in macroeconomics

Macroeconomics as we know it today received its first main contributions in the 1930's, starting with the work of Keynes, and then especially "The General Theory of Employment, Interest and Money" from 1936.[2] It was in this period economics got an understanding of the general budget equation and the dynamics of the economy. That is the starting point of all modern macroeconomic analysis, and a necessary prerequisite for statistical analysis and aggregation of variables.

However, in the 1930's the collection of macroeconomic variables were still in its infancy. And the ability to use the available data was limited. The 1930's were a period with impor-

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1. Five of the leading contributors to the early development of econometrics were later awarded the «The Sveriges Riksbanks Prize in Economics in Memory of Alfred Nobel»: Ragnar Frisch, Jan Tinbergen, Tjallings Koopmans, Trygve Haavelmo and Lawrence Klein.
2. The topics discussed in macroeconomics have been discussed long before Keynes. However, the term «macroeconomics» was an invention of Ragnar Frisch, and the first macroeconomist in the modern sense was probably Irving Fisher. Macroeconomics as dominating today is a mixture of Keynes and marginalist theory (developed from the 1870's and forward), with main contributions dated after 1936. Baumol (2000) states that the formalisation of macroeconomics probably is the main achievement of economics in the 20th century. Some fields in macroeconomics, especially monetary economics, have a longer history, with important contributions from the 16th and 17th century (Niehans, 1990).

tant achievements in theory, but a lack of formal measurement. Theory seemed to give a systematic understanding of how the economy was working, but one was unable to test the implications on actual data. Hence, one needed to develop new statistical measures.

To translate theory into measurement one introduced econometric models of the economy. The models were based on a traditional Keynesian framework, where the economy might be below the optimal level of output because sticky prices and wages destroy the short-term relationship between supply and demand.

The models provided a new tool for economic policy makers. As stated by Lawrence Klein,

> "It is desirable to create tools of analysis suited for public economic policy that are, as much as possible, independent of personal judgements of a particular investigator" (Klein, 1947, p. 111)

Macroeconometric models that combined structural features in an estimated framework provided an answer to this challenge.

These macroeconometric models were introduced into the toolbox of governments and central banks during the early 1950's. The introduction was pioneered by the work of Jan Tinbergen, who became the leader of the Dutch Central Planning Bureau in 1945. However, it soon spread throughout Europe and North-America. The models were mainly used for forecasting and analysis of policy measures. By analysing an econometric model of the economy the politicians could obtain information to guide them in making decisions about how to adjust national budgets to achieve an optimal level of production.

Criticising the Keynesian framework

Keynesian economics focuses on the demand side of the economy. Supply is seen as flexible in the short run. This means that total output can be adjusted by adjustments in demand. Further, the models usually assumed that the short run effects of public spending had almost no effects on private spending, making government intervention very forceful. On the other hand, monetary forces had little weight in these models (Whitley, 1994, pp.42-43).

Some leading economists, especially in the monetarist tradition lead by Milton Friedman, were highly critical of the assumptions in these models. Friedman pointed out several things that is today regarded as the mainstream position in economics (DeLong, 2000).[3]

- Rather than seeing business cycle fluctuations as a decline below a level of potential output, one should regard the business cycle as fluctuations around a trend. This has important implications for the effect of public spending. If the economy fluctuates around a trend there can be too much as well as too little spending – and too much spending would not lead to lower unemployment in the long run but to higher inflation.
- Monetary policy is more potent as a tool of stabilisation in the short run than is fiscal policy.

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3. As pointed out by [DeLong, 2000] the word "monetarism" has been tainted by a close connection to some extreme right-wing positions, and by a strong belief in a stable demand for money, a relationship that broke down in the early 1980's. As a result the word monetarism is almost never referred to in current economics. However, in many theoretical aspects monetarist ideas has supplanted many traditional Keynesian beliefs in what is today described

- Economic policy must take into regard changes in expectations.

Other critique of the Keynesian model came from the real-business-cycle theorists. They focused on the supply side of the economy. Most economists now agree that the supply side is not so simple as it was described in the first decades after the second world war. However, modelling the supply side is still one of the main problems in formal economics.

During the 1950's and 60's, which was a period with high and stable growth, the traditional Keynesian framework seemed to work well. However, with the more volatile conditions after 1970, the developers soon had to admit the need to incorporate other relationships into the model. In a step-by-step process, the developers of econometric models did take regard of the changes in mainstream theory. [Whitley, 1994] points to three important developments:

1. Equilibrium-correction terms, i.e., terms incorporating the cointegration relationship between variables, were taken into the models. As a result one could assure that the model's estimations were contained to a long-term trend. Thereby one could e.g. eliminate the possibility to pursue the Phillips curve indefinitely.
2. The modelling of the supply side was increasingly made more sophisticated.
3. The models have (slowly) incorporated effects of monetary policy into the model framework.

However, Whitley describes the change as "evolutionary rather than revolutionary" (Whitley, 1994, p. 46). Whitley, (1994), p. 79, summarises the development of UK econometric models over the last 20 years in the following way:

"The overall impression is that some of the UK models have not really changed that much in their properties, despite their more acceptable theoretical underpinnings and their us of currently fashionable econometric techniques."

Evaluating the usefulness of macro-econometric models

As pointed out, an important role of the macroeconometric econometric models were be to guide politicians and central banks in their choice between different policy alternatives. Troye (1994), p. 266, lists five criteria that one needs to take into regard when evaluating a theory with respect to practical implementation:

1. external validity,
2. cost of type 1 and type 2 failure,
3. validity of control,
4. predictive validity,
5. the ability to «translate» theory to actual policy measures.

We will focus on the concept of external validity, which we can define as the requirement that a model should be valid outside the data set on which the model is estimated. For empirical modelling external validity will always be difficult: empirical modelling is by definition based on observations from the past. However, exact prediction of future events is not the same as external validity. One must rather understand external validity as the requirement that an estimated model does not build on assumptions that make the predictions of the model systematically unreliable.

However, econometric models can also be expected to play a part in academic economic research. Troye (1994), p. 266, lists five criteria on which to evaluate whether a model

is well formulated with regard to being useful in the development of theory:

- ability to falsify,
- explanatory power,
- validity of theoretic content,
- internal validity,
- external consistence.

We will focus on the concept of internal validity. There is always the possibility that a perceived relationship is not the true causal relationship, but only a reflection of some underlying, not observed, common cause. To claim internal validity we must be reasonably certain that the model we use is describing the true causal relationship in the sample we look at.

The use of macroeconometric modelling in policy analysis - The Lucas' critique

A reasonable understanding of the term "structure" can be "as something which remains fixed when we undertake a policy change ... structure is defined if we can estimate it from the given data." (Sims, 1980, p 12). In other words, for a structural model to be of value the underlying structure needs to be fixed as we change policy.

Lucas (1976) claims that this assumption makes structural macroeconometric models the wrong tool for evaluating macroeconomic policy. He states:

"suppose a reliable model (F,?) is at hand, and one wishes to use it to assess the consequences of alternative monetary and fiscal policy rules…. According to the theory of economic policy, one then simulates the system under alternative policies (theoretically and numerically) and compares outcomes by some criterion. For such comparisons to have any meaning, it is essential that the structure (F,?) not vary

systematically with the choice of [policy]. Everything we know about dynamic economic theory indicates that this presumption is unjustified." (Lucas, 1976, p. 25)

Lucas illustrates this point by giving three examples: for estimating consumption functions, the treatment the effect of tax policy on investment decisions and the relationship between output and inflation. The treatment of temporary tax cuts might be illustrative. In many models such a tax cut had short-term effects on consumption. However, consistent preferences (given no credit constraints) would imply almost no short-term effects.

According to Lucas this critique has serious effects:

"For short-term forecasting, these arguments have long been anticipated in practice, and models with good (and improvable) track properties [with regard to forecasting ability] have been obtained by permitting and measuring «drift» in the parameter vector θ. *Under adaptive models which rationalise these tracking procedures, however, long-run policy simulations are acknowledged to have infinite variance, which leaves open the question of quantitative policy evaluation.*" (Lucas, 1976, p. 39, italics added)

If we subscribe to Lucas' critique, macroeconometric models seems to fail on account of external validity: the relationships found in the model will not be valid outside the data set on which the model is estimated. On this basis we can argue that macroeconometric models are generally not a good tool for policy analysis.

In 1980 Robert E. Lucas formulated a research program for macroeconomists. Lucas argued that since macroeconomist could not conduct experiments in the real

world, they should in stead build "model pseudo worlds" that "provide of fully articulated, artificial economic systems that can serve as laboratories in which policies that should be prohibitively expensive to experiment with in actual economies can be tested out at much lower cost" (Lucas, 1980). He further argues that economists

> "need to test them (models) as useful imitations of reality by subjecting them to shocks for which we are fairly certain how actual economies or part of economies would react. The more dimensions on which the model mimics the answers actual economies give to simple questions, the more we trust its answers to harder questions." (Lucas, 1980)

This proposition was first taken seriously by the "real business cycle" tradition. This is a direction in macroeconomics that dismisses nominal price rigidities and explains business cycle fluctuations with supply shocks. The first important contribution to this literature was Kydland and Prescott (1982). However, to an increasing degree the Lucas agenda of building general equilibrium models and use them as "model economies" has won support also among "new Keynesian" economists. A new Keynesian economist is an economist who work in a marginalist framework, but who accepts the existence of price and wage rigidities. Clarida, Gali and Gertler (1999) provides one influential example.

If we take the Lucas approach to macroeconomics sincerely, the most important task for econometrics would be to identify how the real economy reacts to shocks. Christiano, Eichenbaum and Evans (1999) write that:

> "... we have stressed one motivation for isolating the effects of a monetary policy

shock: the desire to isolate experiments in the data whose outcomes can be compared with the results of analog experiments in models." (Christiano et al., 1999, p. 144)

Christiano et al. (1999) look to the data to find natural experiments. Econometrics analysis thereby provide stylised facts the authors can use to evaluate their "model economy". Using econometric models in themselves are of less interest, at least with regard to policy analysis.

The use of macroeconometric modelling when evaluating theory – can we do estimation without a priori theoretical assumptions?

Dismissing the value of macroeconometric models with regard to policy analysis should in fact not necessarily imply that such models are without interest in development of theory. We could for example analyse policy in an in-the-sample well-specified model, and then compare the results with out-of-sample findings. If we then ex post could explain the differences between the model predictions and actual outcome, this explanation could help us improve upon the model underlying the structural framework.

In his 1980 article, «Macroeconomics and reality», Christopher A. Sims summarises much of the critique of the structural macroeconometric modelling, and then formulates an alternative method of estimation. Sims (1980) argues that these models seems to have little value in the development of theory:

> "though large-scale statistical macroeconomic models exists and are by some criteria successful, a deep vein of skepticism about the value of these models runs through that part of the economic profes-

sion not actively engaged in constructing them. It is still rare for empirical research in macroeconomics to be planned and executed within the framework of one of the large models." (Sims, 1980, p. 1)

Sims has three main points in his critique of traditional econometric modelling:

1. Random normalisation: Macroeconometric models tend to contain a large number of equations, of which many could be interpreted as part of a simultaneous equation system. In fact many of theses equations are estimated independently rather than interdependently. This implies a normalisation (assuming that some equation can be taken as a basis). However, Sims argues that there are an almost infinite number of possible normalisations, and that such normalisations are random.
2. Dynamics: Most macroeconomic variables show some sort of dynamic behaviour (present observation depends on past observations). Sims argues that if the number of lags is not known a priori, this will affect the strength of identification in the models.
3. Expectations: Sims argues, in line with Lucas, that modelling of expectations is important.

Sims critique is alone not an argument to ignore macroeconometric models. Sims himself argues that these points might not be of great concern if the models are used for forecasting or analysis of changes in current policies, like i.e. an increase in an already existing tax. The problem is not the estimation of large models, but the fact that structural models impose too much theory on the estimation. Sims argues that:

"Because existing large models contain too many incredible restrictions, empirical research aimed at testing competing macroeconomic theories too often proceeds in a single- or few-equation framework. For this reason alone it appears worthwhile to investigate the possibility of building large models in a style which does not tend to accumulate restrictions so haphazardly. In addition, though, one might suspect that a more systematic approach to imposing restrictions could lead to capture of empirical regularities which remain hidden to the standard procedures and hence lead to improved forecasts and policy projections. … It should be feasible to estimate large-scale macromodels as unrestricted reduced forms, treating all variables as endogenous" (Sims, 1980, p. 14)

The main point of Sims' critique is one of internal validity: Sims claims that structural models are based on so many more or less random assumptions that they are no longer internally valid. A modelling approach that fails on this account has little value for an academic researcher.

Sims' alternative to structural macroeconometric modelling is the vector autoregressiv analysis, or VAR. The basis of Sims analysis is as follows:

1. We do not know which variables are endogenous or exogenous, so we treat all variables symmetrically, assuming that all variables are endogenous.
2. We do not know how many lags are appropriate, so we use the same number of lags for all variables.
3. Every variable is a function of the lags of itself and the lags of every other variable in the system. Thereby we have a system of equations written on reduced

form.[4] Since all equations have the same number of variables, it is efficient to estimate each equation independently using the methodology of ordinary least squares.

Sims goal was to estimate models "without having to much a priori theory". However, VAR is not free from theory. One uses theory to decide which variables and how many lags to include in the system. One must also use theory to decide how the variables shall be included (as logs, differences etc.).

A problem with the VAR-models is the number of parameters in the system. In a model with quarterly observations, assuming six variables and 12 lags, estimation over a period of 25 years would only leave 28 degrees of freedom, and that before constants, dummies and trends are added. This would be far too few degrees of freedom to achieve any strength in a forecast out-of-sample. However, as the equations are estimated independently there will in most cases be a reasonable relationship between the number of variables and lags included and the number of observations (Greene, 2000). Although the system will normally be over-parameterised (many parameters could be properly excluded), Sims would argue that imposing restrictions would waste important information. Moreover, t-tests of coefficients will often not be reliable guides for paring down the model (Enders, 1998).

The VAR is in itself difficult to interpret from an economic perspective. To get economic "meaning" into the findings, the results need to be related to economic theory. The main problem is that the VAR is

estimated on reduced form, and that the underlying structural system can not be recovered without making additional assumptions. To calculate the impulse responses to various innovations it is necessary to restrict the system. Often this is done through rather arbitrary, non-theoretical methods. Even more restrictions are needed to allow for identification of parameters from economic models. This has lead to a quite extensive literature of so-called "structural VAR-modelling". However, by doing so some of the intentions of the original VAR vanish.

Policy analysis or theoretical development – which criteria are important?

To summarise; according to Robert E. Lucas macroeconometric models might well be internally valid, but they lack external validity. Christopher Sims argues that macroeconometric models lack internal validity. However, Sims does not dismiss their external validity. Sims acknowledges that Lucas' argument is formally correct. However, he claims that Lucas argument depends on a special formulation of policy formation. Sims argues that this formulation is not necessarily accurate, and that one can think of other formulations of policy formation that will not have the same negative implication for the evaluation of policy analysis in a structural framework.

In actual use we can observe the following: Macroeconometric models are still widely used by institutions to evaluate the effects of changes in policy. Among econometricans

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4. The reduced form is an equation system were the endogenous variables are functions of the exogenous variables. This makes it possible to solve the equations in the reduced form independently. However, the parameters obtained on the reduced form are not necessarily the parameters of interest for the economic researcher.

macroeconometric models are seen as alive and kicking. Clive Granger argues that

> "one very possible future could involve large models with academics working with governmental, official, and commercial group together with some agreement about publications." (Granger, 2005, quote appear on p. 19 in mimeo from 2000)

Instead of dismissing these models, Granger argues that one can improve the analysis by comparing the results of several different models, so called thick modelling (Granger and Jeon, 2004).

Among academic economists doing empirical research the VAR-approach has made a large impact. However, from the viewpoint of theory, the VAR has many of the same weaknesses with regard to policy analysis as structural macroeconometric models. According to Christiano, Eichenbaum and Evans

> "authors [in the VAR tradition like Sims and Ben Bernanke] argue that if the analyst has made enough assumptions to isolate another fundamental shock to the economy, then it is possible to understand the consequences of a change in the systematic way that monetary policy responds to that shock, even in the absence of a structural model. Their arguments depend in a critical way on ignoring the Lucas critique. This may or may not be reasonable in their particular applications. We are open minded but skeptical." (Chritiano et al., 1999, pp. 144-145).

In other words, despite trying to make empirical analysis more applicable to the development of theory by increasing the degree of internal validity, the VAR-project

does not seem to have convinced theoretic economists of its validity. However, the main criticism is not with regard to internal validity, but with regard to external validity. Macroeconometric models are, to put it very simply, dismissed because they can not predict the future.

How should econometrics influence economic theory?

A question that has been raised is to which degree formal empirical work have influenced the development of economic theory at all. Lawrence H. Summers (1991)

> "argues that formal empirical work which, (following Sargent), tries to "take models seriously econometrically" has had almost no influence on serious thinking about substantive as opposed to methodological questions. Instead, the only empirical research that has influenced thinking about substantive questions has been based on methodological principles directly opposed to those that have become fashionable in recent years. Successful empirical research has been characterized by attempts to gauge the strength of associations rather than to estimate structural parameters, verbal characterizations of how casual relations might operate rather than explicit mathematical models, and the skilful use of carefully chosen natural experiments rather than sophisticated statistical techniques to achieve identification." (Summers, 1991, pp. 129-130)

Summers does not claim that empirical observation is unimportant for development of economic theory. However, he does claim that formal econometrics is much less important than one could have expected. He gives three arguments to support this:

the lack of references to empirical work in theoretical work, the lack of replication of econometric studies and the lack of econometric papers having stood the test of the times.

Summers does suggest an alternative to formal studies: pragmatic empirical work. Successful pragmatic studies seem to have three important features (Summers, 1991):

1. they return a stylised fact, or a set of stylised facts that characterise "an aspect of how the world [work] rather than parameter estimates or formal tests of point hypothesis",
2. they "produce regularities of a kind that theory can seek to explain",
3. they "have no scientific pretence. They start from a theoretical point of view, not a straitjacket".

What is economic theory about?

In the end the discussion of how econometrics should be used becomes a discussion of what economic theory is supposed to provide. There is an alternative view of the relationship between econometrics and theory, which dates back to Haavelmo (1944). For Haavelmo it is not the nature of econometrics that should change, but the nature of theory. Haavelmo claims that current economic theory is not testable:

- The variables in the theory can often not be observed in the real world. Instead the econometrican must use some sort of «proxy» (e.g. by equalling the price level with the consumer price index).
- Theory does not include any uncertainty into its predictions. However, no theoretic prediction in a social science can be expected to hold on every point of time. Haavelmo argues that theory should pro-

vide for some sort of uncertainty measures when making predictions.

Building on the argument of Haavelmo, Katerina Juselius argues that the econometrican should

"analyse models instead of applying methods. ... Economists frequently formulate an economically well-defined model as the empirical model and *apply statistical methods* to estimate its parameters. In contrast, statisticians might formulate a statistically well-defined model for the data and *analyze the statistical model* to answer the economic questions of interest. The difference may not seem fundamental, but it is probably of the outmost importance. In the first case, statistics are used passively as a tool to get some desired estimates, and in the second case, the model is taken seriously and used actively as a means of analyzing the underlying generating process of the phenomenon in question." (Juselius, 1993, p. 596, italics from original)

According to Juselius model building following this tradition gives important contributions to economics:

"The statistical analysis of the VAR model was shown to facilitate distinction between and analysis of different aspects of reality. ... One important aspect in this respect is that the investigation usually starts with a certain number of prior hypotheses and ends with some associated results. In addition, it produces a number of new results, which were not thought of at the beginning of the analysis. These new results can then be the starting hypotheses of the next analysis, based on a new data set, for instance, from another

country. By applying the same methodological approach to different data sets, it should be possible to make a comparison of similarities and dissimilarities between different countries/regions, and most importantly to investigate whether the dissimilarities can be understood in terms of institutional differences. This is probably the closest one can come to the ideal of a controlled experiment in macroeconomics."(Juselius, 1993, p. 619)

The lack of a clear relationship between theory and the real world makes it almost impossible to hold theoretical models up to empirical testing. To Haavelmo this is signal that economic theory should change. In his Nobel Lecture in 1989 he sets forward the following proposition:

> "Starting with some existing society, we could conceive it [theory] as a structure of rules and regulations within which the members of society have to operate. Their response to these rules as individuals obeying them, produce economic results that would characterize the society. As the results materialize they will stimulate the political process in society towards changing the rules of the game. In other words, the results of the individuals in a society responding in a certain way to the original rules of the game have a feedback effect upon these rules themselves. From the point of view of economic theory and of econometrics it is meaningless to consider these rules of the game, formed by the feedback effect I mentioned, as independent variables." (Haavelmo, 1992, pp. 266-267)

This program is in many way similar to the approach argued by Robert Lucas, and quoted above. In fact, both Haavelmo and

Lucas state that we need to model the economy within a given structure, and then endogenise the responses based on how individuals behave within this structure. The difference is to which extent one believes it is possible to do this within a statistical framework, or whether one has to start on the basis of a set of a priori beliefs, and derive the economy in a theoretical model.

Hence, although the final goal is similar, it is probably inconceivable to obtain a common understanding between theoretical models and statistical models. The most appropriate might be to consider statistical modelling as an alternative approach to traditional theoretic modelling, with other strengths and weaknesses.

One should, for example, not forget that that the statistical approach has much of the same «arbitrariness» as the theoretical approach. While untested theory remains the postulate of the theoretician, the statistical model is the postulate of the available data. An important problem in all quantitative analysis is that it is extremely hard to judge what the data actually reflects.

Conclusion

Structural econometric models have during the last 40 years played an important role as a tool to guide decision making in public as well as private macroeconomic institutions. However, such models have not been much used in academic circles. One reason for this is the widespread critique of such models, of which the "Lucas-critique" is the most important.

The VAR-modelling was introduced as an alternative way to model macroeconomic time series. By imposing less a priori theoretical restrictions on the analysis, one hoped to get more information from the data. Different versions of this method have since

the introduction in the end of the 1970's become a popular way of macroeconomic modelling.

There is however, a discussion of how VAR-models should be used. If one uses the models directly to analyse policy, the problems concerning the Lucas-critique will be present also in a non-structural model. Some economists therefore argue that the primary task of econometrics is to provide "stylised facts", and that policy analysis must be left to theoretic models.

The alternative view is that econometrics models should not be limited by economic theory, but that rather economic theory should build on econometric models. This is a radical departure from the current line of mainstream economic theory.

In practice these two direction can probably not be reconciled. This needs to be clear to those working with structural macroeconometric models. It seems futile to believe that these models at some point can form an economic system in confluence with neoclassical macroeconomic theory. Rather structural macroeconometric models must be seen as an independent research project, and be evaluated on their ability to answer questions asked to economists.

References

Christiano, L. J., M. Eichenbaum and C. L. Evans (1999). "Monetary policy shocks: what have we learned and to what end?" In Taylor and Woodford, eds., *Handbook of Macroeconomics*. Elsevier Science.

Clarida, R., J. Gali and M. Gertler (1999). "The science of monetary policy: a new Keynesian perspective." *Journal of Economic Literature,* 37,

1661–1707.

DeLong, J. B. (2000). "The triumph of monetarism." *Journal of Economic Perspectives*, 14(1), 83–94.

Enders, W. (1998). *Applied econometric time-series*. John Wiley & Sons.

Granger, C. W. J. (2005). "Interactions between large macro models and time series analysis." *International Journal of Finance and Economics*, forthcomming.

Granger, C. W. J. and Y. Jeon (2004). "Thick modeling." *Economic Modeling*, 21, 323–343.

Greene, W. H. (2000). *Econometric Analysis*. Prentice Hall, 4th edn.

Haavelmo, T. (1944). "The probability approach in econometrics." *Econometrica*, 12, 1–118.

Haavelmo, T. (1992). "Econometrics and the welfare state." In *Nobel lectures, economic sciences, 1981–1990*. World Scientific. 26

Juselius, K. (1993). "VAR modelling and Haavelmo's probability approach to macroeconometric modelling." *Empirical economics*, 18, 595–622.

Klein, L. R. (1947). "The use of econometric models as a guide to economic policy." *Econometrica*, 15, 111–151.

Kydland, F. and E. C. Prescott (1982). "Time to build and aggregate fluctuations." *Econometrica*, 50, 1345–1370.

Lucas, R. (1976). "Econometric policy evaluation: a critique." *Carnegie Rochester Conference Series on Public Policy*, 1, 19–46.

Lucas, R. (1980). "Methods and problems in business cycle theory." *Journal of Money, Credit and Banking*, 12(4), 696–715.

Niehans, J. (1990). *A history of economic theory: classical contributions 1720–1980*. John Hopkins University Press.

Sims, C. (1980). "Macroeconomics and reality." *Econometrica*, 48(1), 1–48.

Summers, L. H. (1991). "The scientific illusion in empirical macroeconomics." *Scandinavian Journal of Economics*, 93(2), 129–148.

Troye, S. (1994). *Teori- og forskningsevaluering*. TANO.

Whitley, J. D. (1994). *A course in macroeconomic modelling and forecasting*. Harvester Wheatsheaf.