Uygur, Ercan; Bulutay, Tuncer

Working Paper

The Experience of Econometric Model Building for The Turkish Economy: 1960-1986

Discussion Paper, No. 2004/12

Provided in Cooperation with:
Turkish Economic Association, Ankara

Suggested Citation: Uygur, Ercan; Bulutay, Tuncer (2004) : The Experience of Econometric Model Building for The Turkish Economy: 1960-1986, Discussion Paper, No. 2004/12, Turkish Economic Association, Ankara

TURKISH ECONOMIC ASSOCIATION

DISCUSSION PAPER 2004/12
http://www.tek.org.tr

THE EXPERIENCE OF ECONOMETRIC MODEL BUILDING FOR THE TURKISH ECONOMY: 1960-1986

Tuncer Bulutay and Ercan Uygur

May, 2004

THE EXPERIENCE OF ECONOMETRIC MODEL BUILDING FOR THE TURKISH ECONOMY: 1960-1986

Tuncer Bulutay

Ercan Uygur

Latest Revision: May, 2004

THE EXPERIENCE OF ECONOMETRIC MODEL BUILDING FOR THE TURKISH ECONOMY

TUNCER BULUTAY
ERCAN UYGUR

This paper is composed of two parts. Part I aims to evaluate and give a personal account, of econometric model building in Turkey during 1960-1986, of the first author, who had the first experience in applied econometric work in Turkey. There are six sections in Part I. The first section describes the intellectual atmosphere in Turkey in the first years of the Sixties, where econometrics, among other subjects, was considered as a tool to solve the economic problems of Turkey.

In section 2, the econometric work of the first author is summarized. Here, data problems and difficulties in implementing econometric methods encountered are explained. Section 3 looks back at econometric methodology in general and discusses their nature. Sections 4, 5 and 6 of Part I deal with the structure of and hypothesis testing and prediction with econometric models. Part I is concluded by saying that it would not be realistic to think that economic problems could be solved by using methods such as econometrics and programming and that they are just useful tools.

In Part II of the paper, the aim is to evaluate the econometric models of the Turkish economy built during the period 1960-86. The first econometric study was published in 1967, followed by the second one in 1969. No such works are seen in the 1970's. The other models examined were published in the 1980's. A total of eight models are evaluated in four sections of Part II. After a brief account of econometric model building in Turkey in section 1, section 2 evaluates the models in terms of their specifications and methods of estimation.

In section 3, the models are examined and compared in terms of their dynamic solutions, calibrations, policy simulations and forecasts. The models generally have a Keynesian structure, where for instance money is non-neutral, but may yield different policy simulation results, due to differing effects of for instance public prices. Section 4 of Part II summarizes the main findings.

This paper was presented at the World Conference of the Applied Econometric Association in İstanbul in December 10-12, 1986. It was edited recently once again for those readers interested in applied econometrics, the Turkish economy, and their histories. The author of the first part is T. Bulutay, the second part was written by E. Uygur.

I

1. The Situation in the Beginning

My work on econometrics began in the first years of the Sixties. It was completed in 1966. When I refer to the "beginning" period, I mean the early years of the Sixties.

During that period, there was an optimistic atmosphere, a feeling that economic crises belonged to the past. The fear of a 1929-like crisis in the Fifties appeared unfounded; the future looked bright.

Economies were growing with satisfactory rates. Economic activities were robust; almost everybody was content. It was thought or hoped that poverty and unemployment could be swept out of economies.

Keynesian economic policy was the main device for the welfare and health of economies. It was possible to achieve and sustain economic equilibrium, growth and welfare by means of Keynesian policies.

This was the atmosphere of developed countries in the first years of the Sixties. It naturally had repercussions in the underdeveloped countries. The expectations in underdeveloped countries were also hopeful: It was possible to grow with a reliable economic policy. The important device for underdeveloped countries was economic planning. It might seem a little bizarre today but politicians and economists of developed countries were advising economic planning for underdeveloped countries.

I remember quite well that in the period I am talking about, namely the first years of the Sixties, the high fashion was economic planning. Planning techniques, linear programming, more generally mathematical programming were the fashionable subjects of the day. The most fashionable of them all was econometrics.

These were mysterious subjects. We in Turkey knew nothing about them. We had the following belief concerning these techniques: There was no doubt that if we could acquire the knowledge of mathematical programming or especially econometrics, we would be able to solve all our economic problems. But it was very doubtful that we could learn and digest these techniques.

I think the sources of this belief concerning econometrics were the following: First of all, econometrics was mysterious not only for us. It was not clear and obvious for the creators either.

This, I think, is a normal way of creation. A creation, an innovation, a discovery is not crystal clear in the minds of creators and is introduced usually in a complex, roundabout way. It is not in its simple shape and meaning in its first introduction. Its clear and simple meaning is bestowed on it in later works and generally by others, rather than the creators. The proof of the existence of general equilibrium by Abraham Wald or the proofs of the famous book of John von Neumann and O. Morgenstern on game theory could be given as two examples for the complex character of innovations.

For us in Turkey, in the beginning of the Sixties, there were more or less mysterious books on econometrics. I remember the publications of the Cowles Commission: Koopmans (1950), Hood and Koopmans (1953). It was difficult (at least for me) to learn what econometrics was by reading these books.

There were not very many textbooks. To my knowledge, there was a textbook of Klein which was not very clear for me. There were the textbooks of Tinbergen (1951), Tintner (1952), Valavanis (1959). They were, as first attempts, very valuable works but they could not be considered as proper textbooks of econometrics especially when the progress of econometrics was taken into account.

I should mention the textbook of Johnston (1963). I had this book in the last years of the period I am talking about. It was a godsend for me. I found it extremely useful and used in widely in my book.

The other source of our belief mentioned above was our living in an underdeveloped country. It was, I think, normal for a man living in an underdeveloped country to feel awe for a sophisticated subject recently introduced in developed countries. It was difficult not to feel an inferiority complex; to feel that econometrics might be beyond our reach.

There were not plenty of people around to discuss with or to learn from. Therefore, learning and applying econometrics was a solitary journey. This was so, but it was not as solitary as it was thought at the time. Let me explain this.

Econometrics as a new enterprise was developing in the U.S.A. In the Fifties and the Sixties the intellectual life of Turkey, like several other countries, was turning toward the U.S.A. Up to then, it was normal for an intellectual to be brought up in the

European tradition; therefore to have very little knowledge in econometrics. But the intellectual environment I was in during the Sixties was a highly cultivated one, albeit its lack in econometric methods. Most important of all, there was a very powerful motivation to learn or to open up the opportunities for the young to learn. Without this high-level cultural environment and motivation, it would have been impossible for me to learn and apply econometrics.

Looking back from now with hindsight, this is seen clearly.[1] I first felt it while conducting research on the national income of Turkey before 1948. As is well known, the national income of Turkey is being computed and published since 1948. I tried, with others, to compute the national income series for the period of 1923-1948. Before starting the work I was pessimistic about the data; but during the progress of the work I saw that all the necessary data, with minor exceptions, was available and ready. I came to admire and respect the intention and effort behind these data. Without these intentions and accumulation of knowledge, it was impossible to have any time series.

Insufficiency in data was the other important source of the feeling of discouragement. I felt that it was very difficult, if not impossible, to secure the necessary data for an econometric application. But I found during my work that the data problem was not insurmountable. It was therefore quite possible to obtain the necessary data and carry out the econometric work.

In order not to give a wrong impression, however, I should stress some points. I had to find out, compute or re-compute some series. Some data were computed on the basis of rather shaky assumptions. Others, for example national income series, were being made available with delays of two or three years. Certain works could not be carried out because of the lack of data. There was not an agreement on even the most important data (investment) among the various responsible government agencies. Most important of all, the national income figures I had used in my work were later discarded altogether from the national accounts of Turkey.

[1] It is impossible to overestimate the importance of environment in academic work.Like everybody else, I had a certain level of confidence in my knowledge.I observed an important leap in the level of this confidence when young and bright assistants and docents with high competence and knowledge came to compose our department (“kürsü” in Turkish). Among these brilliant young men I felt myself incomparably more capable. It was not possible to have an increase in my knowledge quantitatively in that short period to justify the leap in my confidence.This was the product of the environment created by these young men and myself.

In view of all these, it might be preposterous to say that there was no insurmountable problem in securing data. But I feel that I am justified in saying that data problems are not restricted to that period or to economics. It is a most serious problem. If it is desired that the econometric method should not be used without healthy data, then one must not build an econometric model even today.

It is hardly necessary to mention that it was a very tedious and dreary work to obtain an econometric equation with the desk calculators. But it had its advantages. You knew what you did. This is an important advantage considering the wide, and in a majority of the cases incompetent, use of the computer in today's econometric practice.

Sufficient computational facilities were not readily available in those years. This was another source of discouragement. I could not use a computer because the computer was a very recent experience in Turkey at the time. I did all my computations with a desk calculator. These were old and rather noisy machines; but they did what I wanted of them.

In spite of all these and because of all these, I did my econometric work, presented it as a docent-ship thesis in 1965; made it ready for publication in 1966. It was published in 1967. After that I have not done much econometric work; in a sense I left the field of econometrics.

2. My Econometric Work in mid 1960's

My book on econometrics published in 1967 consists of two main parts. In the theoretical first part econometric methods are explained. The second part is on econometric application.

At the time, the theoretical first part was the main focus of my intention and work. But looking back from now, it does not seem important and worthy of elaborate treatment. It is the explanation of known econometric methods with the Turkish language.

In the second part, namely the application of econometric methods on the Turkish economy, there are four chapters. In the first chapter (Chapter 7) some equations on consumption and investment are explained. The second chapter (Chapter 8) is on production. Econometric equations on national income, agricultural and industrial production are the subjects of this chapter.

In the subsequent chapter (Chapter 9) foreign trade is investigated with the purpose of reaching equations on imports and exports. The last chapter (Chapter 10) is on taxes. Taxes are treated by making the distinction between direct and indirect taxes.

The results reached in this book are generally the usual ones. I would like to point out two rather different and important results obtained by the econometric equations in my book. One is on investment.

My equations on investment show that the previous year's capital stock has a positive rather than negative effect on current investment. This is against the expectation of economic theory which says that according to the acceleration principle, this effect should be negative. In other words, according to economic theory, public or private capital stock of the previous periods should cause a crowding out effect because of the use of scarce resources.

This result is one of the important results I came across throughout my work on econometrics and economics. I thought then and I still do today that my results are sound.[2] Economic theory or scientific theories in general have a lot of dubious claims. It is necessary to test and scrutinize them.

The second result is on the effectiveness of prices in foreign trade. My econometric application has shown that prices have no important effects on the import and export of Turkey.[3] In a recent study (Uygur, 1986 pp. 96, 97) the same result is obtained. But it is noted in the same study that "...it is possible that the insignificance of the parameters of relative price variables in some foreign trade equations are due to measurement errors in these variables."

I should stress here that I had my econometric equations but they were not forming an econometric model. They were estimated by the simplest econometric method. There was, therefore, the possibility to achieve more reliable and healthy results by using sophisticated econometric methods.

I was sanguine about this possibility at the time I finished my work. I was thinking that it was possible to achieve much more with the elaborate techniques. But as time passed, as my knowledge on economics and generally on science increased I

[2] My results on investment equations are given in Bulutay (1967,p.110-115). For a recent and similar result see Uygur (1986a, p.59,61).
[3] Bulutay (1967, p.129-140).

became more and more convinced that sophisticated econometric methods have very little to offer in the way of achieving sound results.

It was of course a very unrealistic and meaningless fancy to look at econometric methods as a cure for all. I think there is more than sufficient knowledge on econometric methods in Turkey today; but our economic welfare is not any nearer to the desired level. In other words, we have acquired the necessary knowledge of econometrics but we are very far from solving our economic problems.

I now think that econometric methods are useful devices understanding economies. But they are only one and not necessarily the best group of devices. They should be used in collaboration with other devices. In no case should they replace the knowledge of experts whom they should serve as aids.

I shall now try to explain what I now think about econometrics.

3. The Nature of Econometric Methods

It is well known that fashion has an important place in ordinary life. It is the same in scientific life; fashion plays an important role in science too. Some subjects are in the mode for a certain period of time. Then they fade away. For example, in economics growth theories, turnpike theorems were in fashion some time ago. There were extensive discussions on switches of techniques and capital reversing. Now it seems incredible that they were considered so important. It is fashionable nowadays to say something about rational expectations. If rational expectations shares the same fate as that of, for instance, growth theories, it will be quite normal. Like these, econometrics was in high fashion in my youth. Now it is not as fashionable.

One of the reasons for the importance of fashion in science is the following point. In the fundamental problems of civilization such as equality, freedom, justice, realism, idealism, determinism, causality, constant, permanent essence, continuous change, etc., we are almost at the same position as the Ancient Greeks. Some problems persist without solution. In these and related subjects the views of Plato seem relevant even today.

In economics one sees the views of Adam Smith coming to the scene in disguise. With a terminology of rational expectations and sophisticated econometric techniques, what is told in reality is an old story: Give the capitalists every possibility to get richer.

What I would like to stress here is that complicated techniques and sophisticated methods treat marginal, unimportant, minor points. They do not deal with main problems; on the contrary, they divert the attention from them. They keep or try to keep the main body of important and unsolved problems intact by playing and juggling with mathematical symbols.

It could be said, of course, that it is the usual and natural way of things. These methods are the devices of piecemeal engineering. It is unrealistic to expect more from these kinds of techniques. This is true. The problem is that during the period in which fashions reign, things have unusual dimensions. That is, one sees an enormous capacity in a fashionable technique. Econometrics was a fashionable technique in the past and we were very confident of its capacity. Now we can see clearly that it was a delusion.

We live in a world with interaction, simultaneity. Everything has effects on everything else. The series are going together. In a world like this, it is difficult, if not impossible, to find out the cause of something. With a superficial look, econometrics has solved these problems. There are dependent and independent variables in econometric equations. Econometric methods have been developed for the problem of simultaneity. But in reality this is a deceiving illusion. Econometrics did not and could not solve the important problems of causality and simultaneity.

It is too much to hope from econometrics to solve these problems. Considering its power and potential, econometrics must be modest. In this modest way, I would like to point out some useful progress in econometrics. The effects of the inclusion or exclusion of variables are being investigated now in econometric equations. This is certainly a healthy way to proceed. As far as I know, these points were not the focus of attention in the Sixties.

As is well known, in the practice of econometrics there were always exogenous and lagged variables. Nowadays the effects of future expectations on current variables are included and taken into consideration. There are of course some important points of disagreement and discussion. But in my opinion these practices are applications in the true and useful way of science.

In the following section of this part, I would like to draw attention to some important points by separating three function of econometrics.

4. Econometric Structure

It is usually said that the main function of econometric models is to show the structure of economies. I do not deny that econometric models with their several equations are very useful in understanding the working of economies. But the following points must be taken in to consideration.

It is possible to build different models for the same economy in the same period. These models might have very different, in some cases contradictory variables and coefficients. In other words, the same facts will be explained with different and even contradictory theories. This, of course, is not a new case for economics or for another science. But it shows that econometrics has not brought much in the determining of economic structure.

I think that a theory should have a certain, consistent wholeness. A system of equations in a model must represent this self-consistent wholeness. But in econometric models the variables are usually treated separately. When the coefficient of a variable is found to be statistically meaningless, it is easily discarded, neglecting the fact that in a theory, variables are not alone, but interrelated. If you easily discard variables, then you cannot have a self-consistent, meaningful theory.

One can, of course, say that by treating variables separately, by discarding variables after a statistical test, one is building an econometric model by depending on economic facts. I accept that this point has some validity. But it must not be overstressed; because interrelatedness among variables, self-consistency and wholeness are aspects a theory should have. Besides, as mentioned below, there are important problems in testing theories. In other words, it is not easy to test a theory by statistical means in a mechanical way.

The other important point is the changing structure of economies. Accepting that an econometric model represents reality, it might have no relevance when the economic structure changes. In face of this difficulty, it can be said that the economic environment is not changing in such a rapid and radical way or that econometric methods have the necessary devices to face this problem. For me, constant flux is a permanent aspect of economic reality. There might be some devices in econometrics to handle the changes in economic structures; but I doubt their existence, relevance and operationality.

There is another point concerning this change of structure. If an econometric model covers two different periods, consequently two different structures, then the coefficients will include two different effects and will show an average. Thus, the following situation might easily arise. There is a positive effect in the first period and a negative effect in the following period and the average shows nothing. In a sense, what the econometric model has achieved in this case is to abolish two meaningful effects. This is, of course, not restricted to econometrics or economics. It is a general problem of science. But it is most important for rapidly changing environments.

5. Testing with Econometrics

Initially, I had three hopes for econometrics: It would secure the testing of theories; it would take account of disturbances; it would open the way for open, clear, determinate talking or prediction. Now, I am not so sure and hopeful.

I now think that the testing of theories is not a simple business. It is very difficult, if not impossible, to verify or falsify a theory. Two important verities in this wide field are the following. (i) Facts are theory–impregnated; they change according to viewpoints, theories and paradigms. (ii) The world and life are very rich in details, differences, changes. With sufficient attention and care, one can find any data in reality supporting or falsifying any theory.

This, of course, is a general proposition applying to science in general. In economics or econometrics the problem is more acute. There are two important uncertainties: Our concepts such as national income, capital are not clear-cut. Our statistical data are not sufficient, trustworthy or reliable. With such concepts and data it is even more difficult to build healthy theories and test them soundly.

Disturbances, noises are necessary facets or appendages of reality. Because of this, stochastic models must replace deterministic models. I had thought that econometrics with its stochastic equations was a perfect example for these stochastic models. Now, I am not so sure.

There are a lot of assumptions on these stochastic disturbance terms; normal distribution with zero mean and constant variation, etc. What is done with these assumptions is to put away the disturbance term. In a sense, econometrics takes disturbances, noises into account only in words. In reality, econometrics looks at disturbances, sees them and then puts them aside.

I had thought initially that econometrics will open the way of clear, certain talking and prediction. I do not say now that it has not achieved anything in this direction. But there are two important caveats I should point out. If the facts are not clear-cut or certain, what is the use of a clear proposition? After all that is quantum mechanics, uncertainty is the real facet of reality even in physics. In this world of uncertainty and indeterminacy, clearness is not always an advantage but sometimes an important drawback.

The second point is that in econometrics interval estimation is the dominant way. When this interval is wide, which is the case in some econometric practices, where is the determinateness of the estimation of econometric methods? Wideness of the interval increases the reliability of the estimator, but unfortunately decreases the meaning and use of the estimate.

6. Prediction in Econometrics

If an econometric model does not represent the economic structure, then it is difficult, almost impossible, to obtain sound predictions by using it. But the problem does not end here. Even if an econometric model is a healthy representation of the economic structure, there might still be serious problems in prediction.

What I want to point out here is the riddle of induction. (Goodman 1970, pp. 512, 513).[4] According to this riddle one can propose the following: The econometric model represents the present structure very well but the future will be quite different. So, it is wrong to use this model for the prediction of the future. Is this a sound proposition? I think it was more than sound just before the shock in petroleum prices in 1974 or before January 24, 1980 for the Turkish economy.

This is a deficiency for all predictions, not only for econometric models. But there are other forces which show that prediction with simple and rough means (such

[4] "Suppose that all emeralds examined before a certain time t are green. At time t, then , our observations support the hypothesis that all emeralds are green; and this is in accord with our definition of confirmation. Our evidence statements assert that emerald a is green, that emerald b is green, and so on; and each confirms the general hypothesis that all emeralds are green. So far, so good.

Now let me introduce another predicate less familiar then "green". It is the predicate "grue" and it applies to all things examined before t just in case they are green but to other things just in case they are blue. Then at time t we have, for each evidence statement asserting that a given emerald is green, a parallel evidence statement asserting that that emerald is grue. And the statements that emerald a is grue, that emerald b is grue , and so on, will each confirm the general hypothesis that all emeralds are grue. Thus according to our definition, the prediction that all emeralds subsequently examined will be green and the prediction that all will be grue are alike confirmed by evidence statements describing the same observations."

as using simple trends) might be more reliable than sophisticated econometric models. The main thing underlining all these forces is the fact that soundness in prediction is secured not by committing no errors but my making a lot of errors. The net effect of plenty of positive and negative errors is generally near to zero.

Two examples could be given for this proposition: It is easier to reach a true estimate for the growth of the European economy as a whole than to have a sound estimate for each European country separately. In the same way, the economic estimates for a period of one year are more reliable than the estimates for a period of three months.

On the other hand, we have relatively poor estimates for the facts we normally know better. It is normal that economic situations of the near future be better known. We commit rather few errors for the facts we know better. In spite of this small amount of error, we have relatively poor estimates because in a small amount of error there is less possibility for the compensation of positive and negative errors.

As a last point I should say something on change and the character of change. Change is everywhere. In every discipline or science there is little that can be done without taking change into consideration. There is not only gradual change; change also occurs in leaps. Leaps in economies are not the result of only external events; they can be created also internally, endogenously. The petroleum price shock is a good example for the shock created by endogenous variables. In an economy with changes in leaps, with shocks created internally, it is difficult to have a sound prediction with any means including econometric models. This result is more serious for econometrics. Because we can see the future more or less with traditional simple means in gradually changing economies. What we need is a means of prediction for turning points. If econometrics is not of much help in this, what is its use?

In summary, I do not think that econometrics is useless. It has provided very valuable results. We know the structure of economies better now; we are now in a better position in testing theories and predicting the future thanks to the progress of econometrics. But I think that for today we must be modest in these claims. For me the real contribution of econometrics is its openness and capacity for further progress. The direct results and by-products of these works and progress will be the main contribution of econometrics to economic thought.

II

1. General Remarks

As far as I could trace out, a total of ten econometric model studies were done for the Turkish economy during the period 1960-1986.[5] The first of these works, Bulutay (1967), is published almost twenty years ago. Bulutay estimates equations for a total of eleven macro-variables and stops at that stage. It is therefore not a model in the strict sense of the word, as he himself mentioned above in Part I. Yet, it should be considered as the first step in that direction. Then we see three more coming out in the next few years; Korum (1969), Köksal (1970) and Uğurel (1971).

The remaining six are produced in the 1980's[6]; Özmucur (1980), Yörükoğlu (1980), Yağcı (1983 b), Özmucur (1984), Uygur (1986b) and Şenesen (1986). In other words, the 1970's have not witnessed econometrics modelling efforts. One reason could be that quantitative economics in general and econometrics in particular lost ground in that period compared to before. Another reason could be the relative emphasis on political factors in economic debates and studies, as the outcome of the social and political events of the period.

It was unfortunately not possible to obtain a copy of one of the above mentioned works, namely Köksal (1970) which is a Ph.D. thesis submitted at New York University. I therefore make explanations and evaluations on eight models, after a brief look at the previous reviews of some of them.

Three rather short evaluations were made for different subsets of the above mentioned ten studies. The first of these, İlkin and Uğurel (1971), is a review of five books on econometrics and econometric models published in Turkish during 1965-69. In a limited space in "Econometrica", the authors give a condensed picture of how econometrics is explained in the textbooks and how it is applied in Bulutay (1967)

[5] Computable General Equilibrium (CGE) model studies, such as Derviş and Robinson (1978), Lewis and Urata (1983) and Celasun (1986), are not included in this set since they are not considered as "econometric" models. The set does not include any Vector Auto-Regression (VAR) models since there are as yet no published VAR studies. However, I know that the Central Bank of Turkey recently started to make use of a VAR model for short term forecasting purposes.

[6] It should be noted that Özmucur (1980) is a revised version of a Ph.D. thesis submitted in 1976. Naturally, some of the models were revised and re-published. In such cases, only one version is used for explanations and evaluations. Different versions are not counted as separate model studies.

and Korum (1969). They have a mixed feeling in that although they find the applied works quite satisfactory, the text-books are seen to be very inadequate.

The second one, Uygur (1983), provides comparative information on Bulutay (1967), Korum (1969), Özmucur (1980) and Yağcı (1983b) especially in terms of their sizes and estimation methods and periods. The third, Kaytaz and Özmucur (1984), compares the last three models primarily in terms of their specifications. The authors criticize the choice of some behavioural equations of Yağcı (1982) and find them implausible and/or unacceptable.

2. Basic Characteristics, Specification and Estimation

The studies by Korum (1969), Uğurel (1971) and Özmucur (1980) can be labelled as first generation models and they have the following common characteristics:

(i) Especially the first two emphasize the role of econometric models in the process of economic planning which started in 1961 in Turkey.

(ii) In line with this emphasis, they are primarily concerned with the structural analysis of the economy even though they contain one period ahead forecasts and Özmucur (1980) contains policy simulations (multiplier analysis) as well.

(iii) The behavioural equations are all linear in variables and parameters and are estimated by annual data.

(iv) They are solved to obtain the estimates of reduced form parameters from structural parameter estimates and the solution values.

(v) They are all university based studies where Uğurel's is a presented paper[7] and the other two are revisions of authors' theses.

The studies by Yörükoğlu, Yağcı, Özmucur (1984), Uygur and Şenesen, on the other hand, can be labelled as second generation models with the following common characteristics.

(a) They are primarily concerned with forecasting the immediate future and, except the last one, they also contain policy simulations.

(b) The behavioural equations contain non-linearities in variables, though not in parameters, which are estimated by annual data like their predecessors.

(c) They are solved by iterative dynamic simulation methods.

(d) Except the first one, which is a thesis, they are supported by semi-official or private institutions.

First Generation Models

Information on the size, coverage and variables of the three first generation models are provided below in Table 1.

Table 1 Variables and Equations of Korum (Ko), Uğurel (Uğ) and Özmucur 1980 (Ö80) Models

Groups of Endogenous Variables	**Number of Equations**								
	Behavioral			**Identity**			**Total**		
	Ko	Uğ	Ö80	Ko	Uğ	Ö80	Ko	Uğ	Ö80
Production	0	0	3	1	1	2	1	1	5
Price	0	0	5	0	0	0	0	0	5
Exports	0	1	3	0	0	1	0	1	4
Imports	4	3	4	0	0	1	4	3	5
Dom. Demand	6	2	5	1	0	3	7	2	8
Monetary	0	0	2	0	0	1	0	0	3
Fiscal	3	0	3	1	0	2	4	0	5
Income	4	0	2	3	0	2	7	0	4
Other	0	0	1	0	0	2	0	0	3
TOTAL	17	6	28	6	1	14	23	7	42
Exogenous							21	6	25
Lag. Endogenous							11	1	17

Korum's model has two versions. In the first, all the variables are expressed in current prices while in the second the same variables are expressed in real prices. Since he obtains the reduced form solution for the current price model, the information in Table 1 is related to that version. The method of estimation is Ordinary Least Squares (OLS). Problems in estimation, including simultaneity, are mentioned

[7] It is presented at the European Meeting of the Econometric Society in 1971.

but no measures are taken. There are several estimation periods; ranging from 1949-65 to 1959-65, with the majority being 1951-65.

It is seen from Table 1 that nearly two thirds of Korum's behavioural equations explain demand variables. Yet, some of his specifications are unsatisfactory on both economic and econometric grounds. The equation specified for imports of consumer goods includes its lagged value and a time variable. The same is true for imports of construction materials. The equation for imports of raw materials includes its lagged value with a negative parameter and there is no comment on this result. In addition, there is auto-correlation in some of these equations. He admits that the import equations are not successful and this is partly attributed to import controls which could not be taken into account. Specification and estimation problems also exist in domestic demand equations, especially in those that explain agricultural and non-agricultural stock changes.

An interesting feature of Korum's model is that non-agricultural wage and profit (non-agricultural non-wage) incomes are explained which can be used to analyse the functional distribution of income. Korum had done extensive data work on this part of the model and estimation results seem to be satisfactory. On the whole, Korum's model should be regarded as a good start in model construction for which the author himself expresses the need for improvement.

Uğurel's model is the smallest in size of all the models considered here. As in Korum's model, most of the behavioural equations explain import and domestic demand variables. The equation for investment goods imports includes investment expenditure as an explanatory variable but, in contrast to the findings of other model studies, the parameter of this variable is found to be insignificant. What is more, this result is taken to indicate a characteristic of the Turkish economy.

Uğurel takes simultaneity into account in estimation and applies Two Stage Least Squares (2SLS) to a data set of the period 1949-1967. It should be noted that simultaneity is rarely considered in the estimation of econometric models mentioned here and thus this aspect of Uğurel's study needs to be emphasized. On the other hand, half of Uğurel's estimated equations suffer from severe negative autocorrelation, a problem which is not treated nor even considered.

Özmucur (1980) makes extensive use of Korum's model in terms of specification, estimation and other procedures employed. In addition to wage and profit incomes, the latter in the form of an identity, employment and unemployment

are also determined in this model. In terms of the number of equations, import and domestic demand variables constitute the largest block but the distribution of equations among different sectors/aspects of the economy is more even when compared with Korum and Uğurel models. The specification of demand equations are well explained, with references to other empirical studies. On the other hand, some variables are not clearly defined. Examples are the liquid assets variable, which is tried in the consumption function but found to have an insignificant parameter, and the export price index.

Foreign trade price indices constitute a chronic problem in Turkey in terms of data availability and Özmucur's model gets its share from this problem. In this study, all of the sectoral exports, i.e. agricultural, mining and industrial exports, are deflated by the same deflator which could of course lead to systematic and sizeable measurement errors. Measurement errors of this nature are also likely to be present in the real values of import variables. Current values of consumer goods, raw materials, construction materials and machinery imports are deflated by price indices which are in turn obtained by dividing the current values with respective volumes in tons. Real values are in fact, then, volumes in tons and these will be equal if and only if the composition of imports has remained the same. Given these problems, the identities for total real imports and real trade balance are not certain in what they stand for.

Yet, these variables are used in the gross domestic product identity, even though they are different than their national income accounting counterparts. The problem is solved by re-calculating the invisibles item of foreign trade. It needs to be pointed out however that the author is presumably forced into all this because of the unavailability of foreign trade price indices.

Özmucur estimates the behavioural equations with OLS and uses a data set that covers either 1950-74 or 1962-74 periods. Some of the estimated equations suffer from positive autocorrelation but the problem is not considered. The problem of simultaneity in estimation is briefly discussed and the use of OLS is justified on the grounds that 2SLS estimators are too sensitive to other econometric problems and that their variances are larger than those of the OLS estimators. Özmucur devotes more space to different multiplier effects than Korum and Uğurel, the results of which are evaluated below.

Second Generation Models

Table 2 below contains information on the size, coverage and variables of four of the second generation models. This table does not include the model of Yörükoğlu since it was not possible to trace the endogenous variables and thus the size of this model. The author says that the model contains 44 behavioural equations and 99 identities in its largest form. He then goes on to state that some of the endogenous variables are excluded from the model at the solution/simulation stage. (Yörükoğlu , 1980:135). Which variables are indeed excluded at that stage is not explained anywhere. I therefore make only brief notes on this study.[8]

Table 2 Variables and Equations of Yağcı (Ya) , Özmucur 1984 (Ö84), Uygur (Uy) and Şenesen (Şe) Models

Groups of Endogenous Variables	**Number of Equations**											
	Behavioural				**Identity**				**Total**			
	Ya	Ö84	Uy	Şe	Ya	Ö84	Uy	Şe	Ya	Ö84	Uy	Şe
Production	3	5	3	3	1	9	1	1	4	14	4	4
Price	2	11	5	4	0	0	2	0	2	11	7	4
Exports	1	3	2	1	1	1	3	1	2	4	5	2
Imports	1	4	2	2	2	1	5	2	3	5	7	4
Dom. Demand	2	5	4	3	1	16	1	3	3	21	5	6
Monetary	2	6	2	1	2	3	1	0	4	9	3	1
Fiscal	2	4	2	2	1	3	1	1	3	7	3	3
Income	1	5	0	0	2	8	2	2	3	12	2	2
Other	1	7	0	3	2	20	4	3	3	27	4	6
TOTAL	15	50	20	19	12	61	20	13	27	111	40	32
Exogenous									35	84	42	36
Lag. Endogenous									4	42	24	8

Yörükoğlu estimates the behavioural equations with OLS but uses the Cochrane-Orcutt iterative method to estimate equations with auto-correlated errors.

[8] It seems that the author has simply written down some identities for further treatment but left them as they are. Among the identities that relate to budget revenues and expenditures, there are ones that cannot be realized ex-post.

The data used in estimations usually cover the periods 1964-78 and 1968-78. Yörükoğlu expresses that the main purpose of his work is to examine the relationships between the monetary and fiscal variables and other macro-variables. Although there are quite a number of behavioural equations and identities that relate to the monetary and fiscal variables, it is not clear which ones are included in the final version of the model.

Table 2 provides information on Yağcı (1983b) which is a revised version of Yağcı (1982). The main difference between the two versions is that while money supply is exogenous in the latter, it is endogenised in the former. Yağcı estimates the behavioural equations by OLS with annual data for the period 1964-81 except the foreign trade equations which are estimated with the 1970-81 data. Elsewhere, Yağcı (1982) and (1983a), he mentions that OLS estimators are inconsistent but he justifies its use on the grounds that consistency is a large sample property while he uses only 18 or 12 observations. Other econometric problems are not considered however and some of the estimated equations indicate that the errors are auto-correlated. Dummy variables seem to be used without restraint; in a total of 15 behavioural equations, there are five equations that include dummy variables.

Yağcı explains that supply side considerations are given more weight in the model and that supply is primarily determined by factor availability. The main role of demand is said to determine the foreign resource gap. There are three behavioural equations that explain sectoral outputs, but their specifications do not completely support Yağcı's intentions and, furthermore, they seem to constitute a weak part of the model.[9] Manufacturing output is explained by raw material imports and electricity consumption in this sector. Construction sector value added is explained by its lagged value and total demand. Services value added is explained by GNP, where the former constitutes about 40 % of the latter during the sample period.

These equations, especially the construction and services equations, do not really "explain" much in that they do not provide insights in understanding the workings of the economy. Given the declared emphasis on the supply side, one expects more economic explanations and interactions in the equations specified for sectoral outputs.

[9] See also Togan (1983) and Kaytaz and Özmucur (1984) on this point.

The money supply mechanism is well explained in Yağcı's model with an emphasis on public sector transactions in this mechanism. Overall, it is easy to follow this model that has a structuralist flavour. But, there is too much concern for the statistical "fit" in the choice of behavioural equations and too much is attributed to these equations.

Özmucur's second generation model can be found in both Özmucur (1984) and Özmucur (1986). The only difference between the two is that the former is in Turkish and contains forecasts for 1985 while the latter is in English and contains forecasts for 1985 and 1986. This is the largest of all the models considered here, except the one by Yörükoğlu, the size of which is not known as mentioned above, and looks like an expanded version of Özmucur (1980) discussed earlier. The behavioural equations are estimated either by OLS or, in case of autocorrelation, by Generalized Least Squares (GLS). This procedure does not seem to be followed in all equations with auto-correlated errors however since there are quite a number of equations with this problem. Estimations are carried out with data either for the 1965-83 or the 1970-83 periods.

The production block contains behavioural equations for agricultural, manufacturing, construction and services values added. The equation for manufacturing output includes raw material imports as in the Yağcı model and the services equation contains a demographic variable defined to represent urbanization. Agricultural value added is explained by its lagged value and a time trend and construction value added is explained by its lagged value and GNP.

These specifications are not found to be satisfactory by the author himself and he explains that attempts to include other variables have not proved to be successful. In the demand block, while public consumption is explained by a behavioural equation, private consumption is expressed as a residual in an identity. It is not easy to accept this practice, which is not followed in any of the other models considered here. The author justifies it on the grounds that private consumption is calculated in a similar manner by the State Planning Organization. This justification sounds novel but has no economic logic. Again in this block, private manufacturing and housing investments are explained by behavioural equations, where the first one contains dummy variables, but the explanatory power of these equations are not satisfactory. In general then, the demand side of this model is a weak part of it.

Functional distributions of income and sectoral labour demands have an important place in Özmucur's model. As for the latter, real wage rates appear as explanatory variables but their parameters are generally found to be insignificant though they have the expected negative sign. In addition to sectoral deflators, three whole-sale price indices and a cost of living index are also explained in this model.

Table 2 provides information on Uygur (1986b), which is a revised version of Uygur (1986a). The model in the former is estimated first by single equation methods, namely by OLS and GLS if there is autocorrelation. Then, the simultaneous blocks are estimated by Non-Linear Three Stage Least Squares (NL3SLS) and the recursive blocks by Seemingly Unrelated Regression (SUR) methods. The OLS and GLS estimates are compared with the estimates obtained from NL3SLS and SUR. The data used in estimations relate to the 1961-84 period.

In terms of model specification, Uygur's model relies more on theoretically derived behavioural equations as compared to the other models. In the derived behavioural equations that explain sectoral outputs, relative prices appear as explanatory variables to determine capacity utilization. In this respect, the model differs from the others since relative prices do not play a role in them. Another particularity of this model is that market exchange rate, which differs from the official exchange rate considerably at some points of the sample period, is explained. This variable plays an important role in the set up of the model and establishes interactions between monetary, price and real variables of the economy.

The model by Şenesen resembles the model of Yağcı in terms of its set up. The variables explained and some of the specifications are quite similar in both models. The impression that one gets from the model of Yağcı is strengthened in Şenesen's model; that statistical "fit" considerations play a central role in the specification of the behavioural equations. This is perhaps inevitable to a certain extent in the construction of any model because there may be several hypotheses put forward to explain a variable. However, if this leads to a practice whereby combinations of candidate explanatory variables are formed and the one which yields the highest R^2 is chosen, then the whole exercise might become too mechanical and devoid of economics.

When one reads through Şenesen's work, this is the impression one gets as he explains how different subsets of explanatory variables are tried in different mathematical forms and that any equation with an R^2 below 0.9 is discarded. It seems

that the best fit in some equations could only be achieved by making use of dummy variables; there are five behavioural equations with dummy variables out of a total of 19. Having said all this, I do not deny or wish to undermine all the effort and time spent in bringing together a set of equations that satisfy a number of criteria, including validation.

Şenesen estimates the behavioural equations by OLS and the data used relate to a range of periods that vary between 1962-83 and 1972-83. Some of the estimated equations suffer from autocorrelation but the problem is not discussed.

Before looking at the validation and simulation results of the models, it is worth mentioning that Şenesen's private investment equation characterizes a result that is common to all the econometric model studies mentioned here: Real money stock, defined in one way or the other, comes out to be a significant variable in this equation. This result could be interpreted in several ways but it indicates that money is not neutral in the Turkish economy.

3. Solutions/Validations, Policy Simulations and Forecasts

I comment on the solutions, policy simulations and forecasts of the models by concentrating on six variables; private consumption (CON), private investment (INV), GNP, total exports (EXP), total imports (IMP) and general price level (PRI). Below in Table 3, mean absolute percentage errors (MAPE) are given for the solution values and percentage errors (PE) for the forecasts of these six variables in the three first generation models. Note that the solution values of these models are obtained from their reduced forms.

It is seen from the table that Korum's MAPE's are relatively low as compared to Özmucur's, but then the solution period is shorter and the variables are in current prices. This second factor should also be taken into account in making comparisons of forecast PE's. When judged on the basis of MAPE's and PE's, it is not easy to single out any one of the models as successful.

Korum and Uğurel do not have policy simulations; one can only infer short-run (impact) multipliers from the reduced form coefficients of these studies. Özmucur provides not only impact multipliers but also medium and long-run multipliers of three policy variables; public investment expenditure, banknotes and coins and local government taxes. The impact multipliers of public investment are such that CON,

INV, GNP, IMP and PRI are all positively affected from a change in this variable. But the situation is reversed in the medium and long-runs for the first four of these variables. Multipliers of money (banknotes and coins) imply just the opposite; unfavourable effects in the short-run and favourable effects in the medium and long-runs. The multipliers of local government taxes indicate that the effect of an increase in this variable is generally unfavourable.

Table 3 MAPE for solution values and PE for forecasts of selected variables of Korum, Uğurel and Özmucur (1980) Models

	Korum(*)		Uğurel(**)	Özmucur (1980)	
	MAPE 1959-65	PE 1966	PE 1968	MAPE 1962-74	PE 1975
CON	11.6	3.4	11.7	8.9	4.2
INV	12.2	5.9	12.8	13.1	29.8
GNP	3.4	4.1	13.2	6.8	4.9
EXP	-	-	5.0	11.0	-32.3
IMP	6.1	2.1	21.7	14.0	-0.8
PRI	-	-	-	6.8	2.0

(*) Korum's variables are expressed in current prices. Here INV represents private machinery and equipment investment and IMP represents machinery and equipment imports.

(**) Uğurel does not give solution values. Here INV represents total (private+ public) investment and IMP represents machinery and equipment imports.

(-) Not available.

Solution values, policy simulations and forecasts of the second generation models are obtained from the application of non-linear numerical solution methods. Yağcı, Özmucur (1984) and Uygur use the Gauss-Seidel method and Şenesen uses the Newton-Raphson method for this purpose. MAPE's for CON, INV, GNP, EXP, IMP and PRI variables of the second generation models are provided in Table 4.

(i) Foreign trade variables EXP and IMP are expressed in US Dollars in all four models. (ii) To save space and to make the comparisons on an equal basis, 3SLS based solution values of Uygur's model are left out and only OLS based values are used. It should be noted that, on average, the tracking performance of the 3SLS version of Uygur's model is better than the tracking performance of the OLS version.

Table 4 MAPE's for selected variables of Second Generation Models.

	Yağcı(*)	Özmucur(**)	Uygur	Şenesen
	MAPE 1970-81	MAPE 1977-83	MAPE 1971-84	MAPE 1979-84
CON	2.7	-	1.8	3.0
INV	5.2	8.2	4.5	6.4
GNP	2.0	2.0	0.8	0.8
EXP	7.3	9.7	8.2	3.9
IMP	8.5	11.8	5.9	2.3
PRI	-	4.8	4.4	8.2

(*) PRI is given in percentage changes in Yağcı's model.

(**) INV represents private manufacturing sector investment.Simulated values of CON are not provided in Özmucur (1984).

When compared with those of the first generation models, the second generation models have lower MAPE's. It is however difficult to single out any one of these latter models as the best in terms of MAPE's since simulated values refer to different time lengths. While Şenesen's and Özmucur's ex-post simulations cover only six and seven years respectively, Yağcı's cover 12 years and Uygur's 14 years. The implication is that, in terms of stability and convergence, the Yağcı and Uygur models can stand for longer periods. The table indicates that, as expected, the larger errors are associated with private investment and foreign trade variables.

As for policy simulations, Yağcı provides the results of seven "scenarios" for two post–sample years and compares them with (base) forecasts of these years. Four of these are related to policy variables and their effects are as follows. (i) A higher rate of devaluation of the Turkish Lira: Inflation accelerates but CON, GNP, INV, EXP and IMP also increase. (ii) Higher agricultural support prices: Inflation accelerates and the other variables (CON, GNP, INV, EXP, IMP) are adversely affected. (iii) Higher price for the products of state economic enterprises: Results in a lower rate of inflation together with an increase in other variables. (iv) Rise in nominal pubic investment expenditure: Inflation accelerates and all the other variables are negatively influenced.

Özmucur (1984) presents the multiplier effects of six variables on GNP and PRI for the last seven years of the sample period and initial and cumulative effects of four of them are as follows. (i) An increase in agricultural support prices leads to a decline in GNP and an increase in PRI both initially and in the medium-term. (ii) An increase in the official exchange rate per US Dollar brings about an initial decrease in GNP and an initial increase in PRI but its cumulative effect on both variables is positive. (iii) An increase in the time-deposit interest rate reduces both GNP and PRI initially. Its cumulative effect is positive on GNP and negative on PRI. (iv) An increase in public sector energy investment leads to an initial decline in GNP and an initial increase in PRI but its cumulative effect is positive on both variables.

Uygur provides the results of policy simulations for both a within-sample period, 1980-84, and a post-sample period, 1985-87, and compares them with base simulations. The effects of changes in policy variables are considered on GNP, TOX, TOM and PRI and are as follows. (i) A lower rate of discount has a positive effect on GNP and a negative effect on PRI initially. Bu this pattern is reversed in the following years. (ii) A larger discrepancy between the official and market exchange rates brings about a decline in GNP, TOX and TOM both initially and in the years that follow. PRI is lowered initially but is not affected in the following years. (iii) An increase in nominal government expenditures results in higher GNP and higher PRI especially in the later years. EXP is not influenced but IMP rises. (iv) An increase in agricultural support price leads to higher PRI but to lower GNP, TOX and TOM.

Şenesen's study does not contain any policy simulations. The exercises of Yağcı, Özmucur and Uygur all agree on the inflationary effect of increases in agricultural support prices and their negative influence on the other variables. The models of Özmucur and Uygur imply that there is room for government policy to influence the economy: Public expenditure and public investment lead to higher inflation but also to higher growth of GNP. In Yağcı's model there is no room for government policy, in that higher public investment results in higher inflation and lower growth. One result of Yağcı is that higher prices of the products of state enterprises lead to lower inflation and raise growth. It is not easy to accept this result, given the industrial structure of the Turkish economy.

Yağcı provides forecasts for 1982 and 1983, Özmucur for 1985 and 1986 in two papers, Uygur for 1985, 1986 and 1987 and Şenesen for 1985 and 1986. Because there are differences in especially the expenditure data such as for CON and INV and

because some recent data are still provisional, I do not go into comparing the forecasting performance of second generation models. It can be said, however, that like in the sample period simulations, larger errors are observed in private investment and foreign trade variables.

4. Concluding Remarks

Econometric model building in Turkey has a relatively short history and the number of models has increased only recently in the 1980's after a no-model period in the 1970's. The earlier studies, which I labelled as first generation models, seem to be rigorous in the specifications and interpretations of the estimation results. Due to computation limitations, only a few alternative specifications of the behavioural equations are estimated in these models. In the second generation models of the 1980's, there seem to be less economics and less rigour in the specifications and interpretations of the findings. With the availability of fast computation facilities, numerous alternatives of the behavioural equations are estimated with insufficient explanations. Yet, these facilities are not used for alternative and perhaps better estimation methods.

One reason for these outcomes could be that there is more emphasis on the simulation performance and simulation properties in the second generation models. This is not a particularity of the studies on the Turkish economy however; a similar emphasis is observed in the recent modelling studies of the other economies.

In spite of some, and perhaps inevitable, shortcomings, econometric model studies are valuable in understanding certain characteristics of the Turkish economy, in establishing the effects of some policy changes and in forecasting especially the real domestic variables. Some of the characteristics that are worth mentioning are as follows. (i) Money is not neutral. (ii) Foreign trade prices in general influence exports but not imports. (iii) Relative prices are important in the determination of real variables but other real variables are more important. (iv) Divergence between market prices and officially controlled prices has an adverse effect on the general performance of the economy.

BIBLIOGRAPHY

Bulutay, T. (1967) **Ekonometrik Bir Deneme: Teori ve Türk Ekonomisine Uygulama**. Ankara : Siyasal Bilgiler Fakültesi

Celasun, M. (1986) "A General Equilibrium Model of the Turkish Economy, SIMLOG-1", **METU Studies in Development,** 13(1-2), 29-94.

Derviş, K. and Robinson, S. (1978) "The Foreign Exchange Gap, Growth and Industrial Strategy in Turkey: 1973-1983", **World Bank Staff Working Paper** No.306, Washington D.C.: World Bank.

Goodman, N. (1970) "The New Riddle of Induction", in **Readings in the Philosophy of Science,** ed. by B.A. Brody, New Jersey: Prentice-Hall.

Hood, W.C. and Koopmans, T. J. (1953) **Studies in Econometric Method.** Cowles Commission for Research in Economics. New York: John Wiley and Sons.

İlkin, S. and Ugurel, İ. (1971) "Econometrics in Turkey", **Econometrica,** 39(4), 788-89.

Johnston, J. (1963) **Econometric Methods.** New York: McGraw-Hill.

Kaytaz, M. and Özmucur, S. (1984) "Türkiye İçin Makroekonomik Modeller", in **Ord. Prof. Şükrü Baban'a Armağan.** İstanbul: İstanbul İktisat Fakültesi.

Klein, L.R. (1956) **A Textbook of Econometrics.** New York: Row, Peterson and Co.

Koopmans, T.J.(1950) **Statistical Inference in Dynamic Economic Models.** Cowles Commission for Research in Economics. New York: John Wiley and Sons.

Korum, U. (1969) **Ekonometrik Modeller ve Türk Ekonomisi İçin Bir Deneme.** Ankara: Siyasal Bilgiler Fakültesi.

Koksal, B.(1970) **An Econometric Model For Turkey.** Unpublished Ph.D. Thesis, New York University.

Lewis, J.D. and Urata, S. (1983) "Turkey: Recent Economic Performance and Medium-Term Prospects, 1978-1990", **World Bank Staff Working Paper** No.602, Washington D.C.: World Bank.

Özmucur, S. (1980) **Türkiye'nin Ekonometrik Modeli: 1950-1974.** İstanbul: Boğaziçi Üniversitesi.

Özmucur, S. (1984) **Türk Ekonomisi Tahmin Modeli.** İstanbul Türk Sanayicileri ve İşadamları Derneği.

Özmucur, S. (1986) **An Econometric Model For Turkey: 1965-1984.** Istanbul: Turkish Industrialists and Businessmen's Association.

Şenesen, Ü. (1986) **Türkiye Ekonomisi İçin Bir Ekonometrik Model Denemesi.** İstanbul: İstanbul Ticaret Odası.

Tinbergen, J. (1951) **Econometrics.** New York: The Blakiston Co.

Tintner, G. (1952) **Econometrics.** New York: John Wiley and Sons.

Togan, S. (1983) "A Macroeconometric Model of The Turkish Economy-A Comment", **METU Studies in Development,** 10(3), 323-8.

Uğurel, İ. (1971) "A Macroeconomic Model For Turkey: 1949-1967", **Paper Presented at the European Meeting of the Econometric Society,** Barcelona, Semptember.

Uygur, E. (1983) "Makroekonometrik Modeller İktisat Politikası Uygulamasına Yardımcı Olabilir mi?", **Siyasal Bilgiler Fakültesi Dergisi,** 37(1-4), 1-18.

Uygur, E. (1986a) **SESRTCIC Econometric Model of the Turkish Economy.** Ankara: SESRTCIC.

Uygur, E. (1986b) **SESTRCIC Econometric Model of The Turkish Economy.** Ankara: SESRTCIC.

Yağcı, F. (1982) **Türk Ekonomisi İçin Ekonometrik Bir Model Çalışması: TEM1.** İstanbul: Türkiye Sınai Kalkınma Bankası.

Yağcı, F. (1983a) "A Macroeconometric Model of The Turkish Economy", **METU Studies in Development,** 10(1), 1-44.

Yağcı, F. (1983b) **Türk Ekonomisi İçin Ekonometrik Bir Model Çalışması: TEM2.** İstanbul: Türkiye Sınai Kalkınma Bankası.

Valavanis, S. (1959) **Econometrics.** New York: McGraw-Hill.

Yörükoğlu, T.K. (1980) **Türkiye Ekonomisinin Kısa Dönemli Yönetimi: Maliye ve Para Politikaları Üzerine Bir Deneme.** Unpublished Thesis, Istanbul University.