TÜSİAD

AN ECONOMETRIC MODEL FOR TURKEY 1965-1984

TURKISH INDUSTRIALISTS AND BUSINESSMEN'S ASSOCIATION

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derneği

An Econometric Model For Turkey

1965 - 1984

15 JANUARY 1986

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TÜSİAD

TURKISH INDUSTRIALISTS' AND BUSINESSMEN'S ASSOCIATION.

MEMORANDUM OF TÜSİAD'S FOUNDERS

AGREEMENT

We, the undersigned, agree, collectively, to undertake, on detailed terms to be agreed, to assure and provide the financial support necessary for the continued maintainance and fulfillment of the stated objectives of the Turkish Industrialists'and Businessmen's Association. We make this undertaking in the knowledge that the Association has been founded with the objective of contributing, in compliance with the economic principles laid down and envisaged in the Constitution of the Turkish Republic and the ideals of Atatürk, the Republic's founder, to Turkey's development through democratic and planned processes to this country's achieving the standards of living and industrialisation already reached by the Western industrialised world. The Association shall make its contribution to this development by bringing together, in harmony, and taking the maximum possible advantage of the knowledge, activities and experience of members of the professions, academics, businessmen and industrialists.

Date: April 2, 1971

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AN ECONOMETRIC MODEL
FOR TURKEY
1965-1984

FOREWORD

Ever since its foundation in 1971, TUSIAD has, in a spirit of complete impartiality, carefully studied the changing economic structure in Turkey as well as international developments and it has regularly disseminated its findings in publications in both the Turkish and the English languages.

As a result of its conjunctural studies over a period of more than ten years, TUSIAD has formed a wide data-base, made up of an abundance of statistical series pertinent to the national and international economies.

This Report presents a brief summary and the initial findings of the first TUSIAD macro-econometric model (1965-1983). The objective of the study is, by means of a thorough study of trends in the Turkish economy over the past two decades, to determine the direct and indirect relationships between various economic magnitudes and, on the basis of these relationships to forecast major trends into the near future. The model is also designed to be used for policy simulation purposes.

Of course, econometric model studies are by no means static works; they need to be revised and further developed in line with the changing economic structure and policy atmosphere. TUSIAD accordingly proposes to revise and develop its model at regular intervals in the future.

The Report which follows a "Summary & Conclusions", includes sections explaining the underlying economics upon which the model is based, forecasts for 1985, and policy simulation exercises for some economic variables.

The model study was carried out by TUSIAD's Research Department, under the chairmanship of Doc.Dr.Süleyman Özmucur (of Bogazici University), who was assisted by TUSIAD's Research fellow, Adnan Buyukdeniz. Prof.Dr.Erdogan Alkin, Prof.Dr.Demir Demirgil and Ertugrul Ihsan Ozol Secretary General, were consulted and contributed their views and assistance at various stages of the study.

A group of Boğaziçi University students Erkan Mutlu, Altug Karamenderes, Nilgün Arısan, Metin Çoşgel, Tulin Garbioglu, Fezal Akalin worked as research assistants at various stages of the project.

Leyla Dincmen was responsible for the Report's production and printing.

SUMMARY & CONCLUSIONS

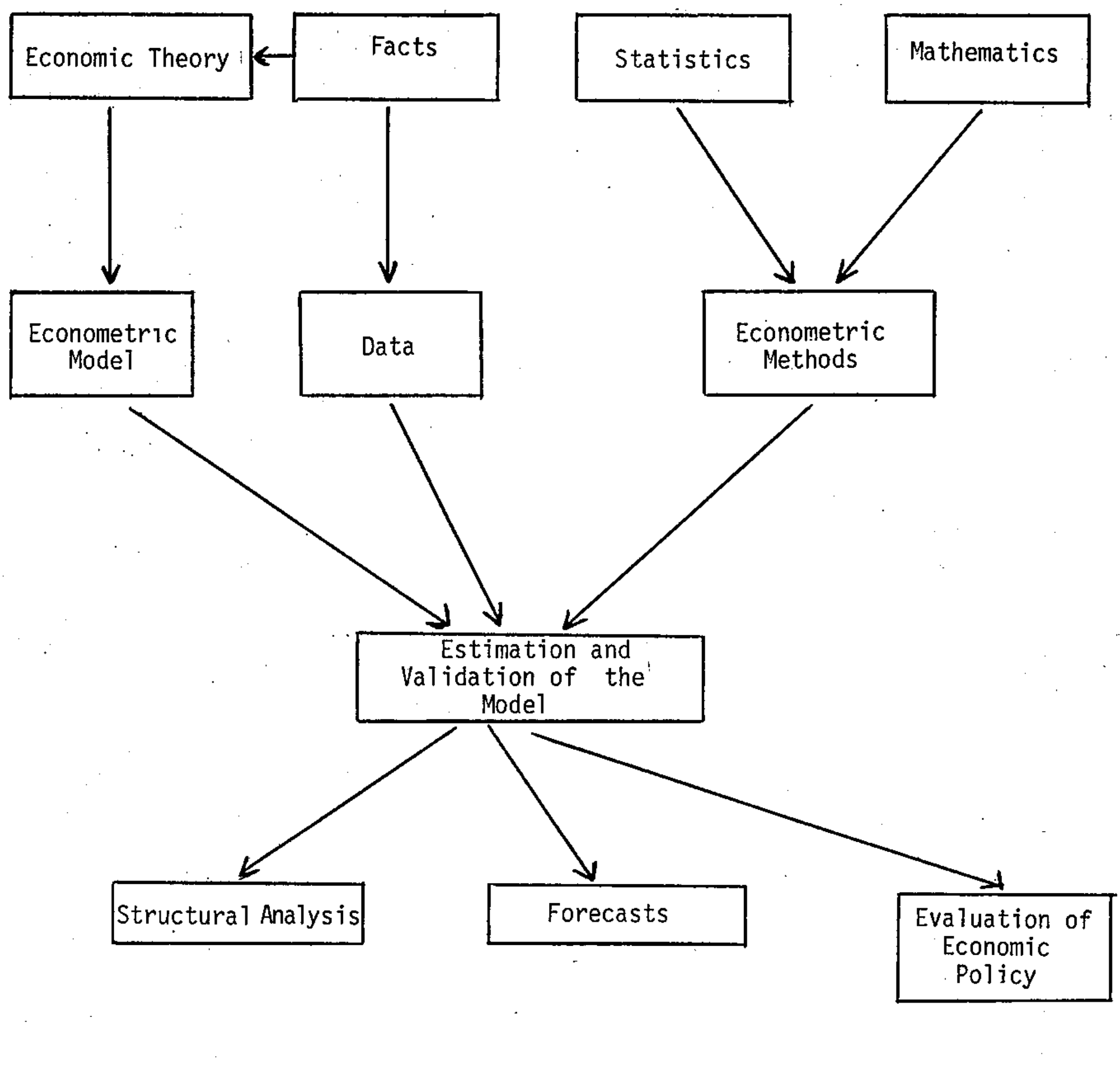
The interpretation of economic facts and developments is not usually as simple as at first appears. The determination of transverse and reciprocal influences, as well as of the direct impact of one economic variable on the other variables may well be of essential importance to a realistic evaluation. To cite an example; the manipulation of the exchange rate with a view to promoting a country's export sales would not only affect exports, but also the cost of imports, the cost structure of domestic production and the export prices of domestically produced goods and services, all of which would, in turn, affect exports. Obvious as this is, it is not possible to trace all these inter-related influences by merely looking at statistical series or resorting to insights provided by economic theory. It is only after all these relationships are formulated within a simultaneous equations system that it becomes possible to discern some meaningful clues about the operation of the various processes in the economy. It will be obvious that as the number of economic variables taken into account increases, so the use of such a method becomes crucial in the production of a reliable analysis.

This was indeed long apparent as regards the analysis of the structure of the Turkish economy past and present and for forecasting major economic trends into the medium-and long-run future Fully aware of the existence of a gap in this area, TUSIAD initiated a macro econometric model study in October 1983. This Report is intended to publicise its initial findings.

The objective of the TUSIAD Econometric Model is, by way of a thorough study of trends in the Turkish economy during the last two decades, to determine the direct and indirect relationships between various major economic magnitudes and, on the basis of these relationships, forecast major trends into the near future. The model is also designed to be used for policy simulation purposes.

As is illustrated in the diagram below, an econometric study consists of the following major inputs; -economic theory, statistical series used in the analysis and econometric methods.
An econometric model may be used for economic analysis, for forecasting and for the formulation of economic policy.

The elaboration of econometric studies, first attempted in the 1930's in developed market economies, regained momentum in the 1960's. Models made important contributions to the formulation of these contries' economic policies. The apparent failure of the macro economic theory to explain economic trends during the 1970's reduced credence in the reliability of econometric models but their revision so as tc assign greater emphasis to the supply side of an economy has resulted in confidence being regained.


Economic Theory
Facts
Statistics
Mathematics
Econometric Model
Data
Econometric Methods
Estimation and Validation of the Model
Structural Analysis
Forecasts
Evaluation of Economic Policy

Past experience with econometric models points to two basic facts. Firstly, performance of an econometric model greatly depends upon the extent to which the economic theory upon which the model is based reflects reality. An econometric model which is incompatible with common sense and economic theory is of little use and cannot be expected to produce satisfactory results. Secondly, models are not built to be believed but to be used. These two points were borne in mind throughout TUSIAD's study.

Several factors are known to have led to econometric models which found widespread acceptance in developed economies failing to achieve a similar level of success in developing countries, including Turkey. The fact that a wholly satisfactory economic development theory for the developing countries has not yet been established, that the economic structure of a developing country is, by definition, undergoing a process of rapid transformation, and that frustrations to which the economy is subjected often create shock effects have all reduced the chances of success in the application of econometric models. What is more, major structural changes and shifts in the economy's direction disrupt continuity in the relationships between economic variables and unfavourably affect the econometric models's performance.

Another problem encountered in developing countries, and in Turkey, is the lack of reliable data. Monthly and quarterly series data are needed in order to develop short-run models. In Turkey, whereas there is something of an abundance of relatively regular data for money-credit, prices and foreign trade, no monthly or quarterly data for the real sectors of the economy - other than the quarterly industrial production index published since the beginning of 1984 is available.

The lack of quarterly data on real magnitudes renders the development of short-run econometric models almost impossible.*

There are also long delays in the publication of statistical series. TUSIAD's model study employs data covering the period 1965-1983 but some of the series for the more recent 1980-1983 sub-period are of a "provisional" nature. Another difficulty with the statistical series is that periodical changes in definitions and classifications are not adjusted retrospectively and this makes comparisons between one period and another both difficult and misleading. To cite and example: "restaurant and hotel employees" are included in the trade sector in some population censuses but in the services sector in others. It also has to be noted that there are discrepancies and inconsistencies between the statistical series published by the various institutions; the statistical series on the Gross National Product and consumption published by the State Planning Organisation vary from those prepared by the State Institute of Statistics. Similar problems are encountered as regards price indices; whereas the Treasury & Foreign Trade Under-Secretariat's indices cover 94 items, those of the State Institute of Statistics cover over 1,000 items. With

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* TUSIAD quarterly model is in preparation. December 1985

their wider and more realistic coverage, these lätter have obvious advantages but their use in econometric models limited by the fact that they are not available for a sufficiently long period of the past to provide a firm basis for forward estimates. There exists a third price index, that of the Istanbul Chamber of Commerce for the City of Istanbul; this alone includes "rent" costs, a factor which may be said to favour its use. But despite their respective merits, it is still an open question as to which of these three indices may be taken as the most reliable indicator of the rate of inflation.

Quantitative restrictions imposed on the economy alse reduce the reliability of calculated relationships. Implicit in the estimation of import demand is the assumption of import freedom, but if there are quotas or other restrictions, the low level of imports may well have stemmed from these rather than from a low level of actual or potential demand. It is extremely difficult for the model to capture the effects of such restrictions. Similarly there are problems as regards pricing, since the practice of adminstrative price fixing is widespread.

The critical function of prices is to reflect the real shortages within the economy. When the demand for a particular commodity increases relative to supply, the resultant excess demand is curbed, in a rationally functioning pricing system, by a rise in the price of that commodity. On the other hand, when the price is fixed administratively and is not adjusted to maintain stability in the market for the commodity concerned, long queues and "under-the-counter" transactions are bound to emerge. It is impossible to incorporate this phenomenon in the model.

Similar problems arise when, for instance, interest, exchange and wage rates are administratively set out of line with market forces. The use of computers has, of course, greatly facilitated the building of large econometric models; indeed, the calculation of a large number of equations can only be done with the extensive use of computers. In the initial stage of this study, a TUSIAD Data Bank, consisting of over 700 variables was established and multivariable regression and simulation programmes were written in FORTRAN language.

Econometric models aim at minimizing errors in estamiton - i.e. in establishing "fits" with the least possible margin of error. In so far as the TUSIAD model was concerned, it was necessary to estimate the least erroneous (highest "fit") equation for each behavioral relationship over the period 1965-1983. Nonetheless, in certain cases, the exclusion of some estimated relationships in favour, solely, of the highest "fit" criteria would be misleading and mixed estimates sometimes yield better results. The following example illustrates this:

	Estimation Method I			Estimation Method II			Mixed Estimate	
Actual	Fitted	Error	Absolute Percentage Error	Fitted	Error	Absolute Percentage Error	Error	Absolute Percentage Error
80	70	10	12.50	85	- 5	6.25	2.5	3.125
90	85	5	5.55	95	- 5	5.55	0	0
100	100	0	0	105	- 5	5.00	-2.5	2.50
110	125	-15	13.63	95	15	13.63	0	0
Mean Absolute Percentage Error			7.92			6.36		1.41

In the equation estimated by Method (absolute), the percentage errors are 12.5, 5.5, 0 and 13.63 (average percentage error 7.92); use of Method 2 gives a percentage error calculated at 6.36. The arithmetical average of the errors arrived at by the two methods gives the errors yielded by the mixed estimates. As will be seen from the table, the average percentage error obtained on this basis is 1.41, well below that of Methods 1 and 2.

TUSIAD's is the largest econometric model so far developed in Turkey and it consists of some 111 equations. The model. adopting a "problem oriented" approach, is made up of equations explaining the major problem areas of the Turkish economy, such as inflation, unemployment, growth, the energy bottleneck, housing, balance of payments difficulties and the like. The model is detailed and elaborated to the extent which the available data allowed. The simultaneous solution of the 111 equations yielded an average percentage error (difference between actual and simulated values) of less than 6 percent of the same period. This, indeed, is a quite satisfactory result. For some variables this error is even lower; the average percentage error for the GNP variable is 1.99 percent, for construction value added it is 1.77 percent and for total investment it is 2.39 percent.

The level of production in the economy is related to the level of investment (changes in the level of productive capacity), raw material and labour inputs. Increases in the level of production (bigger supply) will, ceteris paribus, reduce inflationary pressures in the economy and, by increasing demand for labour, contribute to a reduction in the labour surplus (unemployment).

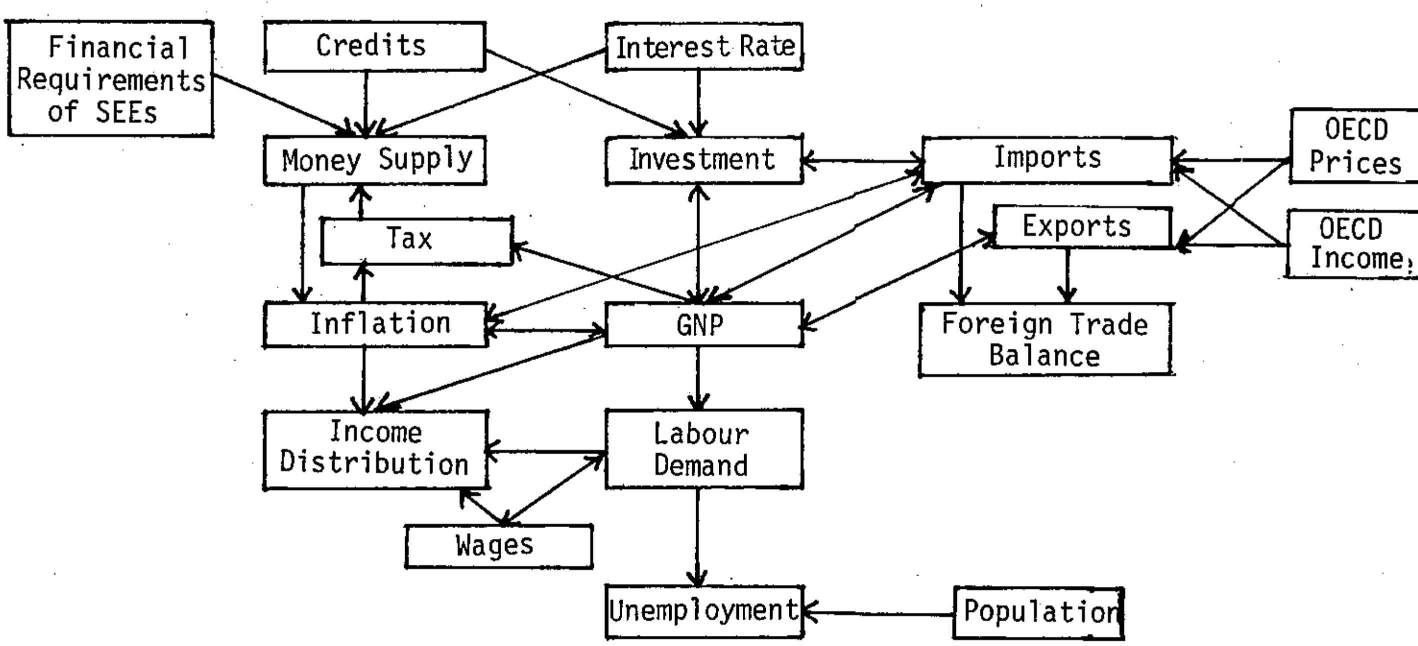
On the other hand, higher levels of production lead to a rise in import demand, in the exportable surplus and in tax revenues; given the same level of budget expenditure, higher tax collection will, in turn, reduce the budget deficit and, through a consequent reduction in inflationary financing, relieve overall inflationary pressures to an important extent. Amongst other causes of monetary expansion may be listed growth of domestic credit and changes in the country's foreign reserves.

Credits from the Central Bank and the deposit banks will stimulate investment and thus the level of output. Changes in the general level of prices are determined by excess demand (approximated by the rate of monetary expansion over and above the real rate of economic growth), changes in input prices (costs), and changes in import prices. An upward movement in price levels will, by inducing a higher level of imports and discouraging exports, result in a bigger foreign trade deficit.

Until 1980, bank deposit interest rates were held at a low level and substantial funds flowed from households into the banking sector. During the same period, a greatly over-valued Turkish Lira encouraged imports but impeded export growth. It is also noteworthy that during this period there were substantial increases in wages in the co-ordinated sector of the labour market.

The combined effect of these three factors, an over-valued currency, artificially low interest rates, and high labour costs, was to maintain the cost of capital to the economy at an artificially low level and to reduce the cost of capital compared with that of labour.

As a result of the relative increase in the cost of capital since 1980, there has been a deceleration in the rate of capital formation. Revival of investment has become a major problem in recent years, especially in the face of relatively low capacity utilization (around 70 percent) in the manufacturing industry, and the stimulation of investment today demands substantial incentives.



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Assuming the continued application of established economic policies and unchanged world conditions, it is anticipated that growth in the GNP will fall from 5.9 percent in 1984 to 5.1 percent in 1985.

The rate of inflation is expected to be around 38-42 percent.

It is reckoned that, in parallel with a 2.3 percent per annum population increase, the civil labour force will rise by 2 percent.

On the basis of the expected production level, it is estimated that the labour surplus (unemployment) will rise to around 16.6 percent of the labour force in 1985.

Imports will reach some $ 11.00 billion and exports are expected to exceed slightly last year's total of $ 7.1 billion; the trade deficit is expected to be around $ 3.7 billion for 1985. A notable increase in workers' remittances may put the current account into balance.

The Turkish Lira will continue to lose value against the dollar and it is anticipated that at the end of 1985 the devaluation rate will be slightly ahead of that of inflation.

On the basis of a 40 percent inflation and growth of 5.0 percent, it is estimated that, at current prices, the GNP will increase by around 45 percent.

In a subsidiary, study, it was determined that income elasticity of taxes was higher in the case of non-agricultural wage incomes than in that of non-wage incomes. It may thus be said that if incomes develop in favour of wage earners rather than of other taxpayers, there will be a more positive rise in tax revenues.

The fact that tax collections fall far short of the potential total results in a smaller volume of public sector savings and investments and, in great measure, the sector's recourse to the Central Bank for its financing requirements is the cause of the high rate of inflation. It follows that the much needed increase in fiscal revenue will subsequently make a major contribution to the solution of such problems as those of unemployment, inflation and income distribution.

Apart from the projections made into the future, attempts have been made in this study to use a multiplier analysis on some economic variables and to note the effects on the level of incomes and prices.

If, for example, normal non-tax revenues are increased by one unit, there will be a compensating fall in GNP in that year. But, in the longer term, the influence will be greater, and positive; at 1968 prices, a TL 1 billion increase in normal non-tax revenues would later generate a TL 1.1 billion rise in GNP.

In the long run, higher rates of interest on term deposits are bound to increase revenues but they will have the opposite effect on prices. Initially, this effect will be more marked, and it will tend to reduce GNP, but its importance will then gradually diminish. Devaluation will, in the long-term, result in higher revenues and prices. It must be borne in mind, however, that this result hes been obtained on the basis of changes in one variable only, leaving other factors at constant values.

In publishing its econometric model and indicating how it is being used to make short-term forecasts, TUSIAD believes that it has provided a foundation upon which much can be built in the future. It hopes that it has been released information which will be useful to all those with a close interest in the Turkish economy.

CHAPTER I

The Model: General Characteristics And Structural Analysis

The TUSIAD macro econometric model consists of some 50 behavioural equations and 61 definitional equations (identities). Of the 237 variables incorporated in the model, 111 are endogenous, 84 exogenous and 42 lagged endogenous. The model can be segregated into ten major blocks, the number of equations in each of which is given below:

Block	Number of equations (Behavioural equations+identities)
Value Added	13
Investment and Capital Stock	15
GNP by Sources and Uses	19
Income Distribution	8
Population, Employment and Wages	16
Foreign Trade	10
Prices	11
Public Finance	7
Money and Credit	9
Construction and Energy	3

1. Value Added

In the model, value added created by the agriculture, manufacturing, construction and services (commerce+banking+transportation and communitions+private and public services) sectors are determined endogenously, while value added by the mining, electricity, gas and water sectors are fed into the model from outside.

The level of value added by the agricultural sector is determined by a trend variable reflecting technological changes introduced in this sector over a period of time, and a one-year lagged value of agricultural value added to take into account year-to-year fluctuations in the level of agricultural output (four year lagged value of the agricultural value added also yielded satisfactory results). Attempts to include in the agricultural value added function such explanatory variables as area sown, labour input, number of tractors, agricultural credits, agricultural support prices and fertilizer usage did not yield very satisfactory results. While it may be easy to depict the effects of support prices and area sown in explaining variations in the level of a single agricultural product, such effects are negligible in so far as changes in the level of total agricultural output is concerned. Due to the fact that there exists a substantial labour surplus with negative productivity, the estimated coefficient of the labour input was found to be statistically insignificant. Agricultural support prices seem to influence the composition rather than the level of agricultural product.

Value added by the manufaeturing industry is both supply and demand determined in the model. In the pre-1980 period, such supply factors as shortage of raw materials and energy led to under-utilization of existing production capacity in industry: insuffficency of demand caused by the consumption restricting policies applied from 1980 onwards has since become the most important single cause of under capacity utilization in industry generally and especially in mánu-facturing.

The model relates value added by the manufacturing industry (at constant 1968 prices) to total fixed capital investments in the previous period as an indicator of increase of productive capacity in industry, to current and previous period raw material imports, and to changes in the level of GNP ($Y_t - Y_{t-1}$), a proxy for demand. The estimated coefficents were statistically significant and as were theoretically to be expected.

In the next stage of the model study, it is planned to analyse production, efficiency, employment and wage determination in the Turkish manufacturing industry by distinguishing between the private and public sectors.

Reckoning that the value added by the construction sector is to a large extent affected by the overall state of the economy, gross domestic income is included as an explanatory variable in the function. Also included is the previous period's value added by the construction sector. This lag can be given two possible interpretations. First, it can be interpreted as an indicator of "continuity" in construction. Second, hypothesizing that value added by the construction sector is a function of "expected" demand we have:

$$Y = f(D^e)$$

or

$Y_t = a + b\,D^e_t$ in linear form where

Y_t = value added by construction sector

D^e = "expected" demand

Since D^e is not an observable variable, it becomes necessary to predict how expectations are formed in the economy. Assuming that an "adaptive expectations" approach is a good approximation of the way in which the expectations formed in the Turkish economy, "expected" demand is formulated to be a weighted average of present and past levels of actual (observed) income.

(2) $D^e_t = \beta_o Y_t + B_1 Y_{t-1} + B_2 Y_{t-2} + \ldots\ldots.$

or more concisely expressed

(3) $D^e_t = \sum_{i=o}^{\infty} \beta_i Y_{t-i}$

by a mathematical transformation (3) can alternatively be written as:

(4) $D^e_t = (1 - \lambda) \sum_{i=o}^{\infty} \lambda^i \, Y_{t-i} \, , \; \beta_i = (1 - \lambda) \, \lambda^i$

lagging D^e_t by one period, multiplying it by λ and subtracting from (4), we obtain

$D^e_t - \lambda \, D^e_{t-1} = (1 - \lambda) \, Y_t$

The unobservable variable "D^e" has thus been eliminated. Now lagging equation (1) by one period, multipling by λ and subracting from Y_t, we have

$Y_t - \lambda \, Y_{t-1} = a \, (1 - \lambda) + b \, (D^e_t - \lambda D^e_{t-1})$

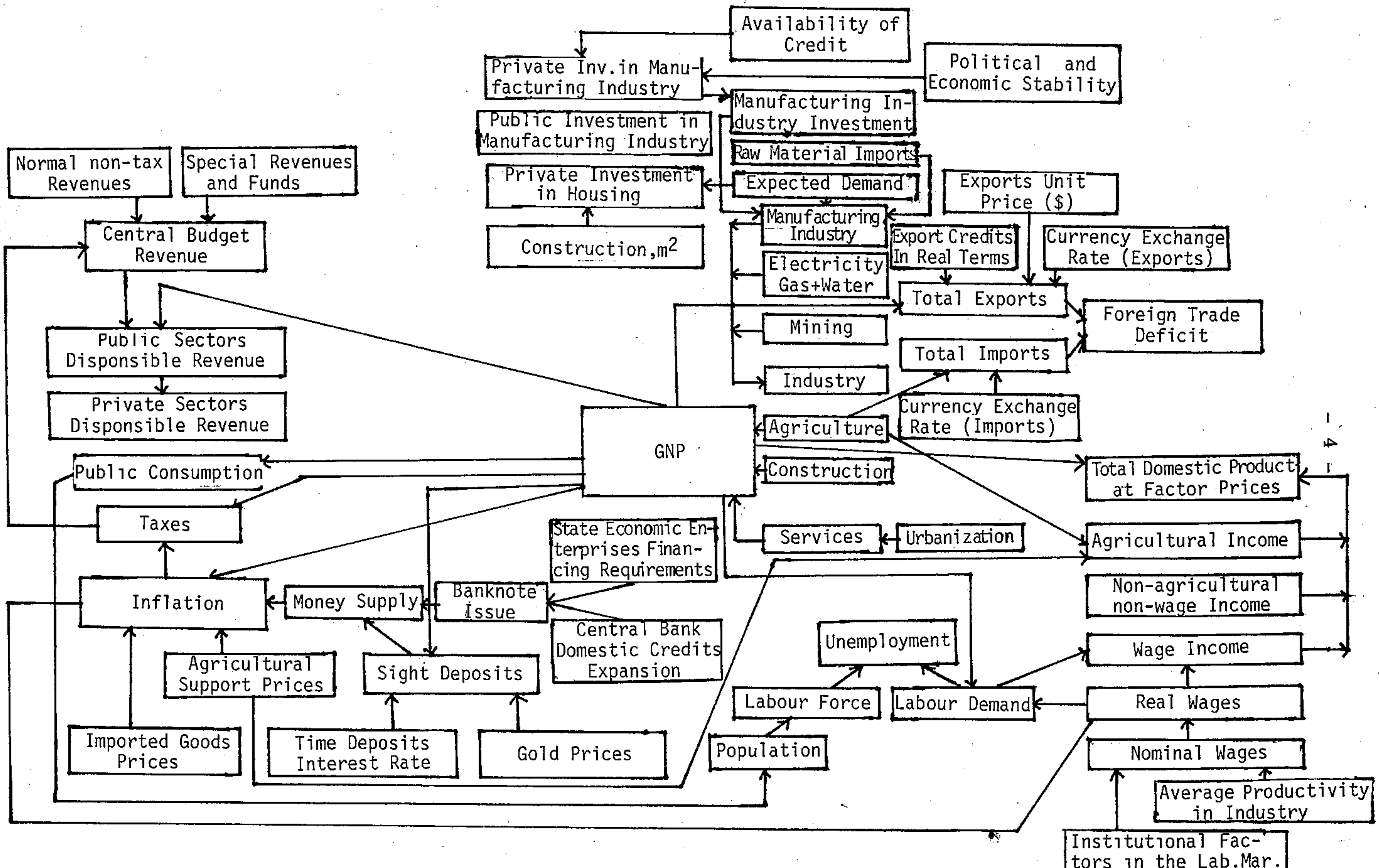
By substituting $(1 - \lambda) \, Y_t$ for $(D^e_t - \lambda D^e_{t-1})$

Y_t will now have been expressed as a function of Y_{t-1}

Therefore, the coefficient of Y_{t-1} in the estimated relationship will have measured the effect of both "expected" demand and "continuity" of construction from the previous period.

The long run effect of Gross National Product on value added in the construction sector in the estimated relationship was found to be:

$\left(\frac{0.0212}{1-.6149} \right) = 0.055$


Availability of Credit
Political and Economic Stability
Private Inv.in Manufacturing Industry
Manufacturing Industry Investment
Public Investment in Manufacturing Industry
Raw Material Imports
Expected Demand
Private Investment in Housing
Construction,m²
Exports Unit Price ($)
Manufacturing Industry
Export Credits In Real Terms
Currency Exchange Rate (Exports)
Electricity Gas+Water
Total Exports
Foreign Trade Deficit
Mining
Total Imports
Industry
Currency Exchange Rate (Imports)
Agriculture
GNP
Construction
Total Domestic Product at Factor Prices
Normal non-tax Revenues
Special Revenues and Funds
Central Budget Revenue
Public Sectors Disponsible Revenue
Private Sectors Disponsible Revenue
Public Consumption
Taxes
Services
Urbanization
Agricultural Income
State Economic Enterprises Financing Requirements
Inflation
Money Supply
Banknote Issue
Central Bank Domestic Credits Expansion
Non-agricultural non-wage Income
Unemployment
Wage Income
Agricultural Support Prices
Sight Deposits
Labour Force
Labour Demand
Real Wages
Imported Goods Prices
Time Deposits Interest Rate
Gold Prices
Population
Nominal Wages
Average Productivity in Industry
Institutional Factors in the Lab.Mar.

Namely, a TL 1 bn. increase in GNP will, ceteris paribus, lead to an increase in construction value added of TL 55 mn., all expressed in constant 1968 prices. The income elasticity of construction value added is, on the other hand, calculated at 0.90

The model relates value added by the services sector to non-service income (income created by industry and agriculture) and urbanization. The percentage of the total population living in settlement areas of over 10,000 people is taken to be an indicator of the rate of urbanization. In parallel with the rise in the rate of urbanization from 31.7 percent in 1965 to 48.0 percent in 1983, the share of value added to the GNP by the services sector has risen from 39.3 percent in 1965 to 45.0 percent in 1983. These estimates indicate a strong positive relationship, within the process of economic development, between services added value and the rate of urbanization.

2. Investment Demand and Capital Stock

In this block, whilst private investment demand in the manufacturing industry and housing sectors is determined behaviorally, public investment demand is taken to be policy-determined. And through dynamic relationships a monetary estimate of capital stock has been reached for the various sectors of the economy.

The model relates private investment demand in the manufacturing industry to the previous level of investment as an indicator of continuity of investment projects into the current period, taking into account the volume of deposit bank credits (in real terms) extended to the manufacturing industry and the effects of changes in the degree of economic and political stability in the country.

In the sample period, investment demand was found not to have been affected by interest rates, which were administratively set artificially below equilibrium throughout most of the period.

In fact, it is only in recent years, since the adoption of a high interest rate policy that financing costs have led to a fall in private investment demand. In the pre-1980 period, the availability of credit rather than the cost of borrowing had been the single most important factor influencing the volume of private sector investment.

The negative impact on private investment demand of the political instability experienced during 1977-79 and of the economic austerity and accompanying demand restricting policies since 1980 can easily be discerned from the estimated relationships.

Private investment demand in the housing sector is modelled so as to be determined by the previous level of national income as a proxy for "expected" demand and cost of construction per m^2. The estimated relationship yielded a strong positive impact of "expected" demand and negative impact of cost of construction m^2 on private investment demand.

In the model, public investment demand in the sectors of agriculture, mining, energy, housing and manufacturing industry and private investment demand in agriculture, mining and energy are determined exogenously.

This block also estimates through dynamic relationships capital stock in agriculture, mining, the manufacturing industry, energy, housing and in the overall economy.

3. Macro Equilibrium of the Economy (GNP by Sources and Uses)

In this block, the macro equilibrium of the economy is determined with the help of two behavioural and seventeen definitional equations.

In relation to the macro equilibrium of the economy, the model determines public consumption and public disposable income endogenously and in consonance with the State Planning Office's method of calculation, private consumption is calculated as a residual.

The public sector's share of total consumption has risen from 13.8 percent in 1965 to 19.4 percent in 1983, in parallel with the rising share of public disposable income within total disposable income (from 11.69 percent in 1965 to 16.2 percent in 1983.)

In the model, public consumption is explained by population and GNP; in the estimated relationship the elasticity of public consumption with respect to population is 2.43, with respect to income 0.41. Namely, a 10 percent increase in the level of national income will induce a 4.1 percent increase in public consumption, whereas a 1.0 percent rise in population will necessitate a 2.43 percent increase in public consumption. Thus it may be concluded that an increasing population brings pressure to bear on public expenditure.

In the model, public disposable income is related to general budget expenditure and Gross National Product. Total consumption is calculated by adding foreign savigns to total disposable income and subtracting total investment expenditure.

4. Income Distribution

The model analyses the factoral distribution of income by dividing total domestic factor income into three categories, namely: agricultural income, non-agricultural wage income, non-agricultural non-wage income (profit income).

The share of non-agricultural wage income varied considerably during the sample period, declining dramatically in years of high and variable inflation. The income share of those in this group rose as high as to 32.41 percent in 1970 from 29.0 percent in 1965 but declined to 22.6 percent in 1983 as a result of both nominal wage increases lagging behind inflation and slower growth of the number employed in industry.

On the other hand, the share of agricultural income, in total factor incomes declined gradually from 36.0 percent in 1965 to 20.0 percent in 1983, an expected phenomenon during the process of economic development.

The income share of those in the third group, namely non-agricultural non-wage income earners, rose consistently throughout the sample period, the rise becoming especially apparant in times of accelerated inflation. The share of this group rose from 34.4 percent of total domestic factor income in 1965 to 57.4 percent in 1983.

Agricultural and non-agricultural wage incomes are determined behaviorally in the model, while non-agricultural non-wage income is calculated as a residual. Although a substantial rise in the income share of non-agricultural non-wage incomes, which also includes interest income, is estimated to have taken place in recent years, a meaningful estimation of the rise in the income accruing to this group requires a separate detailed study.

Variations in agricultural income are explained in the model by changes in agricultural value added and in the agricultural support prices index. The estimated relationship suggests that a one unit increase in real agricultural value added leads to an increase of 1.10 unit of real agricultural income. On the other hand, contrary to a priori expectations, a negative functional relationship was estimated between real agricultural income and the agricultural support prices index; namely, when the agricultural support price index, computed as a weighted average of the prices of major price supported agricultural commodities, increases by 1.0 percent, ceteris paribus, this leads to a decline of about 0.045 percent in real agricultural income. This apparently contradictory result can perhaps be explained by the possibilty that the agricultural price support policy induces a higher increase in the general level of prices than in nominal agricultural incomes.

Non-agricultural wage income in the model is functionally related to non-agricultural labour demand and real wage rate.

Elasticity of non-agricultural real wage income with respect to real wage rates is estimates to be

$$0.80 \; \left(= 1151.45 \; \frac{23.26}{42588.3} \right)$$

Accordingly, a 10.0 percent rise in real wage rate will, ceteris paribus, increase non-agricultural real wage income by 8.0 percent transferring factoral distribution of income in favour of wage-earners.

The elasticity of non-agricultural real wage income with respect to non-agricultural labour demand in estimated to be 1.49.

5. Population, Employment and Wage Determination

In this fifth block of the model, trends in total population; urban population; labour supply; labour demand in agriculture, the manufacturing industry, in construction and in sevices; efficiency of industrial labour; and average nominal and real wage rates are all explained with the help of eight behavioral and eight definitional equations.

During the sample period (1965-83), the population was observed to have grown at an annual average rate of 2.3 percent.

From the estimated urban population total population relationship, some 807 persons out of every addition of 1000 persons to total population can be expected to settle in urban areas (of 10000 + inhabitants)

From the estimated labour supply-population relationship, a 1.0 percent increase in population is estimated to make a 0.882 percent contribution to the economically active population (labour supply); that is the labour supply is expected to grow by some 2.04 percent per annum.

The demand for agricultural labour displayed a declining trend throughout the sample period; this was to be expected during the process of Turkey's economic development and, as a result, the regression of demand for agricultural labour yielded a negative relationship with agricultural output. The "auto-correlation" model quite satisfactory explains the declining demand for labour in the agricultural sector.

The model relates demand for labour in the manufacturing industry to the level of manufacturing output, to the volume of investments in the manufacturing industry and to real wage rates. In the estimated relationship, the effects of manufacturing output and investment on demand for labour in manufacturing were found to be significant and of expected signifinance. The effect of real wages was, on the other hand, found to be of expected sign but statistically insignificant.

This latter result may well have stemmed from the fact that, in the model, no distinction is made between the private and public sectors. As a matter of fact, in a supplementary study, the analysis of labour demand by the manufacturing industry was further developed by studying public and private sectors separaterly. This study showed that the real wage rate had a significant (negative) effect on the private sector's demand for labour while its effects was insignificant in the public sector

The elasticity of demand for labour in the manufacturing with respect to manufacturing output was estimated to be

$$0.35 = 0.0147 \left(\frac{34052}{1411} \right)$$

The variation with respect to manufacturing investment was:

$$0.054 \ (=0.0186 \ (\frac{4171.5}{1411})$$

The estimated coefficients make clear the negative impact on the employment situation in Turkey of the decline in the volume of investment in recent years.

Demand for labour in the construction sector is determined by the value added and the previous year's demand for labour in this sector. The coefficient of the lagged variable may be interpreted to measure the (positive) effect of "expected" demand in this sector.

Demand for labour in the services sector is related to the level of the sector's value added and its real wage rates.

Demand for labour in "industry" is estimated as the sum of demand for labour in the manufacturing industry and electricity, gas, water and mining sectors.

Aggregating the agricultural and non-agricultural labour surplus to give the total labour surplus in the economy, the unemployment rate is calculated as the ratio of the total labour surplus to total labour supply.

Another behaviourally determined variable in this block is the average nominal (daily) wage rate. The model relates wage rates to the previous level of the nominal wage rates and to average labour productivity in industry (output per industrial workers). The coefficients of both explanatory variables are statistically significant and positive.

One reason for including the previous period's wage rates in the equation is to test for the existence of wage "rigidity" in the labour market. In a freely functioning labour market wage rates are determined by the equilibrium between the demand for and the supply of labour: and any lack of equilibrium between supply and demand in such a market is normally corrected by the upward or downward adjustment of wage rates.

In the estimated relationship, the coefficient of the lagged variable was found to be statistically significant and positive, meaning that wages trends in the labour market are rigidly downwards wards. More precisely, when there exists a surplus supply of labour (as has always been the case in the Turkish labour market) the wage rate does not function as a stabilizing factor in the market.

In a significant part of the labour market, wage rates are determined by administratively controlled collective bargaining agreements rather than by the free play of market forces. The effect of average productivity of labour on wage rates was found to be statistically significant, a 1.0 percent improvement in productivity increasing wage rates by 0.33 percent.

The attempt to explain changes in nominal wage rates by "expected" rates of inflation did not yield satisfactory results; this can be explained by the absence of collective bargaining from 1980 until only recently, causing nominal wage rises to lag behind the inflation rate.

Efforts to relate nominal wage rates to the rate of unemployment also failed to give satisfactory results. Theoretically, the higher the rate of unemployment, the lower the level of wages rate but due to the transformation of disguised unemployment into open unemployment in the course of urbanization, the apriori negative relationship between wage rates and the rate of unemployment was not evident.

6. Foreign Trade

The pace of the outward orientation of the Turkish economy has been accelerated for some time, and especially during the last 5-6 years. Taking as a basis the ratio of foreign trade (exports plus imports) to Gross Domestic Product, the degree of exteriority increased from 17.1 percent in 1980 to 22.8 percent in 1983. Of course, as the economy becomes more nearly integrated with the world economy, its susceptibility to the changing world economic situation increases accordingly.

Material and monetary changes originating in other economies become more easily transmitted to the domestic economy through various items in the balance of payments account. The objective of the model's foreign trade block is to formulate the link between the domestic and world economy.

Theoretically, the volume of imports depends upon investment expenditures, output, the deviation of domestic prices from world prices, exchange rates, and the availability of foreign exchange. In the absence of quotas or other quantitative or financial restrictions in the foreign trade regime, it is possible to measure realistically the effect of each of these variables on the import demand. In the absence of free trading conditions, however, where import demand is suppressed (mostly because of shortage of foreign exchange, protection of infant industries, domestic income and employment considerations), it becomes impossible to measure the real magnitude of the effect of these variables, especially the effect of differentials between domestic and world market prices, on import demand.

Throughout the sample period, the widespread imposition of quotas, other quantitative restrictions and prohibitions was the single most important feature of the import regime and it is only since 1984 that relative import freedom has been granted. This is one of the reasons why the equations in this section of the model are less satisfactory than might have been expected.

The model determines total imports, raw material imports, machinery and equipment imports and consumer goods imports endogenously. Total exports, agricultural and industrial exports are explained behaviorally.

All the behavioural equations in this block are estimated at constant 1968 prices and converted into \$ values using the annual average of the US\$/TL exchange rate.

In order that the stock adjustment model may be relevant to the formulation of import and export decisions, lagged values of imports and exports are also included in the equations.

The stock adjustment model provides that only a certain proportion of the "planned" increase in exports and imports is actually realized.

For instance,

1) $Z_t^* = a_0 + a_1 Y_t$

where

Z_t^* = planned imports in period t

Y_t = income in period t.

2) $Z_t - Z_{t-1}$ = changes in imports

$= b(Z_t^* - Z_{t-1}), \; 0 < b < 1$

where b = coefficient of adjustment

Substituting (1) into (2), we have

$$Z_t - Z_{t-1} = b(a_0 + a_1 Y_t - Z_{t-1})$$

and finally

$$Z_t = a_0 b + a_1 b \, Y_t + (1-b) \, Z_{t-1}$$

The total imports equation relates total imports to non-services (agriculture + industry) value-added, to the official exchange rate for imports, and to the previous level of total imports.

In the estimated equation, the coefficient of the non-services value added was found to be statistically significant and positive: since the industrial output and to a lesser extent, agricultural output depend on imported raw materials, output increases in these sectors will induce higher levels of imports. In fact, in the latter half of the 1970s the shortage of imported raw materials, together with an energy shortage, was one of the major factors in under-capacity utilization in industry. The effect on total import demand of the official exchange rate, although (correctly) negative, was estimated to be statistically insignificant. That the estimated effect of the exchange rate on total import demand was found to be negligible stems from the fact that, as has been explained above, in the face of quantitative restrictions it is extremely difficult to ascertain the real effect on import demand of the overall price variable (exchange rate, import prices etc.)

The income (agriculture and industrial value added) elasticity of total import was estimated to be 1.1663 while the long-run elasticity was calculated to be:

$$2.277 = \left(\frac{1.166}{1-0.487} \right)$$

The elasticity of total import demand with respect to the exchange rate was estimated to be -0.027.

The model relates raw material imports to value-added in industry and machinery and equipment imports to value added in industry and agriculture. In these equations, lagged values of the endogenous variables are also included under the stock adjustment assumption.

In the equation estimating import demand for consumer goods, the effect of price differentials between domestic and world markets and of the exchange rate were found to be significant. The equation relates consumer goods imports to income the prices index for consumer goods imports, the ratio of the OECD consumer prices index to the domestic consumer prices index, and the previous year's consumer goods imports. The prices index for consumer goods imports (in TL terms) was computed by multiplying the prices index for consumer goods imports in $ terms with the annual average exchange rate applicable to imports.

According to the estimated relationship, a higher level of income and a higher rate of domestic inflation relative to the rate of "world inflation" will induce a higher level of consumer goods imports. The exchange rate, on the contrary, has a demand reducing effect.

Passing on to the export demand equations, the model relates total export demand to domestic output (as a proxy for the exportable surplus), the annual average official exchange rate for exports, the unit export prices index (in $ terms), export credits in real terms, and the previous year's total exports.

The estimates yielded a positive relationship between total exports and output; the effect on exports of real export credits was also found to be significant, as was the effect of devaluation in stimulating exports.

The agricultural exports are explained by such factors as the OECD (weighted) income index, the GNP deflator as an indicator of domestic prices and export credits in real terms. From the estimated equation, the significant impact of the economic conjuncture in the OECD area on Turkish agricultural exports is easily noted. Higher OECD incomes, together with the support of realistic exchange rate policies by Turkey can be expected to induce a greater volume of agricultural exports by this country.

Rises in domestic prices will, on the other hand, discourage exports by shifting demand into domestic consumption. In real terms, export credits will also have a significant, positive, effect on exports.

The model functionally relates industrial exports to exchange rates, export credits in real terms and the previous year's exports.

Having been estimated in constant TL prices, total exports and total imports are converted into $ values by the (official) annual exchange rates for exports and imports, respectively.The trade deficit is calculated as the difference between imports and expressed in dollar terms.

7. Prices

Within the framework of a conventional macro-economic model, the link between the material and monetary sectors of the economy is established by the interest rate. The interest rate appears to be adeterminant of such components of the aggregate demand as investment demand, demond for consumer durables and the like.

Presuming that the rate of interest is partly a monetary phenomenon (ie. is determined by the conditions prevailing in the money market),changes in the monetary situation will influence the rate of interest which, in turn, influences the various components of the aggregate demand. Thus, changes originating in the monetary sector of the economy are transmitted to the material sector through variations in the rate of interest.

The link between the material and monetary sector is however, cut off in each of the following three cases:

a) Where monetary changes do not influence the rate of interest (either because there exists a liquidity trap in the economy, or because the interest rate is administratively fixed)

b) Where the aggregate demand is interest-insen sitive.

c) Where there is a combination of (a) of (b)

Essentially, nominal interest rates in Turkey are administratively fixed and throughout most of the sample period, especially prior to 1980, did not reflect the true conditions in the money market. The fact that the real rate of interest become more markedly negative in parallel with the acceleration of inflation, meant that investment demand became less and less sensitive of the cost of borrowed funds. Credit availability rather that the cost of money was the major determinant in investment recisions.

Thus it can be concluded that the rate of interest does not seem to be a relevant variable in establishing the link between the real and monetary sectors of the Turkish economy. In order to eliminate this apparent dichotomy in the model, the link between the two sectors is established by price levels.

For instance, in the labour demand equations for the manufacturing industry and services sectors, the real wage rate is obtained by deflation of the nominal wage rate by the Istanbul cost of living index, which is determined partly by monetary factors. Similarly, in the equations explaining total and agricultural exports (all expressed in real values) export credits in real terms are obtained by deflation of total export credits expressed in current prices by the GNP deflator.

In this block, in addition to the estimation of various sectoral price deflators, wholesale price indices and the Istanbul cost of living index are also estimated.

In the model, the level of prices is determined by both supply and demand factors. The wage rate as a cost factor was not found to be statistically significant in the determination of the price level in all the equations. Thus, from the model study's findings, it is difficult to regard changes in wage rates as an important element influencing the rate of inflation. On the other hand, the raw materials import price index, as an indicator of the "imported" inflation was estimated to be an important determinant of domestic price levels.

In order to incorporate into the model the pressure of excess demand on prices, an indicator of "excess demand" has been formulated. Presuming that as the rate of monetary expansion in the economy is faster than the real growth in output, an inflationary demand pressure would be created, the ratio of the two-year moving average of the narrowly defined money supply to real GNP is taken as a measure of "excess demand" in the economy. A two year moving average of the money supply was preferred because money supply amounts are end-of-year figures and also because, in this way, the lagged effects of changes in the money supply on prices can be taken into account.

In this block, the estimated price deflators are used to convert sectoral value addeds at constant prices into current prices.

The model relates the agricultural price deflator to a weighted index for support prices, "excess demand" and the previous level of the deflator, as a proxy for inflationary expectations. According to the estimated relationship, a 10 percent increase in the support prices index will, ceteris paribus, raise the agricultural price deflator by 4.3 percent and a 10.0 percent rise in the deflator will, in turn, cause a 2.0 percent rise in the GNP deflator. The elasticity of the agricultural price deflator with respect to "excess demand" was estimated to be 0.88 percent; that is to say, a 10.0 percent increase in "excess" demand will raise deflator by 8.8 percent. In this sector, in which the output response is weak (i.e. output responds to price changes with long lags) and prices are not administratively fixed, the finding that prices are mainly demand determined is a normal expectation. The price elasticity in agricultural output is quite low, and contrary to the situation in the industrial sector, it is only after long delays that agricultural output responds to price changes.

The price deflator for the manufacturing industry is explained by such variables as the level of output in industry and the general level of prices (as measured by the GNP deflator). But since, in the model, the GNP deflator is explained by such factors as the import prices index, the agricultural prices deflator and "excess" demand, inclusion of the GNP deflator in the equation explaining the price deflator for the manufacturing industry implicity takes into account these demand and supply factors.

The wholesale prices index is functionally related to the GNP deflator. Wholesale prices indices for foodstuffs and industrial raw materials and semi-finished products are explained by the GNP and agricultural price deflators. The Istanbul cost of living index is explained by "excess" demand, the previous level of the deflator (to reflect price expectations), and the wholesale prices index for foodstuff.

8. Public Finance

In this block, central budget revenues are determined with the help of four behavioural and three definitional equations.

In a supplementary study, direct tax revenues were related to non-agricultural wage income and to non-agricultural non-wage income (the agricultural income was excluded because of its small share in direct tax revenues) in an effort to see any possible effect of income distribution on tax revenues. The estimated relationship yielded an elasticity of 1.23 with respect to non-agricultural wage income and 0.0116 with respect to non-agricultural non-wage income. Since the elasticity of direct tax revenue with respect to non-agricultural wage income is substantially higher than that with respect to non-agricultural non-wage incomes, a redistribution of factor incomes in favour of wage earners can be expected to improve direct tax revenues .

The model explains direct tax revenues by two variables; real income and the GNP deflator. The elasticity of direct tax revenues was estimated to be 1.94 with respect to real income and 1.03 with respect to the general level of prices.

Indirect tax revenues are divided into three categories (taxes on goods, taxes on services and taxes on foreign trade), each of which is covered separately. Taxes on goods are related to real GNP and the GNP price deflator, taxes on services to services value added and the previous level of taxes on services, taxes on foreign trade to the volume of imports and the previous level of taxes on foreign trade.

With the help of the definitional equations in this block, the aggregates of total tax revenues, non-tax normal revenues and special revenues and funds represent central budget revenues.

9. Money and Credit

In this ninth block of the model, bank deposits, credits, banknotes issued and the narrowly defined money supply are dealt with behaviourally.

The money supply definition used in the model is behaviourally determined and is:

Money supply= (banknotes issued less those held by the banks)+ sight deposits

The narrow definition of the money supply was preferred due to the statistically closer relationship during the sample period between this definition of the money supply and the changes in nominal GNP. Nonetheless, it must be pointed out that the historically strongly existent relationship between the narrow definition of the money supply and nominal GNP seems to have weakaned recently. In the last one or two years, broader definitions of the money supply seem to explain the variations in nominal GNP more satisfactorily. Therefore, it will be more satisfactory in a future revision of the model to use broader definitions of the money supply

In the model, the money multiplier is not assumed to be constant but is endogenized by way of including the interest rate in the demand for sight deposits equation.

The volume of banknotes issued is explained behaviourally by public deficits, Central Bank credit expansion, gold/exchange reserves and the financial requirements of the State Economic Enterprises.

Of these explanatory variables, Central Bank credit expansion the financial requirements of the State Economic Enterprises and the previous level of banknotes issued were found to be statistically significant in determining the volume of banknotes issued.

In the estimated relationship, the variation of banknotes issued was reckoned to be 0.2342 with respect to Central Bank credit expansion and 0.1326 with respect to the financial requirements of the State Economic Enterprises. But taking into account the fact that the previous level of banknotes issued is also included in the equation, the long-run variations with respect to Central Bank credit expansion and the financial requirements of the State Economic Enterprises may be computed as 0.545 and 0.309, respectively. Thus, a 10.0 percent rise in Central Bank credits will increase the banknotes issued by 5.45 percent and a 10.0 percent increase in the financial requirements of the State Economic Enterprises will open the way for a 3.09 percent rise in the volume of banknotes issued. As a matter of monetary policy, banknotes in circulation are determined by deducting from the behaviourally determined banknotes issued, those held by the banks and so temporarily out of effective circulation. Thus, an increase in the banks' 'note holdings will decrease the banknotes in circulation and a decrease in the banks' holdings will raise this total.

Other component of the narrowly defined money supply is sight deposits; in the model these are explained by the level of GNP and the return on alternative fund holding instruments. Due to the lack of reliable data and relative under-development of the real estate, foreign exchange and capital markets in Turkey, time deposit interest rates, treasury bond rates, and percentage changes in gold prices are taken to be the revenue earning alternatives to holding sight deposits. Acoording to the estimated relationship, the income elasticity of demand for sight deposits is 0.99 and the interest rates elasticity is -0.2278. The elasticity with respect to the percentage change in gold prices was estimated to be -0.004. But only the first two variables (interest rates and income) were found to be statistically significant. Accordingly, time deposits are the alternative to sight deposits and a 10.0 percent increase in the rate of interest paid on time deposits will, ceteris paribus, reduce demand for sight deposits by 2.27 percent.

The demand for time deposits was related, in addition to income and alternative returns, to inflation, but although it showed the expected sign, the relationship between the demand for time deposits and inflation was not statistically significant. According to the estimated relationship, a 10.0 percent increase in time deposit interest rates will, within the same period, induce a 2.7 percent increase in time deposits (the total long-run effect is to increase time deposits by 14.9 percent). A 10.0 percent rise the price of gold will lead to a decline in time deposits of 0.7 percent within the same period, and 3.8 percent in the long-run.

In the model, Central Bank agricultural price support credits are related to agricultural value-added, and to the agricultural support price index. Central Bank credits to the manufacturing industry is related to manufacturing value-added, the manufacturing price deflator and total Central Bank credits. Also in the model, credits extended by deposits banks are related to total Central Bank credits, manufacturing value-added and the manufacturing price deflator. All the explanatory variables are found statistically significant in influencing the demand for and the availability of deposit bank credits. Rises in the level of prices will reduce the real volume of bank credits used by the manufacturing sector, and for the continuity of production in the sector, current-value credits will need to be increased in step with prices.

10. Construction and Energy

In this block, there are three behavioural equations explaining energy production and consumption and area (m^2) built. The elasticity of electricity consumption is estimated to be 2.85 with respect to population and 0.74 with respect to income. Electricity production is explained by existing capital stock and current investments in the energy sector.

The area constructed is related in the model to current and previous levels of GNP, cost (per m^2) of construction and time deposit interest rates. The elasticity with respect to income, cost of construction and interest rates were estimated to be 1.48, -0.080 and -0.172, respectively.

CHAPTER II

EQUATIONS OF THE MODEL*

The TUSİAD macro-econometric model consists of the 50 behavioural and 61 definitional equations given in this section.

The equations were estimated by Least Squares or Generalized Least Squares methods. The t-ratios are given in parathesis.

All dependent variables in each block are denoted the same letter (for instance, for the value-added block, the letter "Y" is used). Subscripts denote the sector (eg. Y_a denote value-added in agriculture). In the foreign trade and investment blocks, two-letter subscripts are used, the former denoting the sector, the latter indicating private-public distinction. (eg. I_{ap} denotes, private investments in agriculture).

All variables in the value-added, Investment and Capital Stock, Gross National Income By Uses and Source, Employment and Foreign Trade blocks are expressed in constant 1968 prices. Variables expressed in current prices are denoted by the superscript "c" (eg. Y_a^c = agricultural value-added at current prices), and dollar values by superscript "$" (eg. $X_t^{\$}$, exports in terms of dollars).

Equations with "*" are estimated for the sample period 1970-83, other for the period 1965-83. The list of variables is given at the end of the section.

1. VALUE ADDED

1.1) Agriculture:

$$Y_a = -1871633.328 + 963.7434\ t + 0.2194\ Y_{a-1}$$
$$(-3.358) \qquad (3.361) \qquad (0.945)$$

$\bar{R}^2 = 0.9479$, D.W. = 1.779 , $X^2 = 2.0$, F = 165.0, MAPE = 2.84, M = 0.567

*General Econometric Package (GEP) developed by Süleyman Özmucur is used in estimating regression coefficients.

1.2) Manufacturing Industry:

$$Y_m = 9646.62 + 0.1664\ (Y_t - Y_{t-1})$$
(6.27) (1.60)

$$+ 0.0011\ Z_r + 0.1484\ I_{t-1} + 0.0011\ Z_{r-1}$$
(2.89) (1.66) (2.72)

$\bar{R}^2 = 0.9735$

D.W. = 1.16 F = 166.0, MAPE = 5.26, M = 0.998

1.3) Construction

$$Y_c = 606.862 + 0.0212\ Y_t + 0.6149\ Y_{c-1}$$
(2.576) (3.145) (5.304)

$\bar{R}^2 = 0.9896$, D.W. = 2.03 , $X^2 = 0.22$ F = 859.7, MAPE = 2.17, M = 0.742

1.4) Services

$$Y_s = -57802.791 + 1920.782\ (N_u/N_t) + 0.6686\ (Y_a + Y_i)$$
(-7.01) (4.768) (6.475)

$\bar{R}^2 = 0.9972$, D.W. = 1.216 F = 3175.6, MAPE = 1.49, M = 1.056

1.5) Industry

$$Y_i = Y_m + Y_b + Y_e$$

1.6) Gross Domestic Product

$$Y_d = Y_a + Y_i + Y_c + Y_s + Y_{iv} - Y_{ik}$$

1.7) Gross National Product

$$Y_t = Y_d + Y_f$$

1.8) Gross National Product (at factor prices)

$$Y_{fa} = Y_t - Y_{vv} + Y_{su}$$

1.9) Agriculture (at current prices)

$$Y_a^c = Y_a \cdot P_a$$

1.10) Industry (at current prices)

$$Y_i^c = Y_i \cdot P_i$$

1.11) Services (at current prices)

$$Y_s^c = Y_s \cdot P_s$$

1.12) Gross Domestic Product (at current prices)

$$Y_d^c = Y_d \cdot P_d$$

1.13) Gross National Product (at current prices)

$$Y_t^c = Y_t \cdot P_y$$

2. INVESTMENT AND CAPITAL STOCK

2.1*) Private Manufacturing Investment Demand

$$I_{mp} = \underset{(1.304)}{754.8161} + \underset{(2.14)}{0.5315}\, I_{mp-1} + \underset{(1.81)}{0.1247}\, (G_m/P_y) - \underset{(-1.168)}{344.965}\, D_{80} - \underset{(-2.29)}{833.045}\, D_{77}$$

$\bar{R}^2 = 0.836$, D.W. $= 1.657$, $X^2 = 2.69$ $F = 17.6$, MAPE $= 5.05$, $M = 0.674$

2.2) Private Housing Investment Demand

$$I_{hp} = -\underset{(-1.231)}{934.2087} + \underset{(8.378)}{0.0452}\, Y_{t-1} - \underset{(-3.585)}{169.0861}\, P_h$$

$\bar{R}^2 = 0.8187$, D.W. $= 2.417$ $F = 41.6$, MAPE $= 7.98$, $M = 0.567$

2.3) Total Private Fixed Investments

$$I_{tp} = I_{mp} + I_{hp} + I_{ap} + I_{bp} + I_{ep} + I_{rp} + I_{up} + I_{dp} + I_{kp} + I_{op}$$

2.4) Total Agricultural Investments

$$I_{at} = I_{ap} + I_{ag}$$

2.5) Total Mining Investments

$$I_{bt} = I_{bp} + I_{bg}$$

2.6) Total Manufacturing Investments

$$I_{mt} = I_{mp} + I_{mg}$$

2.7) Total Energy Investments

$$I_{et} = I_{ep} + I_{eg}$$

2.8) Total Housing Investments

$$I_{ht} = I_{hp} + I_{hg}$$

2.9) Total Fixed Capital Investments

$$I_{tt} = I_{tp} + I_{tg}$$

2.10)Capital Stock in Agriculture

$$K_a = K_{a-1} + I_{at} - D_a$$

2.11)Capital Stock in Mining

$$K_b = K_{b-1} + I_{bt} - D_b$$

2.12)Capital Stock in the Manufacturing Industry

$$K_m = K_{m-1} + I_{mt} + D_m$$

2.13)Capital Stock in Energy

$$K_e = K_{e-1} + I_{et} - D_e$$

2.14)Capital Stock in Housing

$$K_h = K_{h-1} + I_{ht} - D_h$$

2.15)Total Capital Stock

$$K_t = K_{t-1} + I_{tt} - D_t$$

3. MACRO EQUILIBRIUM OF THE ECONOMY (GNP By Sources And Uses)

3.1) Public Disposable Income

$$Y_g = 395.2497 + 0.1949\, Y_t + 0.0296\, T_g - 0.0187\, T_h$$
$$(0.206) \quad (15.23) \quad (4.68) \quad (-3.35)$$

$\bar{R}^2 = 0.9835$, D.W. = 2.115, F = 359.6, MAPE = 3.38, M = 0.772

3.2) Public Consumption

$$\text{Log } C_g = -20.6211 + 0.4116 \log Y_t + 2.4308 \log N_t$$
$$(-5.90) \quad (1.51) \quad (3.85)$$

$\bar{R}^2 = 0.9833$, D.W. = 1.10, F = 533.1, MAPE = 0.396, M = 0.869

3.3) Private Disposable Income

$$Y_p = Y_t + Y_{fark} - Y_g$$

3.4) Private Investment

$$I_p = I_{tp} + I_{sp}$$

3.5) Public Investment

$$I_g = I_{tg} + I_{sg}$$

3.6) Total Investment

$$I_t = I_p + I_g$$

3.7) Total Consumption

$$C_t = Y_t + Y_{fark} + S_f - I_t$$

3.8) Private Consumption

$$C_p = C_t - C_g$$

3.9) Public Savings

$$S_g = Y_g - C_g$$

3.10) Private Savings

$$S_p = Y_p - C_p$$

3.11) Total Disposable Income

$$Y_k = Y_t + Y_{fark}$$

3.12)Total Disposable Income (at current prices)

$$Y_k^c = Y_t^c + Y_{fark}^c$$

3.13)Private Disposable Income(at current prices)

$$Y_p^c = Y_k^c - Y_g^c$$

3.14)Private Investment(at current prices)

$$I_p^c = I_{tp} \cdot P_{in} + I_{sp}^c$$

3.15)Total Investment(at current prices)

$$I_t^c = I_p^c + I_{tg}^c + I_{sg}^c$$

3.16)Total Consumption(at current prices)

$$C_t^c = Y_k^c + S_f^c - I_t^c$$

3.17)Private Consumption(at current prices)

$$C_p^c = C_t^c - C_g^c$$

3.18)Public Savings (at current prices)

$$S_g^c = Y_g^c - C_g^c$$

3.19)Private Savings(at current prices)

$$S_p^c = Y_p^c - C_p^c$$

4. FUNCTIONAL DISTRIBUTION OF INCOME

4.1) Agricultural Income

$$F_a = -4323.239 + 1.1059\ Y_a - 225.9454\ P_{su}$$
$$(-1.30) \quad (11.89) \quad (-3.58)$$

$\bar{R}^2 = 0.922$, D.W. = 1.509, F = 107.4, MAPE = 2.38, M = 0.823

4.2) Non-Agricultural Wage Income

$$F_w = -53774.062 + 1151.4925\ (W^c / P_u) + 13.036\ (E_t - E_a)$$
$$(-9.603) \quad (9.667) \quad (17.904)$$

$\bar{R}^2 = 0.9498$, D.W. = 1.515, F = 171.4, MAPE = 4.65, M = 1.10

4.3) Total Domestic Factor Income

$$F_t = -3104.6315 + 0.8543\ Y_t$$
$$(-1.254) \quad (59.14)$$

$\bar{R}^2 = 0.9948$, D.W. = 1.546, F = 3498.4, MAPE = 1.62, M = 0.977

4.4) Non-Agricultural Non-Wage Income (Profit Income)

$$F_d = F_t - F_a - F_w$$

4.5) Agricultural Income (at current prices)

$$F_a^c = F_a \cdot P_a$$

4.6) Non-Agricultural Wage Income (at current prices)

$$F_w^c = F_w \cdot P_u$$

4.7) Total Domestic Factor Income (at current prices)

$$F_t^c = F_t \cdot P_d$$

4.8) Non-Agricultural Non-Wage Income (at current prices)

$$F_d^c = F_t^c - F_a^c - F_w^c$$

5. POPULATION, EMPLOYMENT AND WAGE DETERMINATION

5.1) Total Population

$$\text{Log } N_t = \underset{(-58.49)}{-34.9763} + \underset{(76.16)}{0.02307}\, t$$

$\bar{R}^2 = 0.9969$, D.W. = 0.407 F = 5801.2, MAPE = 0.055, M = 0.96

5.2) Urban Population

$$N_u = \underset{(-66.82)}{-15534.6797} + \underset{(136.69)}{0.8072}\, N_t$$

$\bar{R}^2 = 0.995$, D.W. = 0.318 F = 18685.4, MAPE = 0.70, M = 1.03

5.3) Urbanization Rate

$$N_u^0 = (N_u/N_t).100$$

5.4) Labour Supply

$$\text{Log } L_t = \underset{(0.342)}{0.0456} + \underset{(11.96)}{0.8868}\, (\text{Log } N_t - 0.8319 \log N_{t-1}) + 0.8319 \text{ Log } L_{t-1}$$

$\bar{R}^2 = 0.8875$, D.W. = 1.11 , $\hat{\rho} = 0.8319$, F = 143.1, MAPE = 0.32, M = 0.65

5.5) Labour Demand (agriculture)

$$\text{Log } E_a = \underset{(0.96)}{0.2314} + \underset{(37.34)}{0.9746} \log E_{a-1}$$

$\bar{R}^2 = 0.987$, D.W. = 0.87 , $X^2 = 10.88$, F = 1394.2, MAPE = 0.01, M = 0.70

5.6) Labour Demand (manufacturing industry)

$$E_m = \underset{(27.17)}{850.7886} + \underset{(3.53)}{0.0186}\, I_{mp} - \underset{(-0.62)}{0.6373}\, (W^c / P_u) + \underset{(21.39)}{0.0147}\, Y_m$$

$\bar{R}^2 = 0.995$, D.W. = 0.75 , $X^2 = 2.44$, F = 1270.8, MAPE = 0.73, M = 0.98

5.7) Labour Demand (Construction)

$$E'_c = 49.1246 + 0.032575\ (Y_c - 0.6835\ Y_{c-1}) + 0.6835\ E_{c-1}$$
$$(19.14) \quad (45.08)$$

$$\bar{R}^2 = 0.9912\ ,\ D.W. = 1.96\ ,\ \hat{\rho} = 0.6835,\ F = 2032.4,\ MAPE = 1.31,\ M = 0.92$$

5.8) Labour Demand (Services)

$$E_s = 1231.9040 + 0.0228\ Y_s - 1.3059\ (W^c\ /\ P_u)$$
$$(47.516) \quad (144.18) \quad (-1.87)$$

$$\bar{R}^2 = 0.9992\ ,\ D.W. = 0.768, \quad F = 11569.4,\ MAPE = 0.45,\ M = 0.97$$

5.9) Labour Demand (Industry)

$$E_i = E_m + E_b + E_e$$

5.10)Total Labour Demand

$$E_t = E_a + E_i + E_c + E_s$$

5.11)Non-Agricultural Labour Surplus

$$U_n = L_t - E_t$$

5.12)Total Labour Surplus

$$U_t = U_n + U_a$$

5.13)Unemployment Rate

$$U_t^o = (U_t\ /\ L_t)\ .\ 100$$

5.14)Labour Productivity (Industry)

$$E_v = Y_i\ /\ E_i$$

5.15)Average Nominal Wage Rate (daily)

$$\text{Log}\ W^c = -0.8955 + 1.0058\ \log W^c_{-1} + 0.3388\ \log E_v$$
$$(-2.905) \quad (39.59) \quad (2.65)$$

$$\bar{R}^2 = 0.9981\ ,\ D.W. = 1.26\ ,\ X^2 = 1.11,\ F = 4693.1,\ MAPE = 0.89,\ M = 0.97$$

5.16)Average Real Wage Rate(daily)

$$W = W^c\ /\ P_u$$

6. FOREIGN TRADE

6.1) Total Imports

$$\text{Log } Z_t = \underset{(-1.57)}{-4.554} + \underset{(2.08)}{1.1663} \log (Y_a + Y_i) - \underset{(-0.56)}{0.027} \log e_m + \underset{(2.14)}{0.4879} \log Z_{t-1}$$

$\bar{R}^2 = 0.9593$, D.W. = 1.85 , $X^2 = 0.22$, F = 142.3, MAPE = 0.58, M = 0.52

6.2) Raw Material Imports

$$\text{Log } Z_r = \underset{(-0.64)}{-0.5396} + \underset{(2.43)}{0.8060} \log Y_i + \underset{(2.53)}{0.4996} \log Z_{r-1}$$

$\bar{R}^2 = 0.9644$, D.W. = 1.97 , $X^2 = 0.22$, F = 244.9, MAPE = 0.60, M = 0.54

6.3) Machinery and Equipment Imports

$$\text{Log } Z_m = \underset{(-0.94)}{-3.7733} + \underset{(0.65)}{0.3302} \log (Y_a + Y_i) + \underset{(8.84)}{1.0182} \log Z_{m-1}$$

$\bar{R}^2 = 0.9749$, D.W. = 1.59 , $X^2 = 0.22$, F = 351.8, MAPE = 1.01, M = 0.61

6.4) Consumer Goods Imports

$$\text{Log } Z_c = \underset{(-1.75)}{-10.8049} + \underset{(2.81)}{2.1955} \log Y_t \underset{(-3.06)}{-0.543} \log (P_c^{\$} \cdot e_m) - \underset{(-1.68)}{0.4044} \log (P_{oecd}/P_u)$$

$$- \underset{(-0.301)}{0.0806} \log Z_{c-1}$$

$\bar{R}^2 = 0.6864$, D.W. = 1.23 , $X^2 = 8.22$, F = 10.85, MAPE = 1.32, M = 0.63

6.5)* Total Exports

$$\text{Log } X_t = \underset{(-0.86)}{-7.1622} + \underset{(2.13)}{1.6303} \log Y_t + \underset{(1.965)}{0.2541} \log e_x - \underset{(-2.82)}{0.7991} \log P_{tx}^{\$}$$

$$+ \underset{(0.24)}{0.0596} \log ((G_x + M_x) / P_y) + \underset{(0.812)}{0.1621} \log X_{t-1}$$

$\bar{R}^2 = 0.849$, D.W. = 1.89 , $X^2 = 0.84$, F = 15.64, MAPE = 0.66, M = 0.80

6.6)*Agricultural Exports

$$\text{Log } X_a = \underset{(-1.06)}{-9.1404} + \underset{(2.43)}{4.1227} \log Y_{oecd} \underset{(-1.59)}{-0.3366} \log P_y + \underset{(2.466)}{0.6546} \log ((G_x+M_x)/P_y)$$

$\bar{R}^2 = 0.7878$, D.W. = 1.40, F = 17.0, MAPE = 0.94, M = 0.73

6.7)*Industrial Exports

$$\text{Log } X_a = \underset{(-0.43)}{-1.38} + \underset{(4.23)}{1.366} \log Y_i + \underset{(3.93)}{1.2456} \log e_x - \underset{(-2.55)}{0.6551} \log (P^{\$}_{mx} \cdot e_x)$$

$\bar{R}^2 = 0.8848$, D.W. = 1.04, F = 47.1, MAPE = 1.64, M = 0.91

6.8) Total Imports ($)

$$Z^{\$}_t = Z_t \cdot P_{tz} / e_{mg}$$

6.9) Total Exports ($)

$$X^{\$}_t = X_t \cdot P_{tx} / e_{xg}$$

6.10)Trade Deficit ($)

$$Z^{\$}_a = Z^{\$}_t - X^{\$}_t$$

7. PRICES

7.1) Agricultural Price Deflator

$$P_a = \underset{(-2.84)}{-38.18} + \underset{(8.69)}{97.70}\, P_{su} + \underset{(3.96)}{284.46} \left(\frac{M_s + M_{s-1}}{2\, Y_t} \right) - \underset{(-3.17)}{0.27}\, P_{a-1}$$

$\bar{R}^2 = 0.9988$, D.W. = 1.55, F = 5289.1, MAPE = 6.12, M = 1.0

7.2) Manufacturing Price Deflator

$$P_m = \underset{(3.86)}{74.54} - \underset{(-6.32)}{0.0036}\, Y_i + \underset{(49.13)}{1.2037}\, P_y - \underset{(-2.32)}{0.1217}\, P_{m-1}$$

$\bar{R}^2 = 0.9998$, D.W. = 1.72, F $\simeq$ 33589.7, MAPE $\simeq$ 4.77, M $\simeq$ 0.98

7.3) Construction Price Deflator

$$P_c = \underset{(3.93)}{42.36} + \underset{(0.74)}{11.50}\, P_h + \underset{(11.53)}{0.6558}\, P_y$$

$\bar{R}^2 = 0.9985$, D.W. = 0.84 F $\simeq$ 6017.7, MAPE $\simeq$ 6.10, M $\simeq$ 0.96

7.4) Services Price Deflator

$$P_s = \underset{(1.74)}{16.56} + \underset{(4.15)}{0.2487}\, P_a + \underset{(15.20)}{0.7076}\, P_m$$

$\bar{R}^2 = 0.9996$, D.W. = 1.20 F = 27740.1, MAPE = 6.10, M = 0.99

7.5) Industrial Price Deflator

$$P_i = \underset{(-1.24)}{-11.03} + \underset{(31.39)}{0.9202}\, P_m + \underset{(2.65)}{0.1058}\, P_{i-1}$$

$\bar{R}^2 = 0.9996$, D.W. = 2.03 F $\simeq$ 23009.9, MAPE $\simeq$ 5.71, M $\simeq$ 0.99

7.6) Gross Domestic Product Deflator

$$P_d = \underset{(1.10)}{1.335} + \underset{(17.18)}{0.2086}\, P_a + \underset{(14.22)}{0.2181}\, P_i + \underset{(22.87)}{0.5632}\, P_s$$

$\bar{R}^2 = 0.999$, D.W. = 1.78 F $\simeq$ 1233614.0, MAPE $\simeq$ 0.43, M $\simeq$ 1.0

7.7 Gross National Product Deflator

$$P_y = -20.08 + 15.65\, P_{rm} + 161.88 \left(\frac{M_s + M_{s-1}}{2\, Y_t} \right) + 0.5588\, P_a$$
$$(-1.39) \quad (7.38) \quad (2.64) \quad (6.36)$$

$\bar{R}^2 = 0.999$, D.W. $=1.24$ $F = 10248.7$, MAPE $= 8.20$, $M = 0.98$

7.8) Wholesale Prices Index (General)

$$P_t = 12.8774 + 98.6710\, (P_y/100) - 0.1360\, P_{t-1}$$
$$(2.67) \quad (44.66) \quad (-4.14)$$

$\bar{R}^2 = 0.9998$, D.W.$=2.29$, $X^2 = 2.0$ $F = 50755.1$, MAPE $= 1.31$, $M = 0.99$

7.9) Wholesale Prices Index (Foodstuffs)

$$P_g = 15.0108 + 48.9618\, (P_a/100) + 33.4858\, (P_y/100)$$
$$(3.77) \quad (12.73) \quad (9.98)$$

$\bar{R}^2 = 0.9999$, D.W. $= 2.70$ $F = 82944.8$, MAPE $= 2.13$, $M = 0.99$

7.10)Wholesale Prices Index(Industrial Raw Materials and Semi-finished Products)

$$P_r = 6.1151 + 176.2606\, (P_y/100) - 74.3259\, (P_a/100)$$
$$(0.33) \quad (11.58) \quad (-4.26)$$

$\bar{R}^2 = 0.9989$, D.W. $= 2.01$ $F = 8644.5$, MAPE $= 5.69$, $M = 0.94$

7.11)Istanbul Cost of Living Index

$$\text{Log } P_u = 1.0317 + 0.7004 \log P_g + 0.1494 \log P_{u-1} + 0.2415 \log \left(\frac{M_s + M_{s-1}}{2\, Y_t} \right)$$
$$(0.98) \quad (3.74) \quad (1.28) \quad (1.35)$$

$\bar{R}^2 = 0.9981$, D.W. $= 0.86$, $X^2 = 2.44$ $F = 3133.6$, MAPE $= 0.79$, $M = 0.96$

8. PUBLIC FINANCE

8.1) Direct Taxes

$$\text{Log } T_d = \underset{(-10.43)}{-13.9584} + \underset{(17.04)}{1.94551} \log Y_t + \underset{(40.88)}{1.0338} \log \left(\frac{P_y}{100}\right)$$

$\bar{R}^2 = 0.9986$, D.W. = 0.97 F = 6802.3, MAPE = 0.45, M = 0.98

8.2) Taxes on Goods

$$T_p = \underset{(-3.40)}{-10193.8657} + \underset{(3.85)}{0.0774}\, Y_t + \underset{(86.63)}{5579.958}\, (P_y/100)$$

$\bar{R}^2 = 0.9985$, D.W. = 1.92 F = 7864.0, MAPE = 6.57, M = 0.98

8.3) Taxes on Services

$$\text{Log } T_s = \underset{(-18.54)}{-3.3567} + \underset{(10.08)}{0.9246} \log Y^c_s + \underset{(0.88)}{0.0943} \log Y^c_{s-1}$$

$\bar{R}^2 = 0.9981$, D.W. = 1.09 F = 4776.6, MAPE = 0.68, M = 0.96

8.4) Taxes on Foreign Trade

$$\text{Log } T_z = \underset{(-2.11)}{-0.6985} + \underset{(1.21)}{0.1002} \log (Z_t \cdot P_{tm}) + \underset{(7.31)}{0.9118} \log T_{z-1}$$

$\bar{R}^2 = 0.9953$, D.W. = 2.72 , $X^2 = 2.88$ F = 1520.9, MAPE = 0.59, M = 0.89

8.5) Indirect Taxes

$$T_i = T_p + T_s + T_z$$

8.6) Total Tax Revenues

$$T_v = T_d + T_i$$

8.7) Central Budget Revenues

$$T_g = T_v + T_n + T_o$$

9. MONEY AND CREDIT

9.1) Banknotes Issued

$$\text{Log } M_h = \underset{(2.06)}{0.7806} + \underset{(1.59)}{0.2342} \log M_t + \underset{(0.645)}{0.1326} \log M_k + \underset{(3.86)}{0.5704} \log M_{h-1}$$

$\bar{R}^2 = 0.9950$, D.W. = 1.83 , $X^2 = 0.23$ $F = 864.2$, MAPE = 0.50, M = 0.95

9.2) Sight Commercial and Savings Deposits

$$\text{Log}\left(\frac{M_d}{P_y}\right) = \underset{(-3.13)}{-3.8113} + \underset{(4.79)}{0.9904} \log Y_t - \underset{(-4.86)}{0.2278} \log R_v - \underset{(-0.39)}{0.0040} \log P_k + \underset{(1.79)}{0.2559} \log \left(\frac{M_{d-1}}{P_{y-1}}\right)$$

$\bar{R}^2 = 0.9585$, D.W. = 1.58 , $X^2 = 3.77$ $F = 104.9$, MAPE = 0.39, M = 0.77

9.3) Time Commercial and Savings Deposits

$$\text{Log}\left(\frac{M_v}{P_y}\right) = \underset{(1.68)}{1.2997} + \underset{(2.91)}{0.2745} \log R_v - \underset{(-2.37)}{0.0702} \log P_k - \underset{(-0.114)}{0.0088} \log \left(\frac{(P_{y-1} - P_{y-2})}{P_{y-2}} \cdot 100\right) + \underset{(8.33)}{0.8162} \log \left(\frac{M_{v-1}}{P_{y-1}}\right)$$

$\bar{R}^2 = 0.9112$, D.W. = 1.81 , $X^2 = 0.67$ $F = 47.1$, MAPE = 1.18, M = 0.67

9.4) Money Supply

$$M_s = M_h + M_d - M_r$$

9.5*) Central Bank Agricultural Price Support Credits

$$\text{Log } M_u = \underset{(0.054)}{1.1310} + \underset{(0.005)}{0.0109} \log Y_a + \underset{(0.16)}{0.0479} P_{su} + \underset{(2.71)}{0.9001} \log M_{u-1}$$

$\bar{R}^2 = 0.9517$, D.W. = 2.10 , $X^2 = 0$, $F = 79.8$, MAPE = 2.16, M = 0.60

9.6) Central Bank's Credits to the Manufacturing Industry

$$\text{Log } M_m = \underset{(-4.67)}{-24.5328} + \underset{(4.99)}{1.0185} \log M_t + \underset{(3.61)}{2.2657} \log Y_m - \underset{(-1.21)}{0.1931} \log P_m$$

$\bar{R}^2 = 0.9928$, D.W. = 1.53, $F = 601.7$, MAPE = 1.23, M = 0.92

9.7) Deposit Banks' Credits to the Manufacturing Industry

$$\text{Log } G_m = \underset{(-4.52)}{-15.0665} + \underset{(0.97)}{0.1261} \log M_t + \underset{(5.16)}{2.0567} \log Y_m + \underset{(5.00)}{0.5064} \log P_m$$

$\bar{R}^2 = 0.9943$, D.W. = 1.41 F = 760.5, MAPE = 0.62, M = 0.93

9.8) Total Central Bank Credits

$$M_t = M_u + M_m + M_p + M_a + M_b + M_e + M_c + M_g + M_x + M_f$$

9.9) Total Deposit Bank Credits

$$G_t = G_m + G_a + G_b + G_e + G_z + G_x + G_c + G_g + G_u + G_s + G_o + G_d$$

10. CONSTRUCTION AND ENERGY

10.1) Electricity Consumption

$$\text{Log } A_c = \underset{(-11.89)}{-22.8147} + \underset{(8.24)}{2.8584} \log N_t + \underset{(4.95)}{0.7407} \log Y_t$$

$\bar{R}^2 = 0.9972$, D.W. = 0.79   F = 3229.4, MAPE = 0.14, M = 1.03

10.2) Electricity Production

$$\text{Log } A_p = \underset{(31.25)}{10.5934} + \underset{(0.58)}{0.0791} I_{et} + \underset{(6.22)}{0.5365} K_e$$

$\bar{R}^2 = 0.974$, D.W. = 0.34, F = 339.3, MAPE = 0.41, M = 1.07

10.3) Area Constructed (m^2)

$$\text{Log } A_a = \underset{(-2.61)}{-7.1791} - \underset{(-1.02)}{0.1720} \log R_v - \underset{(-0.70)}{0.0806} P_h - \underset{(-1.57)}{1.7298} \log Y_t + \underset{(2.78)}{3.2105} \log Y_{t-1}$$

$\bar{R}^2 = 0.887$, D.W. = 2.26,   F = 36.5, MAPE = 0.84, M = 0.72

LIST OF VARIABLES

A_a	Area Constructed (m^2)
A_c	Electricity Consumption
A_p	Electricity Production
C_g	Public Consumption
C_p	Private Consumption
C_t	Total Consumption
D_a	Depreciation (agricultural sector)
D_b	Depreciation (mining sector)
D_e	Depreciation (energy sector)
D_h	Depreciation (construction sector)
D_m	Depreciation (manufacturing industry)
D_t	Depreciation (overall economy)
D_{77}	Dummy (1977, 1978, 1979=1, otherwise=0)
D_{80}	Dummy (1980, 1981, 1982, 1983=1, otherwise=0)
E_a	Labour Demand (agriculture)
E_b	Labour Demand (Mining)
E_c	Labour Demand (Construction)
E_i	Labour Demand (Industry)
E_m	Labour Demand (Manufacturing Industry)
E_s	Labour Demand (Services)
E_t	Total Labour Demand
E_v	Labour Productivity (Industry)
e_m	Official Exchange Rate Applicable to Imports (TL/$)
e_x	Official Exchange Rate Applicable to Exports (TL/$)

e_{mg} Implicit Exchange Rate for Imports

e_{xg} Implicit Exchange Rate for Exports

F_a Agricultural Income

F_d Non-agricultural, Non-Wage Income

F_w Non-agricultural Wage Income

F_t Total Domestic Factor Income

G_a Deposit Banks' Credits to Agriculture

G_b Deposit Banks' Credits to Mining

G_c Deposit Banks' Credits to Construction

G_d Deposit Banks' Undistributed Credits

G_e Deposit Banks' Credits to Energy

G_g Deposit Banks' Credits to Small Tradesman & Artisans

G_m Deposit Banks' Credits to the Manufacturing Industry

G_o Deposit Banks' Credits to Other Financial Institutions

G_s Deposit Banks' Domestic Trade Credits

G_u Deposit Banks' Credits to Tourism

G_x Deposit Banks' Export Credits

G_z Deposit Banks' Import Credits

G_t Total Deposit Banks' Credits

I_{ag} Public Fixed Capital Investment (agriculture)

I_{ap} Private Fixed Capital Investment (agriculture)

I_{at} Total Fixed Capital Investment (agriculture)

I_{bg} Public Fixed Capital Investment (mining)

I_{bp} Private Fixed Capital Investment (mining)

I_{bt} Total Fixed Capital Investment (mining)

I_{eg}	Public Fixed Capital Investment (energy)
I_{ep}	Private Fixed Capital Investment (energy)
I_{et}	Total Fixed Capital Investment (energy)
I_{hg}	Public Fixed Capital Investment (housing)
I_{hp}	Private Fixed Capital Investment (housing)
I_{ht}	Total Fixed Capital Investment (housing)
I_{mg}	Public Fixed Capital Investment (manufacturing industry)
I_{mp}	Private Fixed Capital Investment (manufacturing industry)
I_{mt}	Total Fixed Capital Investment (manufacturing industry)
I_{tt}	Total Fixed Capital Investment
I_{op}	Private Fixed Capital Investment (other services)
I_{dp}	Private Fixed Capital Investment (education)
I_{rp}	Private Fixed Capital Investment (tourism)
I_{up}	Private Eixed Capital Investment (transportation)
I_{kp}	Private Fixed Capital Investment (health services)
I_{sg}	Stock Changes (public sector)
I_{sp}	Stock Changes (private sector)
I_{st}	Total Stock Changes
I_p	Private Investment
I_g	Public Investment
I_t	Total Investment
I_{tp}	Private Fixed Capital Investment (Total)
K_a	Capital Stock (agriculture)
K_b	Capital Stock (mining)
K_e	Capital Stock (energy)
K_h	Capital Stock (housing)
K_m	Capital Stock (manufacturing industry)
K_t	Total Capital Stock

L_t Total Labour Supply

M_k State Economic Enterprises' Financial Requirements

M_d Sight Deposits

M_h Banknotes Issued

M_v Time Deposits

M_s Money Supply (narrow definition)

M_a Central Bank Credits (agriculture)

M_b Central Bank Credits (mining)

M_c Central Bank Credits (commercial)

M_e Central Bank Credits (energy)

M_g Central Bank Credits (small traders' and artisans)

M_m Central Bank Credits (manufacturing industry)

M_p Central Bank Short Term Advances to Treasury

M_u Central Bank Agricultural Price Support Credits

M_x Central Bank Export Credits

M_f Central Bank Bank Liqudation Fund

M_t Total Central Bank Credits

M_r Banknotes Held by the Banks.

N_t Total Population

N_u Urban Population

N_u^o Rate of Urbanization

P_a Agricultural Price Deflator

P_c Construction Deflator

P_d Gross Domestic Product Deflator

P_g Wholesale Prices Index (foodstuff)

P_i Industry Deflator

P_{in} Private Investment Deflator

P_m Manufacturing Deflator

P_s Services Deflator

P_t Wholesale Prices Index

P_u Istanbul Cost of Living Index

P_y Gross National Product Deflator

P_h Cost of Construction per m^2

P_{tm} Import Prices Index (TL.)

P_{tx} Export Prices Index (TL.)

P_{oecd} OECD Prices Index

$P_{cz}^{\$}$ Consumer Goods Import Prices Index ($)

$P_{tz}^{\$}$ Import Prices Index ($)

$P_{tx}^{\$}$ Export Prices Index ($)

P_{sup} Agricultural Support Prices Index

P_k Percentage Change in Price of Gold Ingot

R_v Time Deposit Interest Rate

S_f Foreign Savings

S_g Public Savings

S_p Private Savings

S_t Total Savings

T_d Direct Tax Revenues

T_i Indirect Tax Revenues

T_g Central Budget Revenues

T_n Non-Tax Normal Revenues

T_o Special Revenues and Funds

T_s Taxes on Services

T_p Taxes on Goods

T_v Total Tax Revenues

T_z Taxes on Foreign Trade

T_h Central Budget Expenditure

U_n Non-Agricultural Labour Surplus

U_t Total Labour Surplus

U_t^o Rate of Unemployment

W Average (daily) Nominal Wage Rate

X_a Agricultural Exports

X_i Industrial Exports

X_t Total Exports

Y_a Value Added in Agriculture

Y_b Value Added in Mining

Y_c Value Added in Construction

Y_d Gross Domestic Product

Y_e Value Added in Electricity, Gas, Water

Y_f Factor Revenues from Abroad

Y_g Public Disposable Income

Y_k Total Disposable Income

Y_p Private Disposable Income

Y_m Value Added in the Manufacturing Industry

Y_s Value Added in Services

Y_i Value Added in Industry

Y_{iv} Import Taxes

Y_{ik}	Imputed Banking Service Changes
Y_{vv}	Indirect Tax Revenues
Y_{su}	Subsidies
Y_{fark}	Discrepancy Between State Planning Office and SIS GNP estimates
Y_{oecd}	Index for OECD Income
Y_{fa}	Gross National Income (at Factor Cost)
Y_t	Gross National Product
Z_c	Consumer Goods Imports
Z_m	Machinery and Equipment Imports
Z_r	Raw Material Imports
Z_t	Total Imports
$Z_a^{\$}$	Trade Deficit ($)

CHAPTER III

ESTIMATION AND SIMULTANEOUS SOLUTION OF THE MODEL

The coefficients of the model have been estimated by the Ordinary Least Squares Method, and where high auto-correlation was detected, the Generalized Least Squares Method was preferred in estimating the equation. The auto-correlation coefficient (ρ) is given under the equations corrected for auto-correlation. X^2 "Independence test" as well as the Durbin-Watson Test were applied in the detection of auto-correlation. However, the Durbin-Watson test becomes misleading, especially in cases where the equation includes lagged endogenous variables, so the auto-correlation test needed to be supported by other tests, such as the X^2 "independence test" or Durbin's h test.

Following the estimation of the coefficient, a simultaneous solution of the model is done using the Gauss-Seidel approach. At 0.0001 tolerance level, 10-12 iterations have yielded satisfactory results. That the solution of a model consisting of over 100 equations yielded satisfactory results after a relatively small number of iterations was mainly due to the fact that initial values were set equal to actual values.

GEP (General Econometric Package) and "M" (Model Solution and Simulation) computer programs are used in estimation of the regression coefficients and solution of the model. Both programs were developed by Suleyman Ozmucur.

EX - POST SIMULATION

	Manufacturing Value Added			Construction Value Added			Value Added by Industry			GNP(at 1968 Constant Prices)		
	Actual	Simulated	Percentage Error	Actual	Simulated	Percentage Error	Actual	Simulated	Percentage Error	Actual	Simulated	Percentage Error
1977	44708.9	44575.40	0.299	12045.1	11870.60	1.449	51766.4	51633.84	0.256	203358.2	220413.5	1.448
1978	46130.6	51481.64	-11.600	12545.3	12577.77	-0.259	53546.0	58896.55	-9.992	209182.6	215144.5	-2.850
1979	43316.6	42411.56	2.089	13068.7	12654.08	3.173	51050.2	50143.54	1.775	208343.1	188266.3	2.131
1980	41618.6	40623.10	2.390	13173.7	12969.49	1.550	49548.7	48554.01	2.008	206120.9	203941.0	1.058
1981	45549.2	50487.02	-10.840	13231.7	13478.42	-1.865	54044.3	58981.10	-9.135	214577.3	224886.1	-4.804
1982	48473.3	49534.01	- 2.188	13297.9	13559.08	-1.964	57471.7	58531.54	-1.844	224542.8	227007.3	-1.098
1983	52089.4	49083.14	5.771	13377.7	93667.28	-2.160	61128.0	58122.50	4.917	231942.0	230188.2	0.756
MAPE (1977-83)			(5.025)			(1.774)			(4.270)			(1.997)

	Private Manufacturing Investments			Private Housing Investments			Total Investment			Total Consumption		
	Actual	Simulated	Percentage Error	Actual	Simulated	Percentage Error	Actual	Simulated	Percentage Error	Actual	Simulated	Percentage Error
1977	6302.54	6220.93	1.290	7490.44	7678.68	-2.513	53291.0	53397.80	-0.200	184208.0	181156.8	1.656
1978	5510.24	6755.76	-22.600	6965.01	7770.61	-11.560	44980.0	47030.98	-4.560	196328.0	200238.6	-1.992
1979	4559.82	5387.57	-18.150	7684.18	-7643.28	0.532	42570.2	43357.09	-0.684	176808.8	171922.8	2.763
1980	4217.39	4444.03	- 5.370	9095.90	6998.32	23.061	42105.9	40235.04	4.440	184898.1	184589.0	0.167
1981	4420.78	4629.64	- 4.720	5508.61	6664.50	-20.984	42558.9	43923.60	-3.200	185452.1	194396.6	-4.820
1982	4326.49	4549.20	- 5.140	5877.60	6559.80	-11.600	43146.0	44050.90	-2.090	188509.0	190068.3	-0.827
1983	4368.10	4375.45	- 0.168	6180.90	5980.50	3.240	45093.8	44900.82	0.428	196615.6	195054.8	0.794
MAPE (1977-83)			(8.209)			(10.500)			(2.390)			(1.860)

EX - POST SIMULATION

	Agricultural Income			Non-Agricultural Wage Income			Non-Agricultural Non-Wage Income			Total Employment		
	Actual	Simulated	Percentage Error	Actual	Simulated	Percentage Error	Actual	Simulated	Percentage Error	Actual	Simulated	Percentage Error
1977	42370.80	42366.43	0.010	64742.90	53963.14	16.650	64432.00	71779.05	-11.400	15138.30	15114.03	0.160
1978	43558.40	43336.70	0.509	58059.70	57932.61	0.219	77743.00	79424.05	- 2.162	15248.90	15407.41	-1.039
1979	44794.00	44915.72	-0.272	55879.40	52469.30	6.100	68741.00	73995.73	- 7.644	15256.10	15173.26	0.543
1980	45566.70	42838.41	5.980	46800.20	42634.06	8.902	83879.10	85649.67	- 2.110	15227.50	15178.77	0.320
1981	45028.00	43207.80	4.040	45814.30	48569.50	-6.010	93183.70	97238.10	- 4.350	15367.60	15548.65	-1.178
1982	47647.60	43977.04	7.704	45921.50	48710.08	-6.072	98771.90	98140.63	0.639	15457.00	15574.40	-0.760
1983	37459.95	44888.53	-12.831	43875.03	48388.00	-10.286	112361.20	100268.60	10.760	15591.70	15584.72	0.045
MAPE (1977-83)			(5.470)			(7.740)			(5.580)			(0.570)

	Average Nominal Wage			Total Imports		
	Actual	Simulated	Percentage Error	Actual	Simulated	Percentage Error
1977	146.53	150.56	-2.756	5796270.80	5295965.00	8.632
1978	207.93	196.09	5.690	4599024.00	5804793.00	-26.210
1979	294.31	271.47	7.760	5069432.00	5748461.00	-13.395
1980	426.96	383.57	10.160	7667324.00	6862025.00	10.503
1981	534.84	578.93	-8.240	8933365.00	9820883.00	- 9.930
1982	685.00	725.89	-5.970	8842665.00	9477879.00	- 7.840
1983	907.00	931.23	-2.670	9235001.00	8425007.00	6.605
MAPE			(6.170)			(11.780)

EX - POST SIMULATION

	Total Exports			GNP Deflatör (1968=100)			Banknotes Issued			Money Supply (Narrow Definition)		
	Actual	Simulated	Percentage Error	Actual	Simulated	Percentage Error	Actual	Simulated	Percentage Error	Actual	Simulated	Percentage Error
1977	1753026.0	1926673.0	-9.906	429.23	490.69	-14.310	77944.0	77380.48	0.723	227556.0	225007.9	1.120
1978	2288163.0	2296408.0	-0.360	617.03	633.82	- 2.721	113725.0	114674.00	-0.834	282302.0	292565.1	-3.636
1979	2261195.0	2570381.0	-13.670	1055.72	940.86	10. 70	182888.0	167399.00	8.460	439896.0	383127.3	12.900
1980	2910122.0	3186362.0	-9.492	2151.72	2131.50	0.940	278620.0	258982.00	7.048	696102.0	727560.3	-4.510
1981	4702934.0	4128865.0	12.207	3054.32	3003.48	1.660	386527.0	391620.00	-1.318	958862.0	988792.0	-3.121
1982	5745973.0	5241145.0	8.780	3890.15	3816.40	1.890	542888.0	482209.00	11.177	1332388.0	1242356.0	6.750
1983	5727833.0	648964.5	-13.300	4960.99	5009.90	-0.988	535700.0	640039.90	-19.470	1684600.0	1693642.0	-0.537
MAPE (1977-83)			(9.670)			(4.770)			(7.000)			(4.650)

	Sight Deposits		
	Actual	Simulated	Percentage Error
1977	145352.0	163367.4	-12.394
1978	189301.0	198615.1	- 4.920
1979	297123.0	255842.5	13.890
1980	479524.0	530620.3	-10.650
1981	679360.0	704199.8	- 3.650
1982	921561.0	892209.3	3.180
1983	1326200.0	1248402.0	5.860
MAPE (1977-83)			(7.790)

MEAN ABSOLUTE PERCENTAGE ERRORS (MAPE) 1971-1983

1.	Y_a	1.01	26.	K_e	0.00	50.	F_d^c	6.21
2.	Y_m	3.60	27.	K_h	1.28	51.	F_t^c	5.62
3.	Y_c	1.48	28.	K_t	0.25	52.	F_a	5.05
4.	Y_s	1.17	29.	Y_p	3.41	53.	F_w	4.41
5.	Y_i	3.07	30.	C_g	5.96	54.	F_d	3.79
6.	Y_d	1.07	31.	Y_g	7.32	55.	F_t	1.44
7.	Y_t	1.07	32.	I_p	4.79	56.	N_t	0.42
8.	Y_{fa}	1.16	33.	I_g	0.00	57.	N_u	0.78
9.	Y_a^e	5.28	34.	I_t	2.10	58.	N_u^o	0.48
10.	Y_i^c	10.35	35.	C_t	1.19	59.	E_t	0.33
11.	Y_s^c	4.23	36.	C_p	2.05	60.	U_n	4.01
12.	Y_d^c	4.93	37.	S_g	23.06	61.	U_t	2.96
13.	Y_t^c	5.09	38.	S_p	21.56	62.	L_t	0.34
14.	I_{mp}	6.05	39.	Y_p^c	6.23	63.	U_t^o	2.70
15.	I_{hp}	10.26	40.	I_p^c	4.25	64.	E_a	0.09
16.	I_{tp}	4.85	41.	I_t^c	1.76	65.	E_m	1.46
17.	I_{at}	0.00	42.	C_t^c	6.15	66.	E_c	1.01
18.	I_{bt}	0.00	43.	C_p^c	7.27	67.	E_j	0.82
19.	I_{mt}	2.98	44.	S_g^c	0.00	68.	E_i	1.28
20.	I_{et}	0.00	45.	S_p^c	3.21	69.	E_v	1.77
21.	I_{ht}	9.46	46.	Y_k	2.43	70.	E^c	5.86
22.	I_{tt}	2.14	47.	Y_k^c	5.12	71.	W	5.81
23.	K_a	0.00	48.	F_a^c	5.76	72.	Z_t	10.91
24.	K_b	0.0	49.	F_w^c	6.76	73.	Z_m	14.84
25.	K_m	0.40				74.	Z_r	11.15

75.	Z_c	22.60	100.	M_h	6.60
76.	X_a	11.88	101.	M_d	4.62
77.	X_i	31.68	102.	M_v	16.00
78.	X_t	11.38	103.	M_s	4.89
79.	$Z_t^{\$}$	10.91	104.	M_u	21.05
80.	$X_t^{\$}$	11.38	105.	M_m	17.84
81.	$Z_a^{\$}$	30.20	106.	G_m	8.80
82.	P_a	5.23	107.	M_t	6.66
83.	P_i	11.37	108.	G_t	3.10
84.	P_c	4.22	109.	A_c	3.39
85.	P_d	5.56	110.	A_p	4.65
86.	P_s	4.59	111.	A_a	7.98
87.	P_m	9.08			
88.	P_y	5.71			
89.	P_t	6.60			
90.	P_g	5.65			
91.	P_r	9.23			
92.	P_u	7.83			
93.	T_d	11.06			
94.	T_p	6.71			
95.	T_s	3.63			
96.	T_z	9.01			
97.	T_i	4.72			
98.	T_v	7.84			
99.	T_g	6.64			

Average for the model 5.91

CHAPTER IV

FORECASTS

In this section, forecasts based on the TUSIAD econometric model are provided for some principal economic magnitudes for 1985. Revised forecasts for 1985 will follow upon publication of actual figures for 1984. Long delays in the publication of actual figures in Turkey impedes reliable forecasting well ahead of time.

The 1985 forecasts are based on the following assumptions;

a) There will be no major deviation from the 1980 stabilization programme;
b) There will be no major structural change in the economy;
c) The world economy will follow a similar conjoncture as in the 1981-1984 period and,
d) No major disturbances will occur in the domestic or world economies.

On the basis of recent monetary and fiscal trends in the Turkish economy and the expected government policies for 1985, the following forecasts are made by the TUSIAD Forecasting Group.

In 1985,

- GNP (at constant 1968 prices) is expected to grow at 4.8-5.2%
- The rate of inflation will be around 38 - 42%, well above the government's target of 25%.
- Imports will reach $ 11.0 billion and exports $ 7.3 billion leaving a foreign trade deficit of around $ 3.7 billion.
- The Turkish Lira will continue to depreciate, and the exchange rate (TL/$) will be over 600 by the year-end.
- The volume of excess labour will continue to increase and it will be of the order of 16.6% at the end of 1985.

GROWTH BY MAIN ECONOMIC SECTORS
(At 1968 Constant Prices)

	(% Growth)
Agriculture	3.0
Manufacturing Industry	7.5
Construction	1.0
Services	4.9
Gross National Product	5.0

CONSUMPTION-INVESTMENT
(At 1968 Constant Prices)

	(% Growth)
Total Consumption	5.5
Total Fixed Investments	4.0

GROWTH AND INFLATION

	(%)
GNP Growth Rate	4.8-5.2
Rate of Inflation	38-42

TRADE BALANCE
(Billion $)

Imports	11.0
Exports	7.3
Trade Deficit	3.7

EXCHANGE RATE
(TL/$)

Med-Year	540
1985 Average	525
End-of-Year	600-620

1986 FORECASTS*

GROWTH BY MAIN ECONOMIC SECTORS
(At 1968 prices)

	% Growth
Agriculture	2.7
Manufacturing	6.5
Construction	4.0
Services	4.7
Gross National Product	4.8

CONSUMPTION-INVESTMENT

	% Growth
Total Consumption	5.0
Total Fixed Investment	4.6

FOREIGN TRADE-EXCHANGE RATE

Exports(billion $)	8.5
Imports(billion $)	12.3
Trade Deficit(billion $)	3.8

INFLATION AND GROWTH RATE

Inflation Rate	36-40
Growth Rate	4.6-5.0

*Written in December 1985.

CHAPTER V

Policy Simulation

One of purposes of econometric model building is to provide an appropriate framework for economic policy formulation. With the aid of the model, the effects of major policy variables becomes easier to follow.

In policy simulation exercises, the "multiplier analysis" method is preferred. In this approach, it is possible to see the effects of a policy variable in current and subsequent (t+1, t+2, ...) periods. The total (long run) effect of any variable is calculated by adding the multipliers estimated for current and subsequent periods.

The multiplier analysis offers a clear advantage over what is called the "alternative scenarios" approach. If the simulation is based on the latter approach, in cases where the "expected" change in apolicy variable does not take place, the forecasts become irrelevant.

In the multiplier analysis, the value of a policy variable in period to (eg 1977) is increased by one unit while all other variables are held constant. Thus, all changes to be observed in the endogenous variables will be as a result of only that variable whose value has been changed.

The impact multiplier is given by:

$$(Y^{p}_{1977} - Y^{b}_{1977}) \ / \ (X^{p}_{1977} - X^{b}_{1977})$$

where

Y= the endogenous variable
X= the policy variable
b= base solution
p= simulated solution

The analysis is continued without altering the value of the policy variable (or of other variables) in 1978 and subsequent periods. The difference between the base and the simulated solution yields the next period's dynamic multiplier

$$(Y^{p}_{1978} - Y^{b}_{1978}) \ / \ (X^{p}_{1977} - X^{b}_{1977})$$

The analysis is repeated in exactly the same way for all subsequent periods and so dynamic multipliers for each period are obtained. The total (long-run) multiplier is given by adding together the impact and dynamic multipliers.

In this study, a "multiplier analysis" exercise is carried out for some policy variables:

The policy variables for which multiplier values will be calculated:

T_u= Non-tax normal revenues

M_k= Financial requirements of the State Economic Enterprises

P_{su}=Agricultural support prices index

e_x= Average exchange rate for exports (TL/$)

R_v= Time deposit interest rate

I_{eg}=Public sector energy investments

The table below gives the distributed effects of the above policy variables on Gross National Product and price levels;

GROSS NATIONAL PRODUCT (GNP)

	t	t+1	t+2	t+3	t+4	t+5	t+6
T_n	-0.0065	0.0044	0.0061	-0.0012	0.0032	0.0015	-0.0033
M_k	-0.9827	1.0623	1.4607	-0.2921	0.7702	0.3718	-0.7967
P_{sub}	-28.18	3.64	5.0168	-1.004	2.645	1.27	-2.73
e_x	-5.25	3.5633	4.899	-0.9799	2.583	1.2471	-2.6725
R_v	-6.944	6.944	9.548	-1.907	5.0347	2.4306	-5.2083
I_{eg}	-0.0269	0.0158	0.0217	-0.0043	0.0115	0.0055	-0.0119

GNP DEFLATOR

	t	t+1	t+2	t+3	t+4	t+5	t+6
T_n	0.000	0.00	-0.0001	0.0001	-0.0001	-0.0001	0.0003
M_k	0.0067	-0.0053	-0.0197	0.0212	-0.0336	-0.0286	0.0772
P_{sup}	13.06	-0.0182	-0.0677	0.0727	-0.1154	-0.0983	0.2651
e_x	0.0334	-0.0177	-0.0661	0.0710	-0.1127	-0.0960	0.2589
R_v	-4.775	-0.0346	-0.1289	0.1383	-0.2197	-0.1872	0.5046
I_{eg}	0.0002	-0.0001	-0.0003	0.0003	-0.0005	-0.0004	0.0011

The cumulative effects at the end of the 6th year are in this example:

TOTAL(LONG-RUN) EFFECTS

	G.N.P.	GNP Deflator
T_n	0.0011	0.0001
M_k	1.5935	0.0179
P_{sup}	-19.3422	13.0982
e_x	3.39	0.0708
R_v	9.89	-4.7025
I_{eg}	0.0114	0.0004

Given that there will be a unit increase in non-tax normal revenues. Ceteris paribus, this change will, within the same period, lead to a 0.0065 unit fall in GNP, but a 0.0044 unit increase in the next period. The cumulative effect at the end of the 6th period is to increase GNP by 0.0011 unit. More precisely, if non-tax normal revenues are raised by TL 1 bn., there will be a TL 1.1 mn. increase in GNP, expressed at constant 1968 prices.

The cumulative (long-run) effect of devaluation is to increase the level of income and prices.

The time deposit interest rate is estimated to have a deflationary effect on both income and prices in the initial period. On the other hand, the total (6-year) effect, of devaluation is to induce a rise in the general level of prices and a decline in income.

APPENDIX I

Criteria Used In The Selection Of The Model's Equations

The following criteria are used in the selection of 50 behavioral equations:

1) Whether or not the estimated regression coefficients are of (apriori) expected sign.

2) Whether or not the estimated regression coefficients are statistically significant (significantly different from zero)

The estimated coefficients can be classified in four groups:

a) Rightly signed and statistically significant
b) Rightly signed but statistically insignificant
c) Wrongly signed but statistically significant
d) Wrongly signed and statistically insignificant

Based on these classification, the distribution of the 122 coefficients (excluding the constant terms) in the model is given below:

Group	Number of Coefficients	Percentage Distribution
a	78	63.93 %
b	38	31.15 %
c	3	2.46 %
d	3	2.46 %
	122	100.00 %

95% of the estimated coefficients are of expected sign; and out of the 116 rightly signed coefficients, 78 are statistically significant at the 95% "level of confidence". That some coefficients in the equations are statistically insignificant may be explained by the existance of multicollinearity between the independent variables included in the equation; this may readily easily be observed from the matrix of simple correlation coefficients.

Multicollinearity may sometimes cause the erroneous estimation of the regression coefficient sign. To cite an example, in Equation 10.3, explaining the area of construction (m^2), the dependent variable is regressed on GNP (Y_t) and the previous level of GNP (Y_{t-1}); the estimated coefficient of Y_t was -1.7898 while that of Y_{t-1} was found to be 3.2105. The coefficient of Y_t is statistically insignificant and of "wrong" (unexpected) sign and this is due to the existance of strong multicollinearity between Y_t and Y_{t-1}.

In this case it is very difficult to separate the effects on the dependent variable of Y_t and Y_{t-1}. Nevertheless, because the "total" effect was thought to be essential, despite the existance of strong multicollinearity this equation was preferred in the model. The "total" effect may conveniently be computed by assuming that $Y_t = Y_{t-1}$. The total effect in this case is 1.4807 (3.1205-1.7298) A more realistic way of computing the "total" effect would be take this to be 1.4115 by assuming $Y_t = 1.04\ (Y_{t-1})$, where 0.04 is the rate of growth of Y_t.

3) Whether or not the assumptions of the "Least Squares Estimator" hold.

Some of these assumptions are:

a) The errors terms are not correlated.
b) Explanatory variables are not correlated
c) The explanatory variables are non-stochastic.

If assumption (a) does not hold, this implies the existance of auto-correlation between the error terms; if assumption (b) does not hold, this points to multicollinearity in the equation; if (c) does not hold, problems arising from stochasticity of the independent variables are involved.

To test for the existence of auto-correlation, the Durbin-Watson and Von Neuman ratios are used.

$$D.W. = \sum_{t=2}^{n} (\hat{u}_t - \hat{u}_{t-1})^2 / \sum_{t=1}^{n} \hat{u}_t^2$$

a) For positive auto-correlation
   $d.w. > d_u$ indicates no positive auto-correlation
   $d.w. < d_l$ indicates positive auto-correlation
   $d_l < d.w. < d_u$ is inconclusive

b) For negative auto-correlation

$4-d.w. < d_l$ indicates negative auto-correlation

$4-d.w. > d_u$ indicates no negative auto-correlation

$d_l < 4-d.w. < d_u$ is inconclusive

where d.w. = Durbin-Watson statistic,
d_l = critical lower limit
d_u = critical upper limit

Take for example, Equation 1.4 explaining value added in the services sector. The equation includes 2 explanatory variables and has been estimated over the period 1965-83 (19 observations). Accordingly, the lower and upper limits for the critical d.w. value are

$d_l = 1.08 \qquad d_u = 1.53$

To tes for the existence of positive auto-correlation, we have

$d.w. = 1.216 > d_u = 1.53$

i.e., there is no auto-correlation.

It is to be noted however, that since the equation includes a lagged endogenous variable, the D.W. statistic may in this case be quite misleading. For this reason, it would be useful to obtain a more reliable inference by means of the χ^2 test or Durbin's "h statistics"

To conduct the χ^2 test, the following cross table is needed:

		e_t	
		(-)	(+)
e_{t-1}	(-)		
	(+)		

e_t = error term in period t.

If the error terms e_t and e_{t-1} are independent, i.e. non-auto-correlated, the error terms will have scattered in the boxes at random.

$$\chi^2 = \frac{\Sigma(g-b)^2}{b}$$

Where g= actual values
b= expected values
$(b = \frac{\text{number of observations}-1}{4})$

We can conveniently illustrate the use of this test by examining. Equation 1.1 explaining Agricultural Value-added.

		e_t (-)	e_t (+)
e_{t-1}	(-)	3	4
	(+)	4	7

$$\chi^2 = \frac{(3-4.5)^2}{4.5} + \frac{(4-4.5)^2}{4.5} + \frac{(4-4.5)^2}{4.5} + \frac{(7-4.5)^2}{4.5}$$

$$= 2$$

This value is lower than the critical value 3.841, that is to say that e_t and e_{t-1} are independent and there is no problem of auto-correlation.

When the error terms are auto-correlated, the least square estimator is unbiased but not "efficient". Since the estimater is inefficient, the standard error will have been under-estimated. As a result, the computed value of the t-ratio will have been greater than the actual value. In this case the explanatory variable is likely to be accepted as statistically significant when in fact it is not in explaining the variations in the dependent variable. In order to mitigate such problems, the coefficients are estimated by the Generalized Least Squares Estimators. The computer programme written by Süleyman Özmucur conducts an auto-correlation test and if auto-correlation is indicated, then the coefficients are estimated by using the Generalized Least Squares Method which is nothing more than an extension of the Least Squares Method.

The Generalized Least Squares Method applies the following transformation:

$$Y_t - \hat{\rho}.Y_{t-1} = a(1-\hat{\rho}) + b\ (X_t - \hat{\rho}X_{t-1})$$

where $\hat{\rho}$= estimated coefficient of auto-correlation.

In order not to lose any observation, in line with Kadiyala's suggestion, the first observations are computed as follows:

$$Y_1^* = Y_1 \sqrt{1-\hat{\rho}^2}$$

and

$$X_1^* = X_1 \sqrt{1-\hat{\rho}^2}$$

If there exists second-order auto-correlation, the following transformation is used:

$$Y_t - \hat{\rho}_1 Y_{t-1} - \hat{\rho}_2 Y_{t-2} = a(1-\hat{\rho}_1-\hat{\rho}_2) + b(X_t - \hat{\rho}_1 X_{t-1} - \hat{\rho}_2 X_{t-2})$$

4) Adjusted Coefficient of Determination ($\bar{R}^2$) and the F-Ratio.

One other criterion used in the selection of equations is the coefficient of Determination, adjusted for the number of explanatory variables in order to make possible the comparison of equations including differing number of explanatory variables. The distribution of 50 behavioral equations according to the value of the Adjusted $\bar{R}^2$ is:

$\bar{R}^2$	Number of Equations	Percentage Distribution of Equations
(a)(0. - 0.50)	0	(0.0%)
(b)(0.50-0.70)	1	(2%)
(c)(0.70-0.80)	2	(4%)
(d)(0.80-0.90)	5	(10%)
(e)(0.90-1.00)	42	(84%)
	50	100%

The adjusted $\bar{R}^2$ is above 0.80 for 94% of the equations. Three equations with $\bar{R}^2$ below 0.80 are to be found in the foreign trade section of the model.

Dependent variable should be of the same form in order to compare $\bar{R}^2$ in two regression.

If for example, the dependent variable is Y in one equation and log Y in the other, comparison of adjusted $\bar{R}^2$ would in this case be misleading. To make the comparison possible, the anti-log of the variable(s) in the equation estimated in log form are taken and $\bar{R}^2$ is then calculated on that basis.

The comparison of two equation may also be made in the following manner:

The equations are

$$Y_t = a_o + b_o X_t + U_t$$

$$\log Y_t = a_1 + b_1 \log X_t + U_t$$

Using the transformation

$$Y_t^* = cY_t \quad \text{where} \quad c = \exp\left(- \frac{\Sigma \log Y_t}{n}\right)$$

we have

$$Y_t^* = a_o^* + b_o^* X_t + u_t^*$$

$$\log Y_t^* = a_1^* + b_1^* \log X_t + v_t^*$$

and

$$d = \frac{n}{2} \log \frac{\Sigma \hat{u}_t^{*2}}{\Sigma \hat{v}_t^*} \quad , \; d \sim \chi_i^2$$

The distribution of d is χ^2 with one degree of freedom. If d is greater than the critical χ^2, this implies that the two equations are different.

To illustrate the use of this method, it is convenient to consider the time deposits equation estimated in both linear and logarithmic form.

The estimated relationships for the period (1965-1982) are:

$$M_v = -55794.734 + 124.9724\, P_t - 0.0697\, Y_t + 13575.64\, R_v - 5534.874 \left(\frac{P_{y-1} - P_{y-2}}{P_{y-2}} \cdot 100 \right)$$

$$\bar{R}^2 = 0.9453\ ,\ \Sigma\, \hat{u}^2 = 0.418572\ .\ 10^{11}$$

and

$$\log M_v = -16.116 + 0.263 \log P_t + 1.8185 \log Y_t + 1.1516 \log R_v$$

$$+ 0.0428 \log \left(\frac{p_{y-1} - p_{y-2}}{p_{y-2}} \cdot 100 \right)$$

$$\bar{R}^2 = 0.9620\ ,\ \Sigma\, \hat{v}^2 = 0.13116956\ .\ 10^{1}$$

$$c = \exp\left(- \frac{\Sigma \log M_v}{18} \right) = \exp\left(- \frac{10.1233}{18} \right) = 0.5698$$

$$\Sigma\, \hat{u}^{*2} = c^2\, \Sigma\, \hat{u}^2 = 1.359.10^{10}$$

$$\Sigma\, \upsilon^{*2} = \Sigma\, \hat{\upsilon}^2 = 1.3116956$$

$$d = \frac{18}{2} \left| \log \frac{1.359\ .\ 10^{10}}{1.3116956} \right| = \frac{18}{2} \left| 23.06 \right| = 207.55$$

The computed d value is greater than the critical χ^2 (3.841), meaning that the logarithmic form yields a better result and should thus be preferred to the linear form.

This comparison has been used in cases where the equation is estimated in both forms and if, with all other conditions unchanged, the computed value did not differ from the critical χ^2 value, the linear form was preferred.

To test whether the coefficient of determination is statistically significant, F-ratio is used.

$$F_{(k-1,\ n-k)} = \frac{R^2/(k-1)}{(1-R^2)/(n-k)}$$

5) Mean Absolute Percentage Error (MAPE) and Root Mean Square Percent Error (RMSPE).

R^2 may not always be an appropriate measure in assessing the "explanatory" power of the regession.

R^2 is given by the formula:

$$R^2 = \frac{\Sigma(\hat{Y} - \bar{\hat{Y}})^2}{\Sigma(Y - \bar{Y})^2} = \frac{\text{Regression Sum of Squares}}{\text{Total Sum of Squares}}$$

where,

$\bar{Y}$ = mean value of Y

$\hat{Y}$ = "fitted" value of the dependent variable

$\bar{\hat{Y}}$ = mean value of $\hat{Y}$

Here the equality $\bar{\hat{Y}} = \bar{Y}$ holds

Now, if a constant (b) is added to Y:

Y will have increased by the same scale b, too. The regression sum of squares and, thus the R^2, will therefore have remained unchanged. In other words, $\hat{Y}$ and $(\hat{Y}+b)$ will yield the same value for R^2.

This drawback is best illustrated by an example. Take the regression equation explaining time deposits: the R^2 value for this equation is .9582 but when the residuals are examined, the estimated error rises as high as 767%. For this reason, a more appropriate statistic seems to be needed. Two possibly more appropriate statistics are mean Absolute Percentage Error (MAPE) and Root mean Square Percent Error.

$$\text{MAPE} = \frac{100}{n} \sum_{i=1}^{n} \left| \frac{Y_i - \hat{Y}_1}{Y_i} \right|$$

and

$$\text{RMSPE} = 100.\sqrt{\frac{1}{n} \sum_{i=1}^{n} \left(\frac{Y_i - \hat{Y}_i}{Y_i}\right)^2}$$

In the time deposits regression equation, MAPE and RMSPE are computed to be 170.73 and 250.45, respectively.

To compute MAPE the absolute value of the percentage errors are summed and divided by the number of observations whereas RMSPE is computed by taking the square root of the sum of squared percentage errors and multiplying by 100.

MAPE and RMSPE were the most frequently used measures in the selection of equations and the assessment of the model's forecasting ability. But these two statistics are not necessarily used together In this study MAPE was generally preferred. The distribution of the 50 behavioral equations with respect to MAPE values is given below:

MAPE	Number of Equations	Percentage Distribution
a) 0- 5	46	(92%)
b) 5-10	4	(8%)
c)10-15	0	(0%)
d)15-20	0	(0%)
e)20+	0	(0%)
	50	100%

It must be noted here that no corrections were made in so far as the equations estimated in logarithmic form were concerned. Therefore, MAPE values for these equations are most likely to be under-estimated.

To compute the corrected MAPE, it is necessary first to take the anti log of the dependent variable and calculate the percentage errors and then take their average.

To illustrate how such correction affects the results, we consider again the time deposits equation. The MAPE value for this equation as estimated in linear form is computed to be 170. Estimated in double logarithmic form the same equation yields a MAPE of 1.8758. For a valid comparison, the second (double-logarithmic) equation is taken and the following correction is made:

$$k = \Sigma \log Y_t / n$$

$$= 10.1233$$

and

$$a = k \frac{MAPE}{100}$$

$$= (10.1233)(0.018758)$$
$$= 0.18989$$

we thus have:

$$(k+a) = 10.31319$$

$$MAPE^* = \frac{\exp(k+a) - \exp(k)}{\exp(k)} \cdot 100 = \frac{30127.39 - 24916.861}{24916.861} (100)$$

$$= 20.91$$

where $MAPE^*$ = corrected MAPE
exp = exponential

This is to say that the true MAPE is not 1.8758 but 20.91. Comparing now the MAPE's for both equations estimated in linear and double logarithmic form, the double logarithmic form is to be preferred since it yields a lower MAPE (20.91) than the linear form for which the MAPE is 170.

6) Predicting the Turning Points

Another criterion used in evaluating econometric models is the degree of success achieved by the model in indicating turning points. It is naturally desirable that the model should predict the turning points as accurately as possible, This becomes an important quality of the model, particularly when the model is used for predicting the future.

There exist four possibilities insofar as the prediction of turning points is concerned.

They are:

a) Turning points are predicted correctly.
b) The model predicts a turning point when in fact there is no such turning point
c) The turning point is not predicted due to an error. That is, there is in fact a turning point but the model fails to predict it.
d) Correctly, no turning point has been predicted. There is in fact no turning point, either in reality or in the model's prediction.

Possibilities (b) and (c) indicate that an error is being made in the prediction of turning points.

$$Q_1 = \frac{b}{a+b}$$

and

$$Q_2 = \frac{c}{a+c}$$

Here small Q_1 and Q_2 imply that the model is successful in predicting turning points.

The computer programs* written by Süleyman Özmucur provide different statistics in relation to prediction of turning points.

*GEP (General Econometric Package) and M (Simulation) programs.

The following cross-table is prepared for the analysis of turning points.

		Actual Percentage Change (-)	Actual Percentage Change (+)
Predicted Percentage Change	(-)	a	b
	(+)	c	d

Actual Percentage Change= $a_t = \frac{Y_t - Y_{t-1}}{Y_{t-1}}$

Predicted Percentage Change= $p_t = \frac{\hat{Y}_t - Y_{t-1}}{Y_{t-1}}$

If both growth rates are rising or falling at the same time, this indicates that the model is successful in predicting turning points. Otherwise, the model fails to predict the turning points correctly. It is desirable that all the observations fall in boxes (a) and (d), namely both the actual and the estimated growth rates are falling or rising at the same time.

In this study, three statistics are used in evaluating the model's performance in predicting the turning points.

They are:

$$I_1 = \frac{(a)+(d)}{n-1}$$

$$I_2 = \frac{(d)}{(b)+(d)}$$

$$I_3 = \frac{(d)}{(c)+(d)}$$

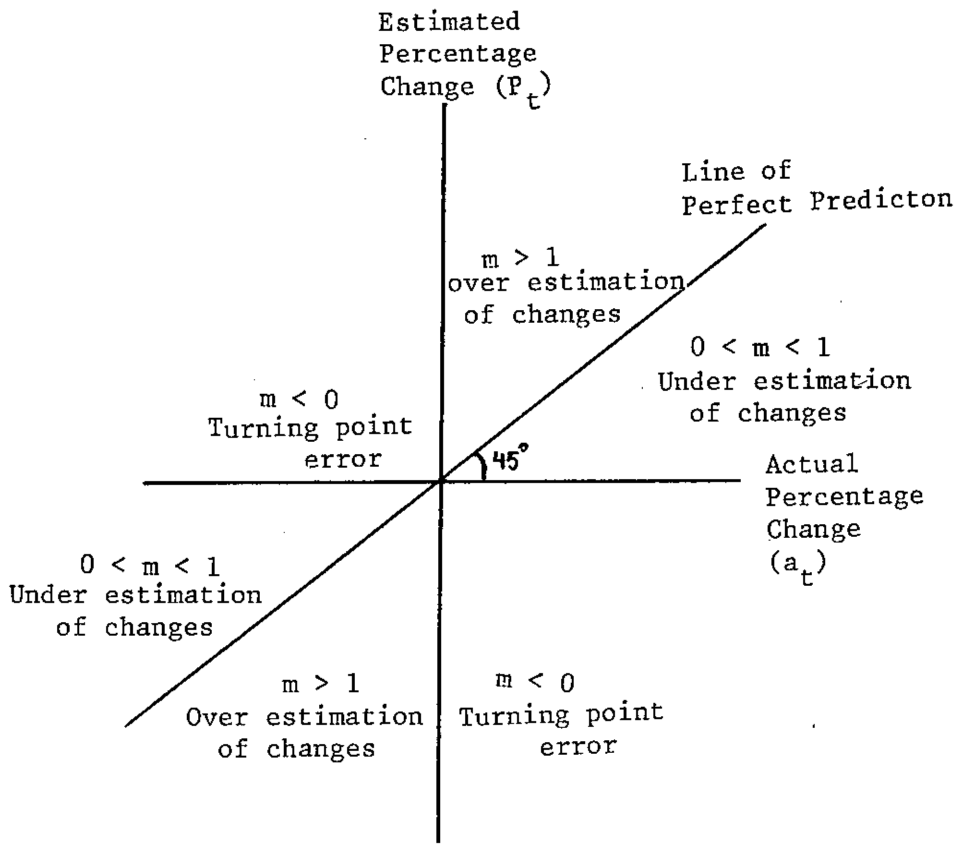
One other statistic used in evaluating the model's performance in predicting the turning points in what is known as the "Theil m" statistic. This statistic is computed by regressing the estimated growth rate on the actual growth rate:

$P_t = ma_t$ where m is the theil-m statistics

If= $m=1$ then the model predicts turning points with perfection.
If $0 < m < 1$ then the model underestimates changes

If $m > 1$ then the model overestimates changes

If $m < 0$ the model fails to predict turning points successfully



The I_1, I_2, I_3 and m statistics computed for the fifty behavioral equations are given below;

	I_1		I_2		I_3	
	Number of Equations	Percentage Distribution	Number of Equations	Perc. Dist-	Num.of Equ.	Perc. Dist.
i) 0-0.50	0	(%)	0	(0%)	0	(0%)
ii) 0.50-0.70	2	(4%)	1	(2%)	2	(4%)
iii) 0.70-0.80	8	(16%)	2	(4%)	6	(12%)
iv) 0.80-0.90	10	(20%)	5	(10%)	7	(14%)
v) 0.90-1.0	30	(60%)	41	(82%)	34	(68%)
Infinity			1		1	
	50		50		50	

As may be inferred from the above table, on the basis of the statistics given, the model is quite successful in predicting turning points. In 30 equations, almost all turning points, and in 40 equations over 80% of the turning points are predicted correctly. The I_2 statistics indicates that in 41 equations, over 90% of actual turning points are predicted correctly.

Due to the fact that the demand for agricultural labour declined steadily over the sample period (1965-1983), (a)=18 and thus I_2 and I_3 values become infinity.

I_1, I_2 and I_3 statistics are of assistance in determining whether or not the turning points are predicted correctly but do not indicate whether they are over estimated or under estimated. Theil-m statistic, however, is quite useful in this respect. The distribution of 50 behavioral equations with respect to the Theil-m statistic is given below:

	Theil m	
i) 0 - 0.70	9	(%18)
ii) 0.70 - 0.80	7	(%14)
iii) 0.80 - 0.90	5	(%10)
iv) 0.90 - 1.00	24	(%48)
v) 1.00 - 1.10	4	(% 8)
vi) 1.10 - 1.20	1	(% 2)
vii) 1.20 - 1.30	0	
viii) 1.30 - 2.00	0	
ix) 2.00 +	0	
Total	50	%100

In 28 equations, the Theil-m statistic was found to be close to unity. In other words, 56% of the behavioral equations included in the model predict the number of turning points exactly; in 21 equations, on the other hand, turning points are underestimated.

7) Comparison with "Naive" Models

Another approach in assessing an econometric model's reliability would be to compare its results with those obtained from "naive" model runs. It would be desirable that the model yield better results than the "naive" model. However, that the model fails to yield better results does not necessarily mean that it is of no use. It is better that the predictions of both the model and the "naive" model are taken into account together in drawing conclusions.

The most frequently used "Naive" models are:

1) $Y_t = a + bt$

2) $Y_t = a + bY_{t-1}$

or

3) $Y_t = bY_{t-1}$

where t = time trend

In this study, the naive model $Y_t = a + bt$ (trend analysis) is used for comparison. Comparing the economic model results with the naive model results, it is possible to see the superiority of the former over the latter.

8) Forecasting Ability of the Model(Post-sample prediction)

A model should perform well not only in predicting the sample period but also forecasting the post sample period. One-year ahead prediction error for the model is 8.52 percent, well below the prediction based on the naive model which has a prediction error of 210 percent.

THE "NAIVE MODEL" RESULTS

Variable	$\bar{R}^2$	F	MAPE	Theil m	D.W.	I 1	I 2	I 3
Y_a	0.948	331.2	2.99	0.65	1.51	.83	.93	.87
Y_m	0.957	401.4	4.95	0.96	0.55	.78	.81	.93
Y_c	0.967	561.5	3.50	0.80	0.53	.78	.82	.93
Y_s	0.981	933.8	3.63	1.06	0.31	.83	.88	.93
Y_i	0.968	553.3	3.98	0.95	0.59	.83	.88	.93
Y_d	0.977	764.5	3.05	0.95	0.43	.83	.88	.93
Y_t	0.975	715.7	3.18	0.97	0.36	.83	.88	.93
Y_{fa}	0.979	843.9	3.06	0.97	.40	.83	.87	.93
Y^c_a	0.609	29.1	342.5	2.73	.18	.67	.67	1.0
Y^c_i	0.525	20.8	717.6	2.04	.22	.67	.67	1.0
Y^c_s	0.565	24.4	593.0	2.49	.20	.67	.67	1.0
Y^c_d	0.565	24.4	519.3	2.49	.20	.67	.67	1.0
Y^c_t	0.571	24.9	517.6	2.43	.20	.67	.67	1.0
I_{mp}	0.398	12.9	25.7	1.23	.20	.67	.73	.73
I_{hp}	0.603	28.4	13.7	0.58	1.02	.72	.75	.85
I_{tp}	0.440	15.1	23.2	0.43	1.12	.83	.85	.92
I_{tt}	0.807	76.3	10.4	0.86	0.37	.78	.86	.86
Y_k	0.900	164.0	5.6	0.78	0.60	.72	.75	.92
I_p	0.374	11.7	21.2	0.42	1.09	.78	.78	.92
I_g	0.831	89.9	10.5	0.71	0.59	.72	.80	.85
I_t	0.697	42.4	14.8	0.61	0.76	.78	.78	.92
C_t	0.930	240.5	5.95	0.78	0.72	.78	.87	.87
C_p	0.898	160.7	6.52	0.73	0.75	.72	.80	.85
S_g	0.536	21.8	19.2	0.73	0.69	.50	.58	.63
S_p	-0.012	0.78	31.7	0.46	1.43	.72	.75	.83
Y^c_k	0.58	25.9	514.9	2.65	0.19	.67	.67	.10
I^c_p	0.609	29.0	488.3	0.84	0.31	.67	.67	1.0
I^c_t	0.607	28.9	588.0	0.84	0.21	.61	.61	1.0
C^c_t	0.573	25.2	500.9	2.72	0.19	.67	.67	1.0
C^c_p	0.567	24.6	508.4	2.69	0.20	.67	.67	1.0

Variable	$\bar{R}^2$	F	MAPE	Theil m	D.W.	I 1	I 2	I 3
S_g^c	0.494	18.6	557.7	1.14	0.25	.61	.65	.92
S_p^c	0.643	33.4	573.6	1.69	0.23	.61	.61	1.0
F_a	0.795	70.9	5.25	0.40	1.29	.72	.69	.90
N_u	0.997	7410.8	1.11	1.065	.35	1.0	1.0	1.0
N_u^o	0.990	1968.9	0.96	0.94	.50	1.0	1.0	1.0
L_t	0.975	712.7	0.66	0.88	.29	.78	.82	.93
U_n	0.892	150.9	22.17	0.95	.26	.72	.76	.93
U_t	0.879	132.6	9.94	0.79	.26	.61	.65	.92
U_t^o	0.864	115.6	7.09	0.70	.30	.61	.65	.92
E_a	0.933	251.7	0.16	0.89	.28	.72	00	00
E_m	0.932	247.4	2.86	0.85	.38	.67	.69	.92
E_c	0.970	583.7	2.59	.78	.63	.67	.75	.86
E_s	0.973	647.1	4.06	0.95	.61	.78	.78	1.0
E_i	0.952	365.8	2.46	0.86	.34	.78	.81	.93
W^c	0.672	37.9	172.7	2.78	.30	.67	.67	1.0
W	0.121	3.47	14.8	0.29	.30	.56	.50	.63
Z_t	0.929	237.4	13.2	1.01	1.11	.72	.84	.79
Z_r	0.934	256.0	14.4	1.09	1.16	.78	.86	.86
Z_c	0.126	3.5	38.7	0.83	1.15	.61	.60	.67
X_a	0.689	40.8	27.9	0.75	1.40	.83	.92	.85
X_m	0.540	22.1	79.6	0.806	.73	.55	.75	.50
P_a	0.623	30.8	228.0	2.96	.18	.67	.67	1.0
P_m	0.558	23.7	323.2	3.46	.19	.67	.67	1.0
P_i	0.546	22.7	328.7	2.92	.20	.67	.67	1.0
P_s	0.580	25.9	277.5	3.21	.19	.67	.67	1.0
P_d	0.582	26.1	275.1	3.15	.19	.67	.67	1.0
P_y	0.584	26.2	276.0	3.12	.19	.67	.67	1.0
P_t	0.586	26.5	254.3	2.99	.19	.67	.67	1.0
P_g	0.605	28.6	215.9	2.96	.19	.67	.67	1.0
P_r	0.564	24.3	319.9	3.01	.21	.61	.65	.92
T_d	0.564	24.3	1064.5	0.86	.18	.67	.67	1.0
T_m	0.613	29.5	399.1	0.75	.17	.67	.67	1.0

Variable	$\bar{R}^2$	F	MAPE	Theil m	D.W.	I 1	I 2	I 3
T_s	0.536	21.8	637.1	1.50	.29	.67	.67	1.0
T_z	0.594	27.4	257.2	1.10	.30	.72	.72	1.0
T_v	0.587	26.5	609.2	1.55	.18	.66	0.66	1.0
M_h	0.650	34.4	307.2	2.78	.19	.78	.75	1.0
M_d	0.599	27.9	387.5	0.75	.24	.67	.67	1.0
M_v	0.404	13.2	1282.0	-1.49	.29	.67	.67	1.0
M_s	0.621	30.5	355.9	1.707	.19	0.67	.67	1.0
M_t	0.795	51.4	265.9	2.52	.40	.84	.84	1.0
G_t	0.709	32.6	211.2	1.45	.26	.69	.69	1.0

APPENDIX II

SOURCES OF DATA

1) Value Added by Agriculture (Y_a) at 1968 producers' prices Million TL
Source:
a) State Institute of Statistics, Turkey's National Income, 1962-1977
b) State Institute of Statistics, (SIS)
Statistical Year-book of Turkey, 1983
c) SIS Monthly Economic Indicators

2) Value Added by the Manufacturing Industry (Y_m) at 1968 producers' prices, Million TL.
Source: as (1)

3) Value Added by Construction (Y_c) 1968 producers' prices, Million TL
Source: as (1)

4) Value Added by Services (Y_s), at 1968 producers' prices, Million TL.
Source: as (1)

Services value added has been considered as the total of commerce, transportation and communications, financial Institutions, housing, the independent professions and services and state services.

5) Value Added by Industry (Y_i), at 1968 producers' prices, Million TL.
Source: as (1)

6) Gross Domestic Product (Y_d) at 1968 producers' prices, Million TL.
Source: as (1)

7) Gross National Product (Y_t) at 1968 producers' prices, Million TL.
Source: as (1)

8) Gross National Product (Y_{fa}) at 1968 factor prices, Million TL.
Source: as (1)

9) Value Added by Agriculture (Y_a^c) at current producers' prices, Million TL.
Source: as (1)

10) Value Added by Industry, (Y_i^c) at current producers' prices, Million TL.
Source: as (1)

11) Value Added by Services (Y_s^c) at current producers' prices, Million TL.
Source: as (1)

12) Gross Domestic Product (Y_d^c), at current producers' prices, Million TL.
Source: as (1)

13) Gross National Product (Y_t^c), at current producers' prices, Million TL.
Source: as (1)

14) Private Fixed Capital Investment. (Manufacturing) (I_{mp}) 1968 prices, Million TL.
Source: State Planning Organisation (SPO) Five Year Development Plans and Annual Programmes. As the SPO constantly changes its base year, with the use of cross deflators and with 1968 as the base, a new price series has been developed by TUSIAD

15) Private Fixed Capital Investment In Housing (I_{hp}) 1968 prices, Million TL.
Source: as (14)

16) Total Private Fixed Capital Investment (I_{tp}), at 1968 prices, Million TL.
Source: as (14)

17) Fixed Capital Investment in Agriculture (I_{at}) at 1968 prices, Million TL.
Source: as (14)

18) Fixed Capital Investment in Mining (I_{bt}), at 1968 prices, Million TL.
Source: as (14)

19) Fixed Capital Investment in the Manufacturing Industry (I_{mt}) at 1968 prices Million TL.
Source: as (14)

20) Fixed Capital Investment in Energy (I_{et}) at 1968 prices, Million TL.
Source: as (14)

21) Fixed Capital Investment in Housing (I_{ht}) at 1968 prices, Million TL.
Source: as (14)

22) Total Fixed Capital Investment (I_{tt}) at 1968 prices, Million TL.
Source: as (14)

23) Agricultural Capital Stock (K_a), at 1968 prices, Million TL.
Source:
For calculation of the Capital Stock series created by the formula $K_a = K_{a-1} + I_{at} - D_a$ it was necessary to know the amount of depreciation (D_a) and the initial year of the capital stock in question. "Structural Changes in the Distribution of Income and Employment in Turkey II", by Erdoğan Özütün, and the State Institute of Statistics, "Yearbook 1979" give the sectoral depreciation values for the period 1968-1976. These values for the period 1968-1971 have been used in the TÜSİAD study for the years 1963 to 1967 and those for the period 1973-1976 have been used for the years 1977 to 1983.

Using the SPO's investment figures and the SIS's added value statistics, marginal capital output ratios have been calculated as

$$\frac{\Delta K_a}{\Delta Y_a} = \frac{I_{at}}{\Delta Y_a}$$

On the basis of the average marginal capital output ratio for the period 1963-1967 and assuming that in the base year the marginal capital output ratio is equal to the average capital output ratio, the basic capital stock has been determined as

$$\frac{\Delta K_a}{\Delta Y_a} = \frac{K_a}{Y_a} = i \Rightarrow K_a = i\, Y_a$$

By adding fixed capital investments to the base year (1963) and deducting depreciation it has been possible to calculate the capital stock values of the following year. In these operations, Suleyman Özmucur's "S" computer programme has been used.

24) Mining Capital Stock (K_b) at 1968 prices, Million TL.
Source: as (23)

25) Manufacturing Industry Capital Stock (K_m) at 1968 prices, Million TL.
Source: as (23)

26) Energy Capital Stock (K_e) at 1968 prices, Million TL.
Source: as (23)

27) Housing Capital Stock (K_h) at 1968 prices, Million TL.
Source: as (23)

28) Total Capital Stock (K_t), at 1968 prices, Million TL.
Source: as (23)

29) Private Disposable Income (Y_p), at 1968 prices, Million TL.
Source: as (14)

30) Public Consumption (C_g), at 1968 prices, Million TL.
Source: as (14)

31) Public Disposable Income (Y_g), at 1968 prices, Million TL.
Source: as (14)

32) Private Investment (I_p), at 1968 prices, Million TL.
Source: as (14)

33) Public Investment (I_g), at 1968 prices, Million TL.
Source: as (14)

34) Total Investment (I_t), at 1968 prices, Million TL.
Source: as (14)

35) Total Consumption (C_t), at 1968 prices, Million TL.
Source: as (14)

36) Private Consumption (C_p), at 1968 prices, Million TL.
Source: as (14)

37) Public Savings (S_g), at 1968 prices, Million TL.
Source: as (14)

38) Private Savings (S_p) at 1968 prices, Million TL.
Source: as (14)

39) Private Disposable Income (Y_p^c), at current prices, Million TL.
Source: as (14)

40) Private Investment (I_p^c), at current prices, Million TL.
Source: as (14)

41) Total Investment (I_t^c), at current prices, Million TL.
Source: as (14)

42) Total Consumption (C_t^c), at current prices, Million TL.
Source: as (14)

43) Private Consumption (C^c_p), at current prices, Million TL.
Source: as (14)

44) Public Savings (S^c_g), at current prices, Million TL.
Source: as (14)

45) Private Savings (S^c_p), at current prices, Million TL.
Source: as (14)

46) Total Disposable Income (Y_k), at 1968 prices, Million TL.
Source: as (14)

47) Total Disposable Income (Y^c_k), at current prices, Million TL.
Source: as (14)

48) Agricultural Income (F^c_a), at current prices, Million TL.
Source: Functional Distribution of Income by Süleyman Özmucur (to be published)

49) Non-Agricultural Wages and Salaries (F^c_w), at current prices, Million TL.
Source: as (48)

50) Non-Agricultural, Non-Wage Income (F^c_d), at current prices, Million TL.
Source: as (48)

51) Total Domestic Factor Income (F^c_t), at current prices, Million TL.
Source: as (48)

52) Agricultural Income (F_a), at 1968 prices, Million TL.
Source: as (48)

53) Non-Agricultural Wages and Salaries (F_w), at 1968 prices, Million TL.
Source: as (48)

54) Non-Agricultural, Non-Wage Income (F_d), at 1968 prices, Million TL.
Source: as (48)

55) Total domestic factor income (F_t), at 1968 prices, Million TL.
Source: as (48)

56) Total Population (N_t), Thousand persons
Source: SIS "Results of General Population Census" (1960, 1965, 1970, 1975, 1980)
Internal years have been calculated by logarithmic interpolation.
$N_t = N_o (1+g)^t_1$ g - annual average growth rate. The annual average growth rate $_o$1975-1980 has been used to determine the 1980-1983 figures.

57) Urban Population (N_u) Thousand persons
Source: as (56)

58) Ratio of Urban Population to total population (N^o_u)
Source: as (56)
Urban population has been taken as persons inhabiting centres of more than (10.000) head of population.

59) Total labor demand (employment) (E_t) Thousand persons
Source: a) SPO, Five Year Development Plans and Annual Programmes
b) Ministry of Finance, Annual Economic Report

60) Non-Agricultural Labour Surplus (U_n) thousand persons
Source: as (59)

61) Total Labour Surplus (U_t) thousand persons
Source: as (59)

62) Civilian Labour Supply (L_t) thousand persons
Source: as (59)

63) Labour Surplus as Percentage of Total Labour Force (U_t^o) thousand persons
Source: as (59)

64) Agricultural Employment (labour demand) (E_a), thousand persons
Source: as (59)

65) Employment (Manufacturing Industry) (E_m), thousand persons
Source: as (59)

66) Employment (Construction) (E_c), thousand persons
Source: as (59)

67) Employment (Services) (E_s), thousand persons
Source: as (59)

68) Employment (Industry) (E_i), thousand persons
Source: as (59)

69) Productivity in Industry (E_v), at 1968 prices, thousand TL
Source: as (1) and (59)
Productivity in industry has been calculated as to value added in industry divided by the number of persons in the labour force.

70) Average daily Wages (W^c) T Lira
Source: Social Insurance Board Statistical Yearbook (various issues)
SIS Statistical Yearbook (various issues)

71) Average Daily Wages (W), at 1968 prices
Source: as (70)
Constant 1968 prices salaries have been calculated by using the Istanbul Chamber of Commerce's "Istanbul Consumer Prices Index" as the deflator for nominal wages.

72) Total Imports (Z_t), at 1968 prices, in thousands of TL.
Source: SIS. Monthly Statistical Bulletins
SIS Foreign Trade Statistics and Statistical Yearbook (various editions)
Import values in TL have been divided by import tonnages to give average prices per tonne.These prices, first expressed in index number series (with 1968=100) are then used to express import series at constant 1968 prices.

73) Machinery and Equipment Imports (Z_m), at 1968 prices, in thousands of TL.
Source: as (72)
The machinery and equipment import prices index has been used as the deflator.

74) Raw Material Imports (Z_r) at 1968 prices, in thousands of TL.
Source: as (72)
The raw materials import prices index has been used as the deflator.

75) Consumer Goods Imports (Z_c), at 1968 prices, in thousans of Tl.
Source: as (72)
The consumer goods import prices index has been used as the deflator

76) Agricultural Goods Exports (X_a), at 1968 prices, in thousans of TL.
Source: as (72)
The agricultural produce export prices index has been used as the deflator.

77) Industrial Goods Exports (X_i), at 1968 prices, in thousands of TL.
Source: as (72)
The industrial goods export prices index has been used as the deflator.

78) Total Exports (X_t), at 1968 prices, in thousands of TL.
Source: as (72)
The total exports prices index has been used as the deflator

79) Total Imports, Dollars ($Z_t^{\$}$) at current prices, in thousands of \$
Source: as (72)
Total imports of current prices have been obtained by applying the total imports prices index to total imports at 1968 prices.
Total imports in TL divided by total imports in \$ yields implicit exchange rate for imports. And using this implicit rate dollar values of imports have been calculated.

80) Total Exports, Dollars ($X_t^{\$}$) at current prices, in thousands of \$
Source: as (72), using the same method for export dollar values as for import dollar values (79).

81) Foreign Trade Deficits ($Z_a^{\$}$) Million Dollars
Source: as (72) plus various editions of the Annual Economic Report published by the Ministry of Finance.

82) Agricultural Deflator (P_a) (1968=100)
Source: as (1)
The agricultural deflator has been calculated as follows:
Agricultural value added (at current prices)/
Agricultural value added (at 1968's prices) X 100

83) Industrial Deflator (P_i) (1968=100)
Source: as (82)

84) Construction Deflator (P_c) (1968=100)
Source: as (82)

85) GDP deflator (P_d) (1968=100)
Source: as (82)

86) Services Deflator (P_s) (1968=100)
Source: as (82)

87) Manufacturing Industry Deflator (P_m) (1968=100)
Source: as (82)

88) GNP Deflator (P_y) (1968=100)
Source: as (82)

89) Wholesale Prices Index (General)(P_t)(1968=100)
Source: SIS, Monthly Statistical Bulletins and SIS, Price Statistics (various issues)

90) Wholesale Prices Index (food items) (P_g)(1968=100)
Source: as (89)

91) Wholesale Prices Index (Industrial Raw Materials and Semi Manufactures) (P_r) (1968=100)
Source: as (89)

92) Istanbul Cost of Living Index for Salaried Persons (P_u)(1968=100)
Source: as (89)

93) Direct Taxes (T_d) Million TL.
Sources: a)Ministry of Finance Budget Revenue Yearbooks (1979-1983)
b)SIS. Monthly Statistical Bulletins

94) Taxes on Goods (T_p), Million TL.
Source: as (93)

95) Taxes on Services (T_s) Million TL.
Source: as (93)

96) Taxes on Foreign Trade (T_z), Million TL.
Source: as (93)

97) Indirect Taxes (T_i), Million TL.
Source: as (93)

98) Tax Revenues (T_v), Million TL.
Source: as (93)

99) Central Budget Revenues (T_g), Million TL.
Source: as (93)

100) Banknotes in Circulation (M_h), Million TL.
Source: Central Bank's Monthly Bulletin and Quarterly Bulletins

101) Sight Deposits (M_d), Million TL.
Source: as (100)

102) Time Deposits (M_v), Million TL.
Source: as (100)

103) Money Supply (M_s), Million TL.
Source: as (100)

104) Central Bank's Price Support Credits (M_u), Million TL.
Source: as (100)

105) Central Bank's Manufacturing Industry Credits (M_m), Million TL.
Source: as (100)

106) Deposits Banks Manufacturing Industry Credits (G_m), Million TL.
Source: as (100)

107) Total Central Bank Credits (M_t), Million TL.
Source: as (100)

108) Total Deposit Bank Credits (G_t), Million TL.
Source: as (100)

109) Total Electricity Consumption (A_a) thousand kwh
Source: SIS Monthly Statistical Bulletins,
SIS Statistical Yearbooks
SPO Annual Development Programmes

110) Total Electricity Production (A_p), thousand kwh
Source: as (109)

111) Total Area Covered by Construction Permits Issued (A_a), thousand m^2
Source: as (109)

112) Mining Value Added (Y_b) at 1968 producer prices, Million TL.
Source: as (1)

113) Electricity, Gas and Water Value Added (Y_e), at 1968 producer prices, Million TL.
Source: as (1)

114) Imputed Banking Services (Y_{ih}), at 1968 producer prices, Million TL.
Source: as (1)

115) Net Factor Income From the Rest of the World (Y_f), at 1968 producer prices Million TL.
Source: as (1)

116) Subsidies (Y_{su}), at 1968 factor prices, Million TL.
Source: as (1)

117) Indirect Taxes (Y_{vv}), at 1968 factor prices, Million TL.
Source: as (1)

118) Economic Dummy Variable (D_{80}), the value of 1 was taken for the period 1980-1983 and a for the remaining years.

119) Political Dummy Variable, (D_{77}), the value of 1 was taken for the period 1977-79, and a for the remaining years.

120) Construction Costs per m^2 according to Construction Permits Issued (P_h) thousand TL.
Source: as (109)

121) Agricultural Private Fixed Capital Investment (I_{ap}), at 1968 prices, Million TL.
Source: as (14)

122) Mining Private Fixed Capital Investment (I_{bp}) at 1968 prices, Million TL.
Source: as (14)

123) Energy Private Fixed Capital Investment (I_{ep}), at 1968 prices, Million TL.
Source: as (14)

124) Transportation Private Fixed Capital Investment (I_{up}), at 1968 prices, Million TL.
Source: as (14)

125) Tourism Private Fixed Capital Investment (I_{rp}), at 1968 prices, Million TL.
Source: as (14)

126) Education Private Fixed Capital Investment (I_{dp}), at 1968 prices, Million TL.
Source: as (14)

127) Health Private Fixed Capital Investment (I_{kp}), at 1968 prices, Million TL.
Source: as (14)

128) Other Services Private Fixed Capital Investment (I_{op}), at 1968 prices, Million TL.
Source: as (14)

129) Total Foreign Savings (S_f), at 1968 prices, Million TL.
Source: as (14)

130) Private Stock Changes (I_{sp}), at 1968 prices, Million TL.
Source: as (14)

131) Public Stock Changes (I_{sg}), at 1968 prices, Million TL.
Source: as (14)

132) Public Disposable Income (Y_g^c), at current prices, Million TL.
Source: as (14)

133) Private Investment, Deflator (P_{in}) (1968=100)
Source: as (14)

134) Public Investment (I_g^c), Million TL.
Source: as (14)

135) Public Consumption (C_g^c), Million TL.
Source: as (14)

136) Total Public Fixed Capital Investment (I_{tg}^c), Million TL.
Source: as (14)

137) Public Stock Changes (I_{sg}^c), Million TL.
Source: as (14)

138) Time (t)

139) Mining Employment (E_b), thousand persons
Source: as (59)

140) Employment in Energy Sector (E_e), thousand persons
Source: as (59)

141) Average Foreign Exchange Rate Applied to Imports (e_m)
Source: as (72)

142) OECD Revenue Index (Y_{oecd})(1968=100)
Source: OECD Economic Outlook (various editions)

143) OECD Consumer Prices Index (P_{oecd})(1968=100)
Source: OECD, Economic Outlook, (various editions)

144) Average Foreign Exchange Rate Applied Exports (e_x)
Source: as (72)

145) Unit Price Index for Total Imports (P_{tz}) (1968=100)
Source: as (72)

146) Unit Price Index For Raw Material Imports (P_{rz})(1968=100)
Source: as (72)

147) Non-taxable Normal Revenues (T_n), Million TL.
Source: as (93)

148) Special Revenues and Funds (T_o), Million TL.
Source: as (93)

149) Time Deposits Interest Rate (R_v)
Source: as (100)

150) Central Budget Expenditure (T_h), Million TL.
Source: as (93)

151) Short-term Advances to the Treasury (M_p), Million TL.
Source: as 100)

152) Central Bank Credits (Agriculture), (M_a), Million TL.
Source: as (100)

153) Central Bank Credits (Mining) (M_b), Million TL.
Source: as (100)

154) Central Bank Credits (Energy) (M_e), Million TL.
Source: as (100)

155) Central Bank Credits (Trade)(M_c), Million TL.
Source: as (100)

156) Central Bank Credits (Small Trades and Artisans) (M_g) Million TL.
Source: as (100)

157) Central Bank Credits (Exports)(M_x), Million TL.
Source: as (100)

158) Deposit Banks' Credits (Agriculture) (G_a), Million TL.
Source: as (100)

159) Deposit Banks' Credits (Mining) (G_b), Million TL.
Source: as (100)

160) Bank Credits (Energy) (G_e), Million TL.
Source: as (100)

161) Bank Credits (Imports) (G_z), Million TL.
Source: as (100)

162) Bank Credits (Exports) (G_x), Million TL.
Source: as (100)

163) Bank Credits (Domestic Trade) (G_s), Million TL.
Source: as (100)

164) Bank Credits (Tourism) (G_u), Million TL.
Source: as (100)

165) Bank Credits (Small Trades and Artisans)(G_g), Million TL.
Source: as (100)

166) Bank Credits (Construction) (G_c), Million TL.
Source: as (100)

167) Agricultural Labour Surplus (U_a), Thousand persons
Source: as (59)

168) Calculation of GNP Differential SPO-SIS (Y_{fark}), at 1968 prices, Million TL.
Source: as (14)

169) Calculation of GNP Differential SPO-SIS (Y^c_{fark}), at current prices, Million TL.
Source: as (14)

170) Unit Price Index (Total Exports) ($P^{\$}_{tx}$) (1968=100)
Source: as (72)

171) Unit Price Index (consumer goods) ($P^{\$}_{cz}$) (1968=100)
Source: as (72)

172) Banknotes Held by Banks (M_r), Million TL.
Source: as (100)

173) Agriculture Public Fixed Capital Investment (I_{ag}), at 1968 prices, Million TL.
Source: as (14)

174) Mining Public Fixed Capital Investment (I_{bg}), at 1968 prices, Million TL.
Source: as (14)

175) Manufacturing Public Fixed Capital Investment (I_{mg}), at 1968 prices, Million TL.
Source: as (14)

176) Energy Public Fixed Capital Investment (I_{eg}), at 1968 prices, Million TL.
Source: as (14)

177) Housing Public Fixed Capital Investment (I_{hg}), at 1968 prices, Million TL.
Source: as (14)

178) Total Public Fixed Capital Investment (I_{tg}), at 1968 prices, Million TL.
Source: as (14)

179) Depreciation (agriculture) (D_a), at 1968 prices, Million TL.
Source: as (23)

180) Depreciation (Mining) (D_b) at 1968 prices, Million TL.
Source: as (23)

181) Depreciation (Manufacturing Industry) (D_m), at 1968 prices, Million TL.
Source: as (23)

182) Depreciation (Energy) (D_e), at 1968 prices, Million TL.
Source: as (23)

183) Depreciation (Housing) (D_h), at 1968 prices, Million TL.
Source: as (23)

184) Depreciation (Total) (D_t), at 1968 prices, Million TL.
Soruce: as (23)

185) Percentage Change in Gold Prices (P_k)
Source: SIS Statistical Yearbook
Central Bank Quarterly Bulletins

186) Import Duties and Changes (Y_{iv}), at 1968 producers prices, Million TL.
Source: as (1)

187) Banks' Liquidation Fund (M_f), Million TL.
Source: as (100)

188) Other Financial Institutions (G_o), Million TL.
Source: as (100)

189) Bank Credits (Un-classified) (G_d), Million TL.
Source: as (100)

190) Unit Price Index (Total Exports) (P_{tx}) (1968=100)
Source: as (72)

191) State Economic Enterprises Financing Requirements (M_k), Million TL.
Source: as (14)

192) Support Prices Index (P_{su})(1968=100)
Source: as (48)

193) Implicit Exchange Rate in Total Imports (e_{mg})
Source: as (72)

194) Implicit Exchange Rate in Total Exports (e_{xg})
Source: as (72)

195) Export Unit Price for the Manufacturing Industry ($, 1968=100)
Source: as (72)

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