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The Israeli Econometric Model: A Key Tool for Economic Analysis

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A Technical Intelligence Report

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The Israeli Econometric Model: A Key Tool for Economic Analysis

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A Technical Intelligence Report

This paper was prepared by

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Office of Near Eastern and South Asian Analysis. Comments and queries are welcome and may be directed to the Chief, Issues and Applications Division, NESA,

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The Israeli Econometric Model: A Key Tool for Economic Analysis

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Summary

Information available as of 1 September 1987 was used in this report.

The econometric model of Israel, developed in the late 1970s, incorporates information on government policies, international economic conditions, resource availabilities, and other factors. As the economy of Israel has evolved and underlying conditions and policies have changed, the model and its supporting data files have been revised and updated.

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The model, written in the TROLL language, now contains almost 200 equations, each of which describes a different facet of the economy. These equations can be solved for each of the last 10 years or the next 10 years. Because projections depend on data inputs that are inherently less certain than those pertaining to the past, the more distant the year projected, the less reliable are the results of the model.

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Most of the equations in the Israeli model, such as those computing the balance of payments and disposable income, are definitional. These equations describe identities that are true for all economies at any time.

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Twenty other equations in the model represent behavioral and technological relationships that give the Israeli economy its character and distinguish it from other economies. For example, fuel imports appear to be a function of their average price, Israeli GNP, and capital availability. The specific form of each of these equations has been estimated from observations of the Israeli economy during the last 10 to 20 years or is based on the judgment of economic analysts. Because such relationships are subject to change over time, projections based on these equations assume that the relationships they represent will remain constant for the projection period.

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The model can be divided into several sections, each describing a sector of the Israeli economy. The most important of these deal with the availability and use of resources in the economy, including private and government consumption, investment, exports, and imports. Linkages among the various sections of the model reflect linkages among the different sectors of the Israeli economy. Moreover, the model is dynamic, showing the impact of events over time.

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The Israeli model lends itself to a variety of analyses. For example, *historical simulations* of the Israeli economy in the first half of the 1980s suggest that, as expected, monetary growth was a major contributor to the

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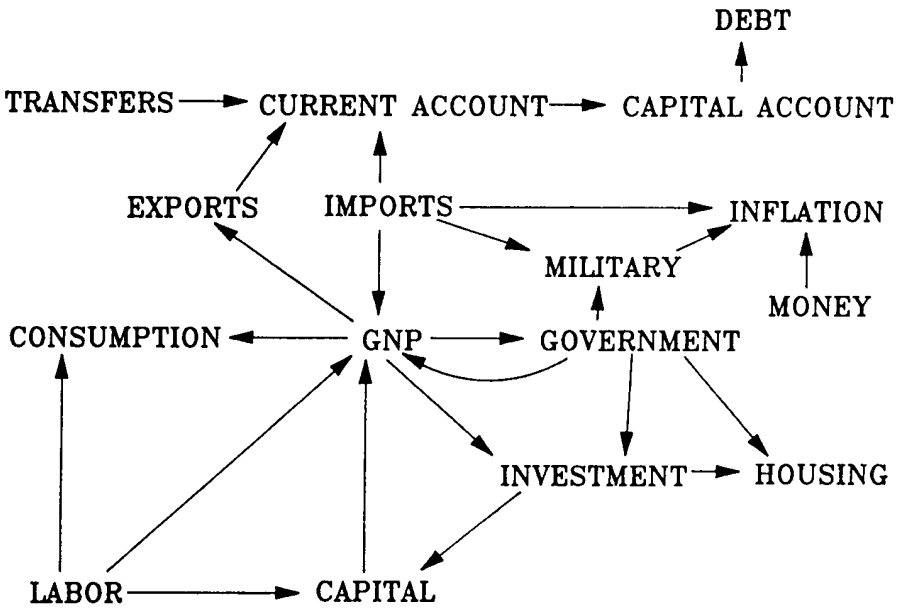
Figure 1
Israeli Econometric Model



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triple-digit inflation in Israel at that time. A *baseline projection* of the Israeli economy over the next two years reveals sluggish growth of output, declining growth of private consumption and investment, and worsening balances of trade and payments as imports rise faster than exports.

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Scenario analysis with the model shows that increases in investment can speed up growth of production during the next two years but would have little effect on private consumption. Consumption would benefit from a reduction in taxes. Moreover, tax cuts appear to reduce the budget surplus less than matching increases in public investment. The model reveals that increased investment is an expensive way to improve labor productivity. Other approaches—such as better training and placement and productivity inducements—should be explored.

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The Israeli model was evaluated by *ex post* simulation of 1977-85 economic activities. A comparison of the simulation with actual observations suggests that the model and the supporting data base provide a consistently accurate description of the Israeli economy during that period.

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The model was also evaluated by comparing *ex ante* projections of 1985-86 economic activities with actual developments in those years. Performance in these cases, which depended additionally on the accuracy of external projections of certain economic activities, was not as consistently good as in the case of the historical simulation. Performance was weakest for projections of rates of growth and inflation, tax revenues, and international payment balances.

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Scope Note

The Israeli economy, like other economies, is a complex set of interacting phenomena. Some of these interactions occur quickly; others take place over longer periods of time. Some involve only one or two factors; others consist of many. The econometric model allows the analyst to study the economy and to gain insights at a level of complexity that is impossible with other approaches. Past, present, and future economic activities can be simulated so that the analyst can look at the roots of current problems, experiment with possible solutions, and project future implications. [redacted] 25X1

The Israeli econometric model has been in use since the late 1970s.[1] This paper describes the latest version, explains how it can be used, and presents some illustrative findings. It also explains some of the limitations of this type of analysis and provides an assessment of the validity of model results.

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The Israeli Econometric Model: A Key Tool for Economic Analysis

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The Structure of the Model

The Israeli econometric model, written in the TROLL language, consists of almost 200 equations.[2] Each describes a different aspect of the Israeli economy. Twenty of these equations contain parameters that have been estimated by econometric analysis of Israeli economic data for the last 10 to 20 years. The model is divided into sections describing Israeli production, private consumption, investment and capital growth, labor supply and employment, government revenues and spending, exports and imports, and Israel's international financial position.

GNP

Israel's GNP was $21 billion in 1985. This equaled Egypt's output of goods and services in that year, although the Egyptian population then totaled 48 million while Israel's stood at only about 3.9 million.

The model estimates total Israeli output of goods and services in 1980 shekels (figure 2) as a Cobb-Douglas function of capital (ISKSM78E), employment (ISEMP), and real government consumption (ISGR):[3]

$$\text{Log(ISYR)} = -1.288 + 0.04*\text{DUM81} - 0.031*\text{DUM84} + 0.366*\text{Log(ISKSM78E)} + 0.597*\text{Log(ISEMP)} + 0.037*\text{Log(ISGR)}$$

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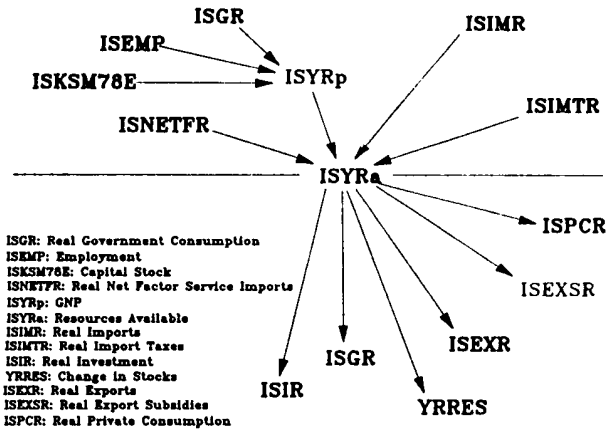
Figure 2
Israel: Real GNP



Variables in black are computed by identities.
Variables in blue are computed by historically derived econometric equations.
Variables in red are exogenously determined.

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[2] The equations in this paper are all written in the TROLL format.

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[3] A Cobb-Douglas function is one in which the variable to be explained, here ISYR, is expressed as a multiplicative function of the explanatory variables:

$$\text{ISYR} = a*\text{ISKSM78E}^b*\text{ISEMP}^c*\text{ISGR}^d$$

The exponents add to 1 (b+c+d=1). The equation implies that production cannot take place if at least one of the factors is missing.

The function is estimated from data for 1973-85 in its logarithmic form in which the explanatory variables are additive and the "a" term is separated into a constant and two dummy variables. The coefficient of determination—commonly called the R^2—of this estimate equals 0.998, indicating that the function explains 99.8 percent of the variation in ISYR during that time. That is, almost all of the changes in the value of ISYR during 1973-85 are explained by the equation specified here, the given parameter estimates, and changes in the values of ISKSM78E, ISEMP, and ISGR during that period.

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DUM81 and DUM84 represent dummy variables for the years 1981 and 1984, respectively. They are used because Israeli output of goods and services in these years is not fully explained by the other variables in the model. By including a variable for each year explicitly in the model, it is possible to estimate coefficients for them that indicate the influence of the years themselves (or rather the factors implicitly associated with these years) on the value of the variable being explained, here ISYR.

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Macroeconometric Modeling

The macroeconometric model is a tool for studying the economy of a country by simulating its activities. It consists of a number of equations, each describing a separate facet of the economy.

Most of the equations are accounting identities, *equally true of any country at any time. Thus, goods and services used must equal those produced or acquired in other ways, say imported from abroad or drawn from inventories. If uses include consumption (C), investment (I), government services (G), exports (X), and net additions to inventories (V) and sources consist of domestic production (Y) and imports (M), one identity in the model would be:*

$$Y = C + I + G + X - M + V$$

Other model equations represent behavioral *or* technological *relationships among the various components of the economy. The exact form of such a relationship is likely to be peculiar to a given country and subject to change over time as government policies, social institutions, economic conditions, technology, and other factors change.*

Consumption, for example, may be a function of population (P) and disposable income (Yd). A possible form of this relationship is:

$$C/P = b1 + b2*Yd/P$$

Here C, P, and Yd are variables, *the values of which change from year to year; b1 and b2 are* parameters *that describe the specific relationship among these variables for a given country and time period and are expected to change little, if at all, over time.*

When the model is run, the economy is simulated one year at a time for the entire simulation period. For each year, each equation in the model is solved for one distinct variable. To do this, the computer must know the values of all the other variables and any parameters in the equation.

Variables computed by equations in the model are said to be endogenous. *Each must appear in at least one distinct equation, and the model must have as many equations as there are endogenous variables. The values of other variables, termed* exogenous, *are taken from external sources and must be supplied to the model for* each year of the simulation period. *Estimates of these values are taken from several sources:*

- *Extrapolation of current trends.*
- *The judgment and research findings of other experts, both within the Intelligence Community and at other government, academic, and research institutions.*
- *Official country publications.*

Projections of exogenous variables involve different degrees of uncertainty. In general, the most confidence resides in those input values subject to little, if any, policy manipulation and those that reflect long-term trends not likely to be quickly reversed. The least certain input data are those strongly

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influenced by factors such as policy decisions and international market forces that may change abruptly.

Where uncertainty is greatest, alternative input values would indicate the sensitivity of model output to the value of the variable in question. When information for an input variable is absent, the model can be used to estimate likely values by indicating the range in which they must fall to be consistent with other known data.

Econometric modeling encourages the collection of a diverse body of information concerning the economy and provides a means of checking its consistency. This helps to assess the value of existing intelligence and research activities and to suggest where additional efforts may be needed.

Parameters *are values that are expected to change slowly or not at all during the simulation period. These may be coefficients of variables in behavioral and technological equations or values appearing in identities. Projections with such equations are valid only for the period in which the parameters are expected to remain constant.*

While coefficient estimates may be based on analyst judgment or taken from other sources, most are derived by econometric techniques from recent historical data. The period involved varies from equation to equation, the goal being to find estimates that cause the equation to fit the historical data best while meeting various consistency, bias, and other criteria. In general, parameter estimates are considered unsuitable unless the resulting equation explains at least 95 percent of the variation in the value of the endogenous variable over the historical estimation period.

Estimates attained in this way are likely to be incorrect to some extent because of problems in the underlying historical data base and limitations in the estimation procedure. The procedure itself, however, assesses the probability of any deviation of the true coefficient value from its estimated value.[a] *It therefore is possible to estimate the probability that the true value falls within any given range around the estimate. In most cases an estimate is accepted only if there is less than a 5-percent chance that the deviation is so large that the true value may be zero or of the opposite sign.*

[a] Statistical estimation of a parameter also yields the standard error of the estimate. In general, there is less than a 5-percent probability that the true value of the parameter is more than two standard errors from the estimated value. This statistical rule of thumb allows us to assess the validity of the parameter estimate. If the standard error is greater than half the value of the parameter itself, the probability that its true value is zero or of the opposite sign is greater than 2.5 percent.

Government consumption is not a factor of production. It is a demand variable. The public sector, however, plays an important role in the Israeli economy:

- It directly produces goods and services that account for a large share of the total output of the economy.
- Government agencies provide entrepreneurial services that facilitate the efforts of other sectors of the economy, making their capital and labor more productive, thus helping to increase their total output along with that of the economy as a whole.
- Government spending, as large as it is in the economy, almost certainly influences the decisions of other producers. Increases in such spending probably encourage those producers to increase output.

It is, therefore, reasonable to expect the level of government activities to be significant in explaining the level of GNP. 25X1

It might be more appropriate to measure these activities by some government variable that reflects output rather than demand. Government consumption, however, appears to be a good proxy for that variable. It significantly improves the fit of the model to the historical data, raising the expectation of more accurate GNP forecasts.

Each coefficient in a Cobb-Douglas function provides an estimate of the relative change in GNP associated with a 1-percent change in a factor of production. Thus, a 1-percent increase in capital stock is associated with a 0.37-percent rise in real output. The coefficients also indicate the share of total output attributable to the individual factors. This equation portrays an economy where labor inputs play a bigger role than capital in determining output. Not surprisingly, government spending is also important. 25X1

Net real additions to stocks (YRRES) are derived from the difference between total availability of goods and services—output plus imports and import taxes (ISIMR and ISIMTR) and total uses—private consumption (ISPCR), total investment (ISIR), government spending, exports (ISEXR), and export subsidies (ISEXSR):

$$ISYR = ISPCR + ISIR + ISGR + ISEXR + ISEXSR - ISIMR - ISIMTR - ISNETFR + YRRES$$ 25X1

Real additions to stocks are converted to current terms using the investment deflator. Additions in current terms along with consumption, investment, government spending, exports, and imports in current terms are used to arrive at GNP in current shekels (ISY). A comparison of real and nominal estimates of GNP yields the GNP deflator (ISYDEF) and the rate of inflation:

$$ISYDEF = ISY/ISYR$$ 25X1

Private Income and Consumption

Private consumption in Israel was two-thirds the level of GNP, $13.7 billion, in 1985. In the model real consumption in the private sector is estimated by a behavioral equation from real disposable income (ISDISPR), lagged private consumption, and the inflation rate for imports (DDIMPDEF) (figure 3):[4] 25X1

$$ISPCR = -2.74 + 0.216*ISDISPR + 0.825*ISPCR(-1) - 0.029*DDIMPDEF$$ 25X1

Here the marginal propensity to consume out of additional disposable income appears to be quite low. But the rate of inflation in the import sector is a significant inducement to private spending. 25X1

The rate of inflation for private consumption (DDPCDEF) is estimated as a behavioral function of the rate of growth of the money supply (DDM2) and that of total military consumption (DDG2), both of 25X1

[4] $R^2 = 0.991$; estimated with 1965-85 data. 25X1

which are projected outside the model by analysts. The rate appears to have trended upward during 1973-85 (DUM7385O) apart from the influence of the other explanatory variables (TIME is an index for year):[5]

DDPCDEF = 0.767*DUM7385O*TIME
+ 143.395*DUM7385E − 21.363*DUM78
+ 0.697*DDM2 + 1.216*DDG2

Changes in military spending appear to be twice as important as those in the money supply in determining the rate of inflation. The deflator derived from the inflation rate is used to determine the nominal value of private consumption.

Private disposable income in current shekels (ISDISP) is arrived at by subtracting direct taxes (ISDT) and those on domestic production (ISTDPFY), public-sector business income (ISGBUSIN), and private-sector loans to the government (ISNETCL) from GNP (figure 4). Subsidies to business (ISBUSSUB), other government transfers to the private sector (ISGTRAN), and personal remittances from abroad (ISFTRANP) are then added:

ISDISP = ISY − ISTDPFY − ISGBUSIN
− ISDT − ISNETCL + ISBUSSUB
+ ISTRAN + ISFTRANP

This is converted to real disposable income by using the deflator for private consumption.

Investment and Capital Stock

Total Israeli investment in 1985 was $4.1 billion—about 20 percent of GNP. Capital stock was valued at almost $50 billion, giving an average capital-output ratio of 2.4.

The model calculates total investment, in current shekels, as the sum of private and public housing investment (ISINH1 and ISPUBH), private and public nonresidential investment (ISINS and ISPUB1), investment in ships and planes (ISVSP), and changes in stocks (ISINSTOK):

ISI = ISINH1 + ISPUBH + ISINS + ISPUB1
+ ISVSP + ISINSTOK

The private housing and nonresidential investment components are both computed in real terms (figure 5). Real private housing is a behavioral function of past values of real personal transfers from abroad and government transfers to the private sector:[6]

$$ISINH1R = -2.94 + 0.569*\left(\frac{ISFTRANP(-1)}{ISIDEF(-1)} + \frac{ISFTRANP(-2)}{ISIDEF(-2)}\right) + 0.127*\left(\frac{ISGTRAN(-1)}{ISIDEF(-1)} + \frac{ISGTRAN(-2)}{ISIDEF(-2)}\right) - 2.174*DUM7385$$

Changes in foreign transfer payments are far more important than those in government transfers in determining the level of private housing investment.

The investment sector deflator (ISIDEF) is derived from the sector rate of inflation (DDIDEF), a behavioral function of the rate of growth of the money supply and of total military consumption (figure 6):[7]

DDIDEF = 104.67*DUM7385E
+ 0.841*DUM7385O*TIME + 0.685*DDM2
+ 1.369*DDG2

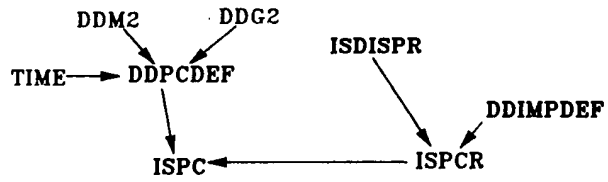
As with the rate of inflation for private consumption, changes in military spending are twice as important as changes in the money supply in determining inflation in the investment sector. The investment deflator is used to convert current private investment into real investment.

[5] DUM78 and DUM7385E are dummy variables for 1978 and 1985, respectively. $R^2 = 0.998$; estimated with 1975-85 data.

[6] DUM7385 is a dummy variable for all years after 1972. $R^2 = 0.930$; estimated with 1967-85 data.

[7] $R^2 = 0.996$; estimated with 1975-85 data

Figure 3
Israel: Private Consumption



DDM2: Money Supply Rate of Growth
DDG2: Percent Change in Total Military Consumption
TIME: Index for Year
DDPCDEF: Private Consumption Inflation Rate
ISDISPR: Real Disposable Income
DDIMPDEF: Inflation Rate in the Import Sector
ISPC: Private Consumption
ISPCR: Real Private Consumption

Variables in black are computed by identities.
Variables in blue are computed by historically derived econometric equations.
Variables in red are exogenously determined.

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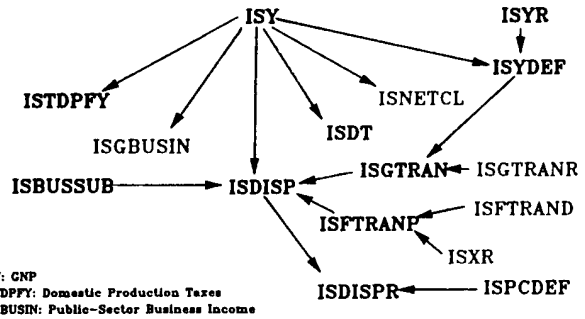
Figure 4
Israel: Disposable Income



ISY: GNP
ISTDPFY: Domestic Production Taxes
ISGBUSIN: Public-Sector Business Income
ISYR: Real GNP
ISYDEF: GNP Deflator
ISNETCL: Net Compulsory Loans
ISDT: Total Direct Taxes
ISBUSSUB: Business Subsidies
ISDISP: Nominal Disposable Income
ISGTRAN: Net Transfers to the Private Sector
ISGTRANR: Real Net Transfers to the Private Sector
ISFTRANP: Personal Transfers from Abroad
ISFTRAND: Personal Transfers from Abroad (Dollars)
ISXR: Exchange Rate
ISDISPR: Real Disposable Income
ISPCDEF: Private Consumption Deflator

Variables in black are computed by identities.
Variables in blue are computed by historically derived econometric equations.
Variables in red are exogenously determined.

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Real private nonresidential investment is estimated as a behavioral function of the unemployment rate (ISUN), past levels of real capital stock, and the tax rate on domestic production (TDPRATE) (figure 7). It appears to have also been influenced by a separate secular trend that is believed to have leveled off after 1985 (TIME4):[8]

$$ISINSR = 3.86 - 145.976*ISUN + 44.445*ISUN(-1) + 12.982*TDPRATE - 1.146*ISKSM78E(-2) + 3.675*TIME4$$

Increasing unemployment lowers investment probably because of rising pessimism, although this negative influence is reduced with time. Investment appears to be encouraged by a higher tax rate on domestic production, but it is negatively related to the available stock of capital.

[8] $R^2 = 0.993$; estimated with 1975-85 data. We would not expect the tax rate on domestic production to encourage private investment as it appears to do in this equation. Perhaps it is investment that affects government tax rate decisions, or there may be some other factor or factors that influence both investment and the tax rate in the same way. This component of the model is under review.

The other investment components—public residential and nonresidential investment, investment in ships and planes, and changes in stocks—are estimated outside the model by analysts.

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Real capital stock is subject to a rate of depreciation (DEP5). It is augmented, however, by private and public nonresidential investment (figure 8):

$$ISKSM78E = ISKSM78E*DEP5 + (ISINS+ISPUB1)*(0.25245/ISIDEF)$$

The last factor converts current shekel values into 1978 values.

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Labor

Israel had a labor force of approximately 1.47 million in 1985, with civilian employment at about 1.37 million. The model estimates labor supply as a behavioral function of the number of persons 14 or older

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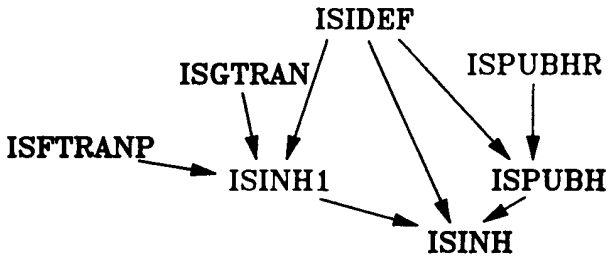
Figure 5
Israel: Investment Housing



ISIDEF: Investment Deflator
ISGTRAN: Net Transfers to Private Sector
ISPUBHR: Real Government Housing Investment
ISFTRANP: Personal Transfers from Abroad
ISINH1: Private Housing Investment
ISPUBH: Public Housing Investment
ISINH: Total Housing Investment

Variables in black are computed by identities.
Variables in blue are computed by historically derived econometric equations.
Variables in red are exogenously determined.

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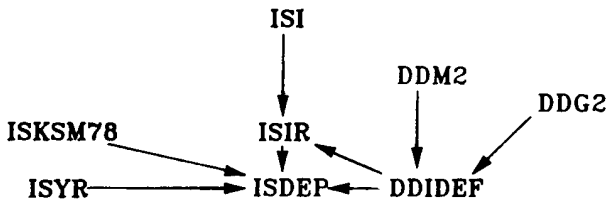
Figure 6
Israel: Real Investment



ISI: Investment
ISIR: Real Investment
ISKSM78: Capital Stock
ISYR: Real GNP
DDM2: Money Supply Growth Rate
DDG2: Percent Change in Real Total Military Consumption
ISDEP: Depreciation Allowance
DDIDEF: Investment Sector Inflation Rate

Variables in black are computed by identities.
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(ISPOP14) and the extent of military activity, with lagged total real military spending (ISGTMCR) serving as a measure of that activity (figure 9):[9]

$$ISLS = -71.978 + 0.547*ISPOP14 - 2.812*ISGTMCR(-1)$$

It appears that only about half the population over age 13 enters the labor force, but an even greater share of the working-age population is likely to belong. As expected, military activity reduces the size of the labor force. Both explanatory variables are exogenous to the model.

Civilian employment is estimated from the labor supply and military activity by a behavioral equation:[10]

$$ISEMP = 375.161 + 0.79*ISLS(-1) - 5.802*(ISGTMCR + ISGTMCR(-1))/2 - 7.193*SSTIME$$

[9] $R^2 = 0.999$; estimated with 1973-85 data.

[10] SSTIME is a sinusoidal function of year that appears to account for a two-to-three-year cycle in employment. $R^2 = 0.994$; estimated with 1973-85 data.

About 20 percent of the new entrants into the labor force find it difficult to get jobs. Again, military activity tends to reduce actual employment of those in the labor force. From employment and the labor supply it is possible to estimate the unemployment rate.

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Another behavioral equation relates the average number of hours worked per week to the real wage rate (ISWRR)—also exogenously supplied to the model—and military spending:[11]

$$ISAHWW = 44.349 - 3.417*ISWRR(-1) + 0.082*ISGTMCR(-1)$$

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Increasing the real wage rate appears to discourage employment, but military activity tends to raise the number of hours worked.

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[11] $R^2 = 0.933$; estimated with 1973-85 data.

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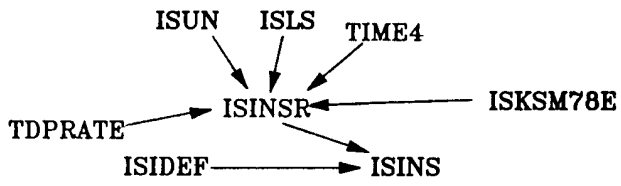
Figure 7
Israel: Private Nonresidential Investment



ISUN: Unemployment Rate
ISLS: Labor Supply
TIME4: Index for Year
ISINSR: Real Private Nonresidental Investment
ISKSM78E: Capital Stock
TDPRATE: Domestic Production Tax Rate
ISIDEF: Investment Deflator
ISINS: Private Nonresidential Investment

Variables in black are computed by identities.
Variables in blue are computed by historically derived econometric equations.
Variables in red are exogenously determined.

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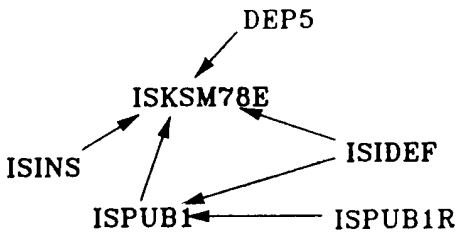
Figure 8
Israel: Capital Formation



DEP5: Depreciation Rate
ISKSM78E: Capital Stock
ISINS: Private Nonresidential Investment
ISPUB1: Public Nonresidential Investment
ISIDEF: Investment Deflator
ISPUB1R: Real Public Nonresidential Investment

Variables in black are computed by identities.
Variables in blue are computed by historically derived econometric equations.
Variables in red are exogenously determined.

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The ratio of GNP to total hours of employment then is used as an estimate of labor productivity:

$$ISPROD = ISYR/(ISEMP*ISAHWW*0.001)$$

This is a measure of the efficiency of Israeli labor. Rising productivity can result from increases in capital stock, improvements in the quality of labor because of education and skill achievement, or changing technology. Evidence suggests that Israeli labor productivity has been essentially stagnant since 1980.

Government Finances

Total expenditures for the Israeli Government represented almost three-fourths of GNP in 1985. Consumption accounted for about 47 percent of these expenditures, investment for another 4 percent, foreign interest payments for about 18 percent, and transfers of various kinds—such as unemployment, old age, and welfare payments—for 31 percent.

Government revenues, on the other hand, were only about half of GNP, with foreign grants representing another 17 percent of GNP. The difference between total government income and expenditures was made up by borrowing from the Bank of Israel and from private sources.

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In the model (figure 10), government consumption is defined to include domestic military and nonmilitary spending (ISGDMCR and ISGDNMCR, respectively) and military imports (ISGFMCR2) less sales of military equipment abroad (ISGEXR):

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$$ISGR = ISGDNMCR + ISGDMCR + ISGFMCR2 - ISGEXR$$

Real values for these variables are supplied from outside the model.

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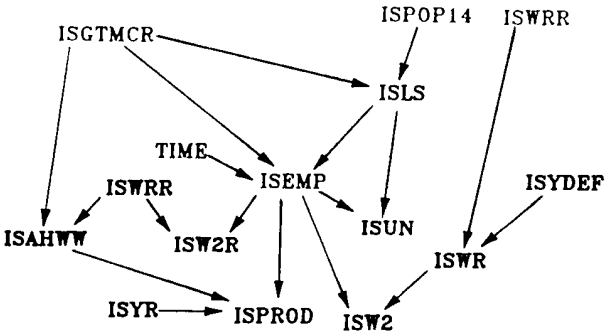
Figure 9
Israel: Labor



ISGTMCR: Real Military Consumption
ISPOP14: Population Over Age 14
ISWRR: Real Wage Rate
ISLS: Labor Supply
TIME: Year
ISAHWW: Average Weekly Hours Worked
ISW2R: Real Wage Bill
ISEMP: Employment
ISUN: Unemployment Rate
ISYDEF: GNP Deflator
ISWR: Wage Rate
ISYR: Real GNP
ISPROD: Labor Productivity
ISW2: Wage Bill

Variables in black are computed by identities.
Variables in blue are computed by historically derived econometric equations.
Variables in red are exogenously determined.

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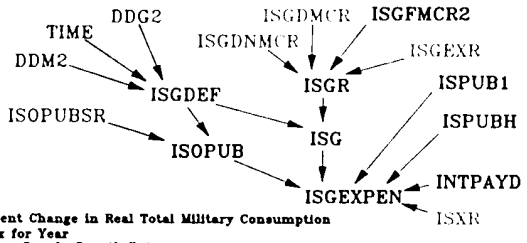
Figure 10
Israel: Government Spending



DDG2: Percent Change in Real Total Military Consumption
TIME: Index for Year
DDM2: Money Supply Growth Rate
ISOPUBSR: Other Public-Sector Real Spending
ISGDEF: Government Consumption Deflator
ISGDNMCR: Real Government Domestic Nonmilitary Consumption
ISGDMCR: Real Government Domestic Military Consumption
ISGFMCR2: Real Government Foreign Military Consumption
ISGEXR: Real Defense Sales
ISGR: Real Government Consumption
ISG: Government Consumption
ISOPUB: Other Public-Sector Spending
ISPUB1: Public-Sector Nonresidential Investment
ISPUBH: Public-Sector Housing Investment
INTPAYD: Interest Payment on Foreign Debt
ISXR: Exchange Rate
ISGEXPEN: Total Government Expenditures

Variables in black are computed by identities.
Variables in blue are computed by historically derived econometric equations.
Variables in red are exogenously determined.

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The rate of inflation in the public sector (DDGDEF) is a behavioral function of the rate of growth of the money supply and the rate of growth of total military consumption. During 1973-85 it appears to have been subject to a separate secular trend:[12]

$$DDGDEF = 0.593*DUM7385O*TIME + 97.004*DUM7385E + 0.752*DDM2 + 0.95*DDG2$$

As with the other inflation rate equations, changes in military consumption have more influence over prices of government output than changes in the money supply. Government consumption in current shekels is computed from the real level and a deflator derived from the estimated rate of inflation.

Government spending is computed by adding up its components—consumption (ISG), residential and nonresidential investment (ISPUBH and ISPUB1, respectively), other spending (ISOPUB), and interest payments abroad on the medium- and long-term foreign debt (INTPAYD):

$$ISGEXPEN = ISG + ISPUBH + ISPUB1 + ISOPUB + INTPAYD*ISXR$$

All but the last are computed in real terms by analysts outside the model.

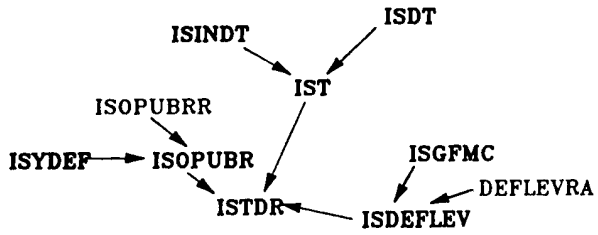
Government revenues are estimated as the sum of civilian taxes (IST), defense import taxes (ISDEFLEV), and nontax public-sector revenue (ISOPUBR), which includes income from public-sector enterprises (ISGBUSIN) and compulsory loans to the government (figure 11):

$$ISTDR = IST + ISDEFLEV + ISOPUBR$$

[12] $R^2 = 0.997$; estimated with 1975-85 data.

25X1

Figure 11
Israel: Government Revenues



ISINDT: Total Indirect Taxes
ISDT: Total Direct Taxes
IST: Total Taxes
ISOPUBRR: Real Nontax Domestic Public-Sector Revenue
ISYDEF: GNP Deflator
ISOPUBR: Nontax Domestic Public-Sector Revenue
ISTDR: Total Public-Sector Domestic Revenue
ISGFMC: Defense Imports
DEFLEVRA: Defense Import Tax Rate
ISDEFLEV: Defense Import Taxes

Variables in black are computed by identities.
Variables in red are exogenously determined.

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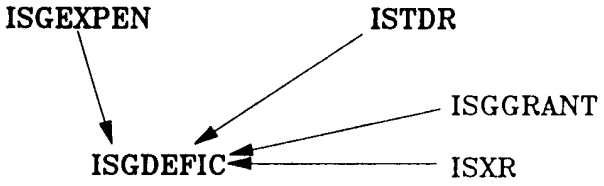
Figure 12
Israel: Government Deficit



ISGEXPEN: Total Government Expenditures
ISTDR: Total Government Revenues
ISGGRANT: Intergovernment Grants
ISXR: Exchange Rate
ISGDEFIC: Government Deficit

Variables in black are computed by identities.
Variables in red are exogenously determined.

25X1

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25X1

The last three values are supplied from outside the model.

Tax revenues are disaggregated into direct and indirect taxes (ISDT and ISINDT):

$$IST = ISDT + ISINDT$$

Direct taxes consist of those on wages (ISTWFY), nonwage income (ISTOI), profits (ISTCI), insurance (ISNIT), and inventory (ISINVT):

$$ISDT = ISTWFY + ISTOI + ISTCI + ISNIT + ISINVT$$

The first four are computed within the model from internally calculated tax bases and tax rates projected externally by analysts. Analysts also supply inventory tax projections.

Indirect taxes consist of those on domestic production (ISTDPFY) and those on civilian imports (ISTIMFY):

$$ISINDT = ISTDPFY + ISTIMFY$$

The government budget deficit is computed as expenditures less revenues and foreign grants (ISGGRANT) (figure 12):

$$ISGDEFIC = ISGEXPEN - ISTDR - ISGGRANT*ISXR$$

Grants are exogenously supplied to the model from analyst projections.

The money supply (ISM2) is also externally estimated and supplied to the model. As noted above, the growth of the money supply is an important determinant of the rate of inflation in various sectors of the economy.

Foreign Trade

Total Israeli exports of goods and nonfactor services were equivalent to about 50 percent of GNP in 1985 (table 1). At the same time imports were equivalent to

25X1

Table 1
Israeli Foreign Trade, 1985

	Imports		Exports	
	Million US $	*Percent*	*Million US $*	*Percent*
Commodities				
Foodstuffs	784	9.6	684	10.9
Grains	408	5.0		
Fruit			476	7.6
Raw materials	294	3.6	318	5.1
Fuels	1,343	16.4		
Crude oil	1,209	14.8		
Manufactured goods	5,572	68.1	5,251	83.9
Chemicals	626	7.7	978	15.6
Transport equipment	435	5.3	314	5.0
Aircraft			272	4.4
Road vehicles	357	4.4		
Semifinished goods	1,063	13.0	823	13.2
Metal manufactures	419	5.1	556	8.9
Machinery	1,788	21.8	1,064	17.0
Consumer goods	1,661	20.3	2,072	33.1
Precious stones	1,298	15.9	1,453	23.2
Other	192	2.4		
Partners				
Developed economies	6,533	79.8	4,806	76.8
United States	1,674	20.5	2,139	34.2
European Community	3,683	45.0	1,979	31.6
Communist	45	0.6	48	0.8
LDCs	222	2.7	597	9.5
Other	1,384	16.9	806	12.9

25X1

about 60 percent of GNP. Israel basically imports energy, manufactured goods, and precious stones while exporting manufactured products and reexporting the precious stones. Most of its trade is with the United States and the European Community.

Exports. The model computes the value of diamond and other commodity exports separately from behavioral equations. The dollar value of diamond exports is a function of imports of diamonds (ISIMDID) in the preceding year, the diamond export deflator (ISEXDDEF), and the gross domestic product of the United Kingdom (UKY) (figure 13):[13]

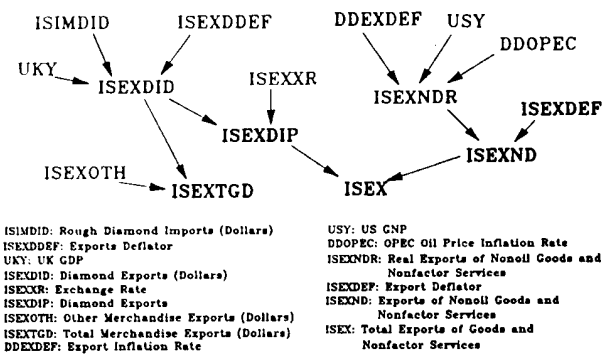
$$\text{ISEXDID} = -1430.45 + 0.378*\text{ISIMDID}(-1) + 7.133*\text{ISEXDDEF} + 7.795*\text{UKY}$$

25X1

[13] $R^2 = 0.958$; estimated with 1968-85 data.

25X1

Figure 13
Israel: Exports—Goods and Nonfactor Services



Variables in black are computed by identities.
Variables in blue are computed by historically derived econometric equations.
Variables in red are exogenously determined.

315262 12-87

An increase in crude diamond imports in one year leads to the growth of exports of diamonds the following year. British GDP serves here as a proxy for economic conditions in Israel's principal markets. The rise of export prices may encourage both sellers and buyers—the former because of rising profits, the latter because of expectations of still higher prices. The last two explanatory variables are estimated outside the model.

The real value of other commodity and nonfactor service exports is a function of US GNP (USY), the percent change in OPEC oil prices (DDOPEC), and the inflation rate for exports in general (DDEXDEF):[14]

$$ISEXNDR = -30.106 + 0.025*USY - 0.009*DDOPEC + 0.014*DDEXDEF(-1)$$

[14] $R^2 = 0.992$; estimated with 1974-85 data.

The United States is Israel's single most important export customer. The two price variables also appear to have an influence on exports. Increases in the price of oil shift import resources among potential customers toward fuels and away from Israeli products. On the other hand, a higher rate of export price inflation probably creates expectations of still further price increases among these customers and induces them to speed up purchases from Israel. 25X1

The first two variables are estimated outside the model (figure 14), but the inflation rate in the export sector is computed by the model as a behavioral function of the rates of growth of the money supply, of total military consumption, and of real imports (DDIMR):[15]

$$DDEXDEF = 0.613*DDM2 + 0.311*DDM2(-1) + 1.283*DDG2 - 0.842*DDIMR$$

The rate of growth of imports seems to have a moderating influence on export inflation, perhaps because imports, particularly diamond imports, play a large role in the availability of goods for export. 25X1

Exports of factor services and export subsidies are externally provided to the model. Factor services include property use, management services, and labor. 25X1

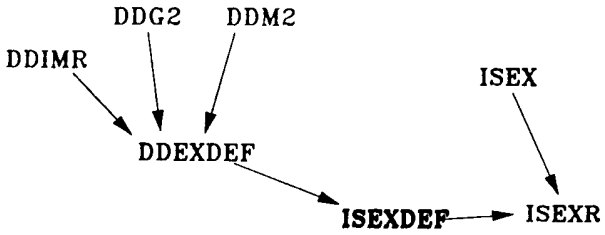
Imports. The volume of fuel imports is estimated by a behavioral equation from past and current real GNP, the average FOB unit price of energy imports (ISPENM) in those years, and the real stock of capital (figure 15):[16] 25X1

$$ISIMFULQ = -10547 + 153.719*ISYR + 201.299*ISYR(-1) + 4.192*ISPENM - 13.015*ISPENM(-1) - 249.982*ISKSM78$$

[15] $R^2 = 0.998$; estimated with 1975-85 data. 25X1

[16] $R^2 = 0.967$; estimated with 1975-85 data. The negative relationship between capital and energy imports may reflect the energy efficiency of new capital permitting a reduction in energy import dependence. In any case, inclusion of the capital variable in the equation improves its fit to the historical data and promises to provide better forecasts. This component of the model is also under review. 25X1

Figure 14
Israel: Real Exports



DDIMR: Percent Change in Real Imports
DDG2: Percent Change in Real Total Military Consumption
DDM2: Money Supply Growth Rate
DDEXDEF: Exports Inflation Rate
ISEX: Total Exports of Goods and Nonfactor Services
ISEXDEF: Exports Deflator
ISEXR: Real Exports of Goods and Nonfactor Services

Variables in black are computed by identities.
Variables in blue are computed by historically derived econometric equations.
Variables in red are exogenously determined.

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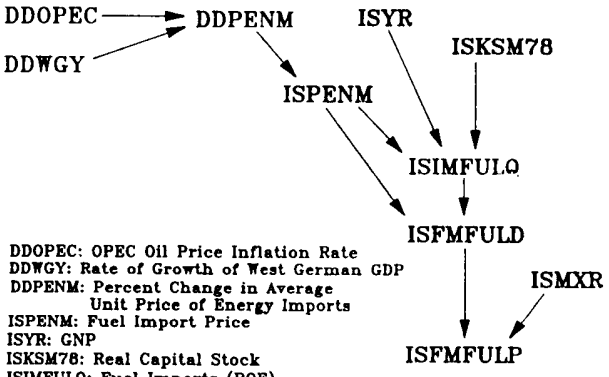
Figure 15
Israel: Imports—Fuel



DDOPEC: OPEC Oil Price Inflation Rate
DDWGY: Rate of Growth of West German GDP
DDPENM: Percent Change in Average Unit Price of Energy Imports
ISPENM: Fuel Import Price
ISYR: GNP
ISKSM78: Real Capital Stock
ISIMFULQ: Fuel Imports (BOE)
ISFMFULD: Fuel Imports (Dollars)
ISMXR: Import Exchange Rate
ISFMFULP: Fuel Imports

Variables in black are computed by identities.
Variables in blue are computed by historically derived econometric equations.
Variables in red are exogenously determined.

315264 12-87

Rising domestic output of goods and services requires additional energy inputs, which must come from abroad. Israel's initial reaction to energy price changes probably involves anticipation of additional movements in the same direction. Hence, rising prices tend to speed up purchases; falling prices tend to postpone them. Prolonged shifts in energy prices, however, negate somewhat the short-run impact on imports. The negative relationship between capital and energy imports suggests that these two production inputs are substitutes.

In the model, changes in the price of energy imports are a function of changes in the OPEC price of oil and in the West German GDP (DDWGY):[17]

$$DDPENM = -6.873 + 1.043*DDOPEC - 0.113*DDOPEC(-1) + 2.171*DDWGY$$

[17] $R^2 = 0.986$; estimated with 1976-85 data.

The price of Israeli energy imports appears to respond quickly to OPEC oil price movements. With time, however, changes in import prices tend to be reversed somewhat. The rate of growth of West German output probably serves as a proxy for economic activity in the West.[18] The more rapidly production increases in the OECD countries, the greater the growth rate of energy demand, and the more rapid the rise in energy prices. 25X1

The energy price inflation rate is used to arrive at the current average price of Israeli energy imports. This is used to estimate the FOB value of these imports: 25X1

$$ISFMFULD = ISIMFULQ*ISPENM/1000$$

25X1

[18] Several different proxies for the level of economic activity among the OECD countries were tested. The model that included the rate of growth of the West German economy provided the best fit to the historical data. 25X1

The CIF dollar value of rough diamond imports is computed by another behavioral equation on the basis of past and current changes in the OPEC price of oil, a diamond import deflator (ISIMDDEF) for the current and past year, the British GDP, and the level of current private nonresidential investment (ISINSR) (figure 16):[19]

$$\begin{aligned}\text{ISIMDID} = &-3017.33 + 21.27*\text{UKY} \\ &+ 4.766*\text{ISYDEF}(-1) - 1.74*(\text{DDOPEC} \\ &+ \text{DDOPEC}(-1))/2 + 14.829*\text{ISIMDDEF} \\ &- 17.663*\text{ISIMDDEF}(-1) - 60.926*\text{ISINSR}\end{aligned}$$

Increases in the rate of growth of the OPEC price of oil and in private nonresidential investment adversely affect diamond imports. Increases in domestic prices probably encourage Israelis to import more diamonds. These imports cannot quickly adjust to rising diamond prices. All of these explanatory variables except for ISINSR are supplied to the model externally from analyst projections.

The CIF value is converted to an FOB value on the basis of externally supplied historically derived estimates of the proportion related to insurance, freight, and other charges (ISCIF):

$$\text{ISFMDID} = \text{ISIMDID}*(1-\text{ISCIF})$$

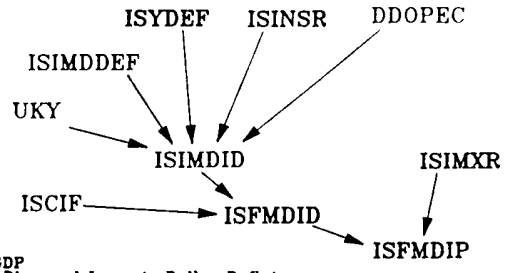
Both energy and diamond dollar import values are translated to current shekel values by an import exchange rate. The base year value of this rate is supplied to the model from observation. The value for subsequent years changes proportionately with the level of the overall exchange rate, which is supplied from external estimates.

The real shekel value of other commodity and nonfactor service imports is estimated as a function of the lagged value of these imports, real total investment in the current and preceding years, and real disposable income (figure 17):[20]

$$\begin{aligned}\text{ISPIMOTR} = &\ 0.356*\text{ISPIMOTR}(-1) \\ &+ 0.258*\text{ISDISPR} + 0.905*\text{ISIR} \\ &- 0.836*\text{ISIR}(-1)\end{aligned}$$

[19] $R^2 = 0.978$; estimated with 1967-85 data.
[20] $R^2 = 0.999$; estimated with 1975-85 data.

Figure 16
Israel: Imports—Diamonds



UKY: UK GDP
ISIMDDEF: Diamond Imports Dollar Deflator
ISYDEF: GNP Deflator
ISINSR: Real Private Nonresidential Investment
DDOPEC: OPEC Oil Price Inflation Rate
ISIMDID: Rough Diamond Imports (Dollars)
ISCIF: Share of Insurance, Freight, and other charges in the value of commodity imports
ISFMDID: Diamond Imports (FOB Dollars)
ISIMXR: Import Exchange Rate
ISFMDIP: Rough Diamond Imports (FOB Shekels)

Variables in black are computed by identities.
Variables in blue are computed by historically derived econometric equations.
Variables in red are exogenously determined.

315265 12-87

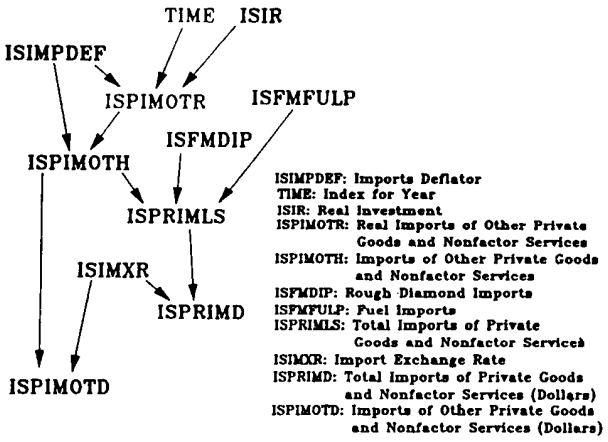
As might be expected, all of the explanatory variables are positively related to these imports. The influence of investments is negative after the first year possibly because they result in domestic production of import substitutes.

An import deflator converts these real values to nominal ones. The base year value of the deflator is supplied to the model from historical observation and changed each year in proportion to changes in the exchange rate and an externally estimated index of the dollar price of imports.

The dollar value of defense imports (ISIMDEFD) is supplied to the model from external estimates. This is changed into shekels at the externally supplied exchange rate.

Imports of factor services are externally provided to the model.

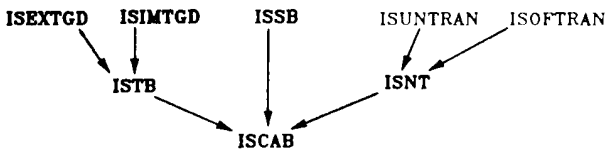
Figure 17
Israel: Imports—Private



Variables in black are computed by identities.
Variables in blue are computed by historically derived econometric equations.
Variables in red are exogenously determined.

315266 12-87

Figure 18
Israel: Current Account Balance



ISEXTGD: Total Exports of Goods (Dollars)
ISIMTGD: Total Imports of Goods (Dollars)
ISTB: Merchandise Trade Balance (Dollars)
ISSB: Service Balance (Dollars)
ISUNTRAN: Private Transfers (Dollars)
ISOFTRAN: Official Transfers (Dollars)
ISNT: Net Transfers (Dollars)
ISCAB: Current Account Balance (Dollars)

Variables in black are computed by identities.
Variables in red are exogenously determined.

25X1

315267 12-87

25X1

Balance of Payments

The sum of the trade, services, and transfers balances represents the *current account balance* (figure 18):

$$ISCAB = ISTB + ISSB + ISNT$$

The *commodity trade balance* is given as the difference between total commodity exports and imports as computed within the model:

$$ISTB = ISEXDID + ISEXOTH - ISIMDEFD - ISFMDID - ISFMFULD - ISIMOTH$$

Nondiamond exports (ISEXOTH) and nondiamond, nonmilitary, and nonfuel imports (ISIMOTH) do not include nonfactor service trade and are projected outside the model by analysts.

The *service balance* is the difference between service receipts (ISEXSD) and service payments (ISIMSD) (figure 19):

$$ISSB = ISEXSD - ISIMSD$$

Receipts include interest earnings (INTRECD) and other service receipts (ISEXOSD). The latter are externally projected. INTRECD is computed within the model from an externally projected interest rate and an internally computed estimate of foreign asset holdings (ISFATOT):

$$INTRECD = WIR*ISFATOT(-1)$$

25X1

Service payments include interest (INTPAYD) on Israel's medium- and long-term debt (ISGDEBT). This is computed by the model from an externally supplied rate of interest (IR) and the debt level:

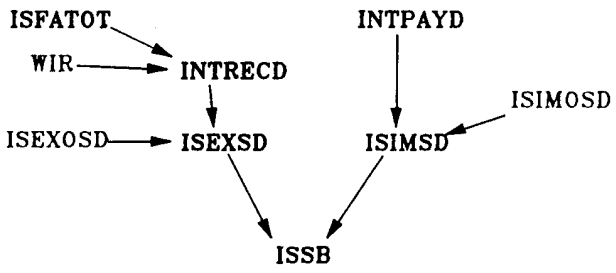
$$INTPAYD = IR*ISGDEBT(-1)$$

Other service payments (ISIMOSD) are projected outside the model by analysts.

25X1

25X1

Figure 19
Israel: Service Balance



ISFATOT: Total Foreign Assets (Dollars)
WIR: Interest Rate on Foreign Assets
INTRECD: Interest Receipts (Dollars)
ISEXOSD: Other Service Exports (Dollars)
ISEXSD: Total Service Exports (Dollars)
INTPAYD: Interest Payments (Dollars)
ISIMOSD: Other Service Imports (Dollars)
ISIMSD: Total Service Imports (Dollars)
ISSB: Service Balance (Dollars)

Variables in black are computed by identities.
Variables in blue are computed by historically derived econometric equations.
Variables in red are exogenously determined.

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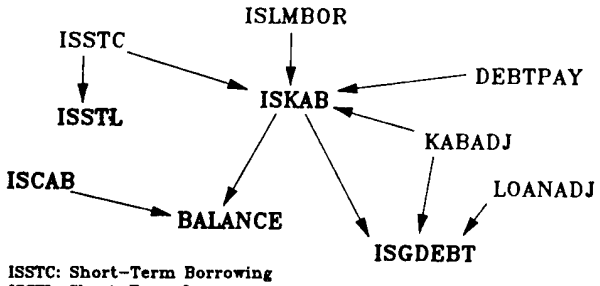
Figure 20
Israel: Capital Account Balance



ISSTC: Short-Term Borrowing
ISSTL: Short-Term Loans
ISLMBOR: Medium- and Long-Term Borrowing
ISKAB: Capital Account Balance
DEBTPAY: Foreign Debt Repayment
KABADJ: Capital Account Adjustment
LOANADJ: Loan Adjustment
ISCAB: Current Account Balance
BALANCE: Change in Foreign Assets Needed for Overall Balance
ISGDEBT: Gross Foreign Debt

Variables in black are computed by identities.
Variables in red are exogenously determined.

25X1

315269 12-87

25X1

Total *net transfers* include private payments, such as personal remittances from West Germany and other sources and institutional payments to private individuals, and official intergovernmental payments, such as grants in aid. These transfers are projected outside the model by analysts.

A *capital account balance* is computed from the externally supplied estimates of borrowing of various maturities and debt repayment. These factors also determine changes in the level of foreign debt from year to year.

The model keeps track of foreign debt and foreign asset holdings (figure 20). Changes in gross medium- and long-term debt are computed as the sum of net changes in short-term debt (ISSTC) and new medium- and long-term borrowing (ISLMBOR) less repayment of existing debt of these maturities (DEBTPAY). Gross medium- and long-term debt is then:

$$ISGDEBT = ISGDEBT(-1) + ISLMBOR - DEBTPAY + ISSTC$$

Net debt requires the subtraction of total foreign asset holdings (ISFATOT). These are estimated by a behavioral equation as a function of the same variables: (figure 21) [21]

$$ISFATOT = -4628 + .605*ISLMBOR - 1.701*ISSTC + 2.365*ISSTC(-1) + 5.551*DEBTPAY + 7.579*DEBTPAY(-1)$$

25X1

All of the explanatory variables are projected outside the model by analysts.

25X1
25X1

The model computes annual debt service payments—the sum of interest payments and debt repayments (figure 22). It also computes various debt service ratios: the ratio of debt service payments to export revenues, income from exports and transfers, and gross national product.

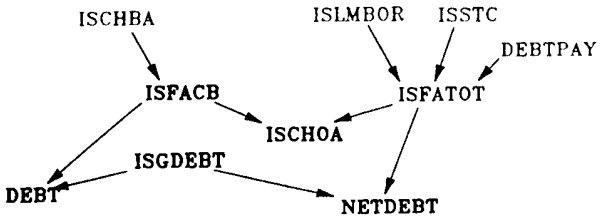
25X1

[21] $R^2 = 0.997$; estimated with 1975-85 data.

25X1

25X1

Figure 21
Israel: Foreign Debt



ISCHBA: Changes in Commercial Bank Foreign Assets
ISFACB: Commercial Bank Foreign Assets
ISLMBOR: Medium- and Long-Term Borrowing
ISSTC: Short-Term Borrowing
DEBTPAY: Foreign Debt Repayment
ISFATOT: Total Foreign Assets
ISCHOA: Change in Noncommercial Bank Foreign Assets
ISGDEBT: Gross Foreign Debt
DEBT: Foreign Debt Net of Commercial Bank Foreign Assets
NETDEBT: Foreign Debt Net of Total Foreign Assets

Variables in black are computed by identities.
Variables in blue are computed by historically derived econometric equations.
Variables in red are exogenously determined.

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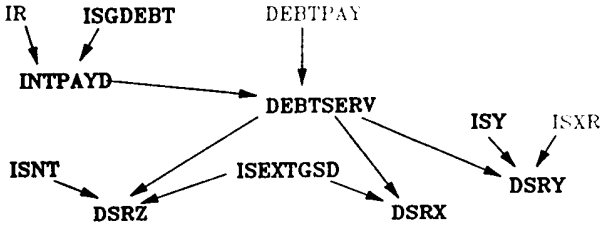
Figure 22
Israel: Debt Service



IR: Interest Rate for Foreign Debt
ISGDEBT: Gross Foreign Debt
INTPAYD: Interest Payments (Dollars)
DEBTPAY: Debt Repayments
DEBTSERV: Debt Service
ISY: GNP
ISXR: Exchange Rate
DSRY: Debt Service-GNP Ratio
ISNT: Net Transfers (Dollars)
ISEXTGSD: Total Exports of Goods and Services (Dollars)
DSRZ: Debt Service-Receipts Ratio
DSRX: Debt Service-Exports Ratio

Variables in black are computed by identities.
Variables in red are exogenously determined.

315272 12-87

25X1

25X1

A civilian trade deficit is defined as the difference between exports and imports of goods and services less military imports:

$$CIVDEF = ISEXTGSD - ISIMTGSD - ISIMDEFD$$

Non-US military aid (NONUSIMD) and debt repayments are subtracted from this deficit to arrive at a measure of the international financial gap before capital flows (figure 23):

$$FINGAP = CIVDEF - NONUSIMD - DEBTPAY$$

Applying the Israeli Model

The Israeli econometric model is a versatile tool that can be used to examine a variety of problems:

- How well has the Israeli economy performed in the recent past?
- Why have certain economic problems developed in Israel?
- Would the Israeli economy run better with different policies?
- Under the conditions likely to prevail over the next several years, what trends in Israeli economic activities can be expected?
- How might this projection change if one or more of the assumed natural conditions or Israeli Government policies were different?
- What resources or conditions may be needed to carry out specific policies or to reach given goals of the Israeli Government?

25X1

25X1

To address these questions the Israeli model must be supplied with values for *exogenous variables* that it does not compute (table 2) and with estimates of the *parameters* of the 20 technological and behavioral

Table 2
Major Data Inputs—Exogenous Variables

Capital
- Nonresidential capital survival rate
- Real changes in stocks
- Real government housing investment
- Real government nonresidential investment
- Real investment in ships and planes
- Share of GNP attributable to income from dwellings

Labor
- Real public-sector wages
- Real wage rate

Fiscal
- Export subsidies
- Implicit tax rate for national insurance
- Implicit tax rate on domestic consumption
- Implicit tax rate on nondefense imports
- Implicit tax rate on other income
- Implicit tax rate on wages
- Inventory surtax
- Other real public-sector spending
- Public-sector business income
- Ratio of import taxes to gross taxes on civilian imports
- Real export subsidies
- Real government nonmilitary domestic consumption
- Real net government transfers to the private sector
- Real nontax domestic public-sector revenue
- Real subsidies to business for domestic production
- Real subsidy component of government loans to business
- Tax rate on business income

Monetary
- Money supply
- Real net private credit absorbed by the government
- Real private-sector credit from the Bank of Israel

Defense
- Defense imports in dollars
- Rate of change in defense import prices
- Real defense exports
- Real government domestic military consumption
- Total foreign exchange expenditures on defense

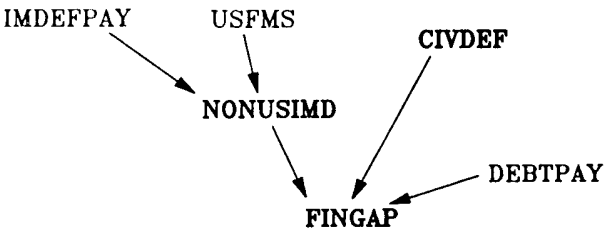
Foreign Trade
- Export price deflator for diamonds
- Exports of factor services in dollars
- Exports of other commodities in dollars
- Exports of other services in dollars
- Import price deflator for diamonds
- Imports of factor services in dollars
- Imports of other commodities in dollars
- Imports of other services in dollars
- Imports of ships and planes
- OPEC price of oil
- Rate of change of dollar import prices
- Real imports of ships and planes
- Share of the value of commodity imports attributable to insurance, freight, and other costs
- Shekel-dollar exchange rate

International Finance
- Bonds issued abroad
- Changes in the foreign asset holdings of commercial banks
- Interest rate on foreign assets
- Interest rate on foreign liabilities
- Intergovernment grants
- Medium- and long-term foreign borrowing
- Official transfers
- Other public-sector foreign capital
- Personal transfers from abroad in dollars
- Private transfers
- Repayments of medium- and long-term debts
- Short-term foreign borrowing
- US economic aid
- US military assistance

Other
- British GDP
- Israeli population age 14 or older
- US GNP
- West German GDP

25X1

Figure 23
Israel: Financial Gap



IMDEFPAY: Total Foreign Exchange Spending on Defence
USFMS: US Military Aid
NONUSIMD: Non-US-Financed Military Imports
CIVDEF: Civilian Trade Deficit
DEBTPAY: Repayment of Long-term Loans
FINGAP: Financial Gap Before Capital Inflows

Variables in black are computed by identities.
Variables in red are exogenously determined.

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equations. With these inputs the model computes values for a variety of *endogenous variables,* including various types of public and private consumption, investment and capital stock, labor supply and employment, government revenues and spending, exports, imports, and international financial debits and credits (table 3).

Historical Analysis—Israeli Hyperinflation

The Israeli econometric model was constructed to replicate developments in the Israeli economy during 1977-85 as closely as possible. Simulation of the economy for this period can help determine why certain phenomena occurred and the extent to which they would have differed under other circumstances.

The Israeli economy, for example, suffered from hyperinflation during the first half of the 1980s. Regression analysis of inflation rates in different sectors of the economy, performed while preparing data for inclusion in the model, suggested, as was generally believed, that growth of the money supply and of military consumption were important factors in the surge of prices. 25X1

On the basis of historical money supply growth, the model simulated a value for the GNP deflator that was close to the actual value for each year of the period (table 4). The money supply growth rate for 1984 was then assumed to be half the actual rate, and the money supply used by the model for that year was adjusted accordingly. All other values were held constant. The resulting simulated inflation rate for 1984 was less than one-third the actual rate for that year, and the computed GNP deflators for 1984 and 1985 were about 44 and 38 percent, respectively, of the actual values. 25X1

It is possible that the policy of expanding monetary credit played only an intermediate role in the inflation, being induced by other factors that should more properly be assigned the primary role. Nevertheless, the results suggest that, if the government had been willing to implement a more austere monetary policy, it could have controlled the rise in prices to a greater extent. 25X1 25X1

Projecting the Future—The Baseline Case

A projection of Israeli economic activity during 1987-89, using the best available estimates of the data inputs for that period, shows real GNP growing by 1 to 1.5 percent the first two years but declining almost 2 percent in 1989 (table 5).[22] Real private consumption and investment grow steadily, if at declining rates, all three years. The decline in private nonresidential investment, 5 percent in 1987, drops off appreciably in 1988-89. Government investment is stagnant, while government consumption, after declining 1 percent in 1987, remains roughly constant over the next two years. 25X1 25X1

Table 3
Major Model Output—Endogenous Variables

	Shekels		Rates of Growth		Deflator
	Real	Nominal	Real	Nominal	
Output/Demand					
GNP	X	X	X	X	X
Private Consumption	X	X	X	X	X
Disposable income	X	X			
Net business product		X			
Capital					
Investment	X	X	X	X	X
Housing investment		X			
Private housing investment	X	X			
Private nonresidential investment	X	X			
Capital stock	X	X			
Depreciation	X				
Labor					
Employment					
Productivity			X		
Supply					
Unemployment rate					
Wage rate		X	X		
Wage bill	X	X			
Government					
Consumption	X	X	X	X	X
Military consumption	X		X		
Foreign military consumption	X		X		
Domestic military consumption	X		X		
Expenditures		X			
Revenues		X			
Deficit		X			
Total taxes		X			
Direct taxes		X			
Indirect taxes		X			
Bank of Israel borrowing		X			

Table 3
Major Model Output—Endogenous Variables (continued)

	Shekels		Dollars
	Real	Nominal	
International trade			
Trade balance			X
Exports			
Commodities			X
Services			X
Diamonds	X		X
Other	X	X	
Imports			
Commodities			X
Services			X
Diamonds			X
Fuel	X	X	X
Other private	X	X	X
Military	X	X	
Civilian			X
Service balance			X
International finance			
Net transfers			X
Current account balance			X
Capital account balance			X
Overall balance			X
Gross foreign debt			X
Net foreign debt			X
Debt service payments			X
Debt service ratio			

25X1

Using Econometric Models

A model may be intended to do no more than describe the economic system of a country. Merely setting forth the set of equations forces analysts to differentiate explicitly between what they consider important and what they do not. Estimating the parameters of the equations statistically can then validate their judgment and provide a still more detailed description of the economy.

The econometric model, however, can serve an even more useful purpose—simulating the operation of the economy so as to compute values of important variables for a given year. This involves solving each equation for the value of some variable. If the model is to be simulated over a period of years, the equations are solved for each year in turn.

Various types of simulations are possible—historical and current analysis, or projections of future developments. Using the best estimates of the values of the exogenous variables for a given period yields a baseline simulation *of that period against which to compare the output of other scenarios.*

Policy scenarios *test the implications of various government policies. The values of relevant exogenous variables and parameters are varied to reflect changes in those policies. The outcome of such scenarios can then be compared with one another and with the outcome of the baseline projection to determine the impact of the policies on specific endogenous variables.*

Simulations can also be used to test the impact of variables outside the economic system. These might include natural phenomena such as weather conditions, technological factors such as those governing production, the behavior of people and institutions within the country such as that involved in consumption out of income, and the actions of other countries as exhibited by what they buy, sell, or lend.

Sensitivity analysis *is performed to study how one variable influences others in the model. This may result in estimates of elasticities—the extent to which changes in one variable alter the values of others. Some of these changes may involve important multipliers, such as the extent to which increases in investment or government spending cause GNP to grow by an even greater amount.*

The model can help to distinguish direct from indirect effects among variables. Direct influences may be readily apparent. In a complex system, however, a variable may also influence another through intermediate variables. Such indirect impacts can reinforce or counteract the direct influence. They can occur quickly or only after the passage of a long time. Economic analyses involving only two main variables may overlook such indirect influence or provide an estimate of the total effects without distinguishing between direct and indirect components.

Sensitivity analysis can also be used to determine where data accuracy is most important. If an important endogenous variable is highly sensitive to the value of a given exogenous variable, it is important to know that value with some accuracy. A model of an economy usually involves many exogenous data inputs. It may well be difficult to estimate them all with great accuracy. Sensitivity analysis can help to determine which of the exogenous variables have the greatest influence on model performance and therefore should be estimated more carefully. Research resources can then be focused on these variables.

Goal analysis *involves simulations aimed at determining how a country can achieve a given goal, such as a specific rate of GNP growth, a given unemployment level, or a specific inflation rate. Such analysis may reveal the existence of bottlenecks and determine whether the goal is feasible or infeasible under a given set of conditions and government policies.*

In optimization analysis *a model is used to determine the combination of values of model components that maximizes or minimizes a given variable, such as government revenues or the current account deficit. A simulation model is not well suited to optimization analyses. Other types of models have been developed specifically for this purpose. But these models may not be able to handle complex problems such as those that exist in a dynamic economy. For these questions, even the approximate answers that can be obtained by iterative simulations may be useful.*

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Table 4
Actual and Estimated GNP Deflators, 1978-85

	Actual Values		Simulated Values		
	Money Supply (*million shekels*)	Deflator	Baseline Historical Deflator	Reduced Money Growth Scenario	
				Money Supply (*million shekels*)	Simulated Deflator
1978	19	0.24	0.28	19	0.28
1979	39	0.43	0.48	39	0.48
1980	92	1.00	1.08	92	1.08
1981	202	2.27	2.31	202	2.31
1982	496	5.08	4.77	496	4.77
1983	1,509	12.74	12.77	1,509	12.77
1984	9,240	61.31	61.58	5,283	26.75
1985	25,052	220.93	222.30	14,321	83.78

25X1

Both exports and imports grow throughout the period, but the growth rate for the latter drops off rapidly. This change results mostly from a drastic decline in the growth of civilian imports over the three years. Net factor service imports, which are projected to rise substantially this year, drop somewhat next year and at a much faster rate the following year.

Despite the slowing growth of imports, they continue to increase more rapidly than exports over the three years, causing the trade deficit to grow. Although the service account deficit is fairly level throughout the period, a slow rise in net transfers cannot prevent sharp increases in the current account deficit in 1988 and in the financial gap in 1989. Total debt, however, is projected to fall slightly with the debt service ratio remaining roughly constant.

Scenario Analyses

Given this baseline projection, a best guess of the future, the model can be used to explore the implications of various scenarios. These can involve changes in Israeli Government policies or in factors beyond its control—such as the policies of other governments, international financial conditions, or natural phenomena. Such studies, while involving hypothetical situations, provide a better understanding of the strengths of the Israeli economy and of barriers and bottlenecks that may appear in different situations. 25X1

Policy Analysis. Scenario analysis reveals that the government budget balance is sensitive to nonmilitary spending (table 6). The baseline projection shows a surplus growing rapidly during 1987-89. One assumption of this projection is that real domestic nonmilitary spending remains constant. When this spending is allowed to rise by 10 percent in 1988 and again in 1989, however, total nominal government spending rises only slightly, but the 1988 budget surplus falls 15 percent below the baseline level and that for 1989 is 30 percent lower than the corresponding baseline level. 25X1

Model analysis reveals that raising investment can speed up GNP growth (table 7). In the baseline projection real GNP grows slowly during 1987-89—at least partly because real investment, which was almost 9 percent lower in 1986 than it was in 1979, is expected to grow only 5.8 percent in 1987, 3.7 percent in 1988, and less than 2 percent in 1989. Setting real investment growth in the model to 10 percent each

Table 5
Baseline Projection

	1987	1988	1989
Main Economic Indicators			
	Million 1980 shekels (except where noted)		
Gross national product	115.09	116.74	114.57
Percent change	1.37	1.43	−1.86
GNP deflator	341.70	400.79	470.55
Percent change	15.07	17.29	17.41
Capacity utilization rate (*percent*)	95.57	96.04	93.44
Unemployment rate (*percent*)	7.47	7.46	7.57
Components of aggregate demand			
Private consumption	92.50	99.77	106.22
Percent change	9.69	7.85	6.47
Total investment	25.28	26.22	26.71
Percent change	5.79	3.71	1.88
Government consumption	38.14	38.44	38.30
Percent change	−1.14	0.79	−0.37
Exports	61.25	64.05	65.84
Percent change	1.08	4.57	2.79
Imports	96.33	100.45	102.15
Percent change	10.14	4.27	1.70
Net factor imports	6.18	6.07	5.51
	Million US $		
Balance of payments			
Trade balance	−2,992.63	−3,554.68	−4,083.15
Exports	7,767.85	8,262.84	8,723.75
Imports	10,760.47	11,817.52	12,806.90
Service balance	−1,639.53	−1,657.82	−1,566.00
Of which:			
Interest paid	2,685.33	2,651.13	2,774.19
Interest received	1,073.80	1,219.32	1,308.19
Net transfers	4,488.00	4,552.00	4,750.00
Official	3,500.00	3,500.00	3,650.00
Private	988.00	1,052.00	1,100.00
Current account balance	−144.15	−660.49	−899.14
Direct defense imports	1,700.00	1,800.00	1,800.00
Defense import payments	2,115.00	2,210.00	2,300.00
US-financed payments	2,326.00	2,614.00	2,600.00
Non-US-financed imports	−211.00	−404.00	−300.00
Debt repayment	1,480.00	1,455.00	1,610.00
Total debt	29,457.00	29,202.00	28,692.00

Table 5
Baseline Projection (continued)

	1987	1988	1989
	Million US $		
Debt service ratio	0.34	0.32	0.32
Financial gap	−4,201.15	−4,463.49	−5,159.14
External fund	2,738.00	2,802.00	2,850.00
Of which:			
US economic aid	1,200.00	1,200.00	1,200.00
Detailed Components of Real GNP			
	Million 1980 shekels (except where noted)		
Private consumption	**92.50**	**99.77**	**106.22**
Percent change	9.69	7.85	6.47
Total investment	**25.28**	**26.22**	**26.71**
Percent change	5.79	3.71	1.88
Private nonresidential	12.19	11.89	11.64
Percent change	−4.85	−2.46	−2.10
Private residential	8.09	9.33	9.77
Percent change	26.69	15.31	4.74
Ships and planes	0.60	0.70	0.70
Percent change	20.00	16.67	0.00
Private inventory	0.40	0.30	0.40
Percent change	100.00	−25.00	33.33
Government nonresidential	3.00	3.00	3.10
Percent change	0.00	0.00	3.33
Government residential	1.00	1.00	1.10
Percent change	0.00	0.00	10.00
Government consumption	**38.14**	**38.44**	**38.30**
Percent change	−1.14	0.79	−0.37
Domestic nonmilitary	12.60	12.70	13.00
Percent change	−1.87	0.79	2.36
Total military	25.54	25.74	25.30
Percent change	−0.78	0.79	−1.72
Foreign military	10.54	10.74	10.23
Percent change	0.00	1.91	−4.76
Domestic military	15.30	15.40	15.50
Percent change	−0.65	0.65	0.65
Defense sales	0.30	0.40	0.43
Percent change	50.00	33.33	7.50
Foreign trade sector			
Exports	61.25	64.05	65.84
Percent change	1.08	4.57	2.79

Table 5
Baseline Projection (continued)

	1987	1988	1989
	Million 1980 shekels (except where noted)		
Imports	96.33	100.45	102.15
Percent change	10.14	4.27	1.70
Civilian imports	71.10	74.33	76.05
Percent change	11.32	4.54	2.32
Ships and planes	0.33	0.33	0.34
Percent change	0.00	0.00	3.03
Direct defense imports	8.72	8.89	8.46
Percent change	0.00	1.91	−4.76
Import taxes	16.18	16.91	17.30
Percent change	11.25	4.46	2.33
Net factor imports	6.18	6.07	5.51
Percent change	9.47	−1.69	−9.36
Assumed Values for Exogenous Variables			
Government variables			
Domestic nonmilitary expenditures	12.60	12.70	13.00
Percent change	−1.87	0.79	2.36
Domestic military expenditures	15.30	15.40	15.50
Percent change	−0.65	0.65	0.65
Residential investment	1.00	1.00	1.10
Percent change	0.00	0.00	10.00
Nonresidential investment	3.00	3.00	3.10
Percent change	0.00	0.00	3.33
	Million current shekels (except where noted)		
Net transfers to private sector	**9,020.83**	**11,142.04**	**12,657.92**
Percent change	16.39	23.51	13.61
Net credit absorption by government	−3,416.98	−2,003.96	−4,705.55
Percent change	−42.47	−41.35	134.81
Public-sector wages	7,175.66	8,416.64	10,163.98
Percent change	15.07	17.29	20.76
Bank of Israel credit to private sector	717.57	961.90	1,317.55
Percent change	34.25	34.05	36.97
	Percent		
Tax rates			
Defense import taxes	20.91	20.91	20.91
Inventory surtax	11.43	15.88	11.86
Business income tax	4.93	4.93	4.93
Domestic production tax (including value-added tax)	20.85	20.85	20.85

Table 5
Baseline Projection (continued)

	1987	1988	1989
	Percent		
Import tax	17.92	17.92	17.92
National insurance tax	16.68	16.68	16.68
Wage tax	17.71	17.71	17.71
Taxes on other income	13.56	13.56	13.56
	Percent change		
Balance of payments			
Dollar price of imports	0.67	2.81	4.32
Dollar price of oil	26.92	9.09	5.56
World interest rate	8.00	8.00	8.50
Exchange rate (level)	1.64	1.84	1.93
	Million US $		
Foreign debt repayments	1,480.00	1,455.00	1,610.00
Direct defense import payments	2,115.00	2,210.00	2,300.00
Direct defense imports	1,700.00	1,800.00	1,800.00
Net foreign borrowing by government	3,131.00	3,449.00	3,340.00
Total gross capital flow (excluding military aid)	2,738.00	2,802.00	2,850.00
US economic assistance	1,200.00	1,200.00	1,200.00
US FMS (military assistance)	2,326.00	2,614.00	2,600.00

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year raises the growth rate of real GNP almost 0.26 percentage point in 1988 and 0.52 percentage point in 1989. In 1989 real GNP is almost 1 million 1980 shekels higher.

The model indicates that real public nonresidential investment would have to be 25 percent higher in 1987, 50 percent higher in 1988, and over 100 percent higher in 1989 above the baseline levels to account for the increased rate of growth of total real investment envisaged here. The government would have to decide whether such increases in public investment would be worth the expected growth of GNP.

The government can try to spur private consumption growth by expanding production or reducing taxes (table 8). The model shows that reducing taxes on domestic production in 1988 and 1989 10 percent below the baseline levels lowers government revenues by 600 million current shekels in the first year and 700 million shekels in the second. The government budget surplus is 20 percent below baseline levels in both years. Secondary effects cause a slight decline in investment. Real private consumption is 0.3 percent higher than the baseline level in the first year and almost 0.6 percent higher in the second.

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On the other hand, an increase in real public nonresidential investment by the same amount as the decline in taxes speeds up the growth of capital stock, permitting faster growth of real output. This gain is wiped out, however, by lower exports and greater imports caused by indirect relationships in the economy.

Table 6
A Government Budget Balance Scenario, 1986-89

	Real Nonmilitary Government Spending [a]	Total Government Spending [b]	Government Budget Balance [b]
Baseline projection			
1986	12.84	22.0	0.6
1987	12.6	25.2	1.4
1988	12.7	29.4	2.5
1989	13.0	33.2	3.4
10-percent growth rate for nonmilitary government consumption			
1987	12.6	25.2	1.4
1988	13.9	29.8	2.1
1989	15.3	34.1	2.4

[a] Million 1980 shekels.
[b] Billion current shekels.

Table 7
Accelerating GNP Growth Through Investment: Shortrun Potential and Costs, 1987-89

Million 1980 shekels

	Real GNP		Real Investment Percent Change	Real Public Non-residential Investment
	Value	Percent Change		
Baseline projection				
1987	115.1	1.37	5.79	3.00
1988	116.7	1.43	3.71	3.00
1989	114.6	−1.86	1.88	3.10
Greater investment				
1987	115.0	1.41	10.0	3.27
1988	117.0	1.69	10.0	4.70
1989	115.4	−1.34	10.0	7.26

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Table 8
Approaches to Expanding Private Consumption, 1988-89

Economic Activity	Baseline Case		Increased Investment		Reduced Taxes	
	1988	1989	1988	1989	1988	1989
National accounts (*million 1980 shekels*)						
GNP	116.7	114.6	117.1	115.2	116.7	114.5
Disposable income	122.9	124.2	122.1	124.1	124.4	125.7
Private consumption	99.8	106.2	99.6	106.1	100.1	106.8
Investment	26.2	26.7	28.5	29.1	25.9	26.4
Capital stock (*million 1978 shekels*)	72.2	72.1	72.7	73.3	72.1	72.0
Government finance (*billion current shekels*)						
Government budget balance	2.5	3.4	1.8	2.5	2.0	2.7
Taxes on domestic production	6.9	8.0	6.8	8.0	6.2	7.2
Government revenues	24.8	29.0	24.7	29.0	24.2	28.3
Public investment	0.9	1.1	1.6	1.9	0.9	1.1
Total spending	29.4	33.2	30.0	34.0	29.4	33.2

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Table 9
Improving Labor Productivity, 1988-89

Economic Activity	Baseline Case		Improved Labor Efficiency		Increased Investment	
	1988	1989	1988	1989	1988	1989
National accounts *(million 1980 shekels)*						
GNP	116.7	114.6	117.2	119.0	117.2	119.0
Investment	26.2	26.7	26.2	26.7	29.5	54.8
Capital stock *(million 1978 shekels)*	72.2	72.1	72.2	72.1	73.0	80.0
Labor						
Change in productivity *(percent)*	0.6	−2.4	1.0	1.0	1.0	1.0
Output elasticity	0.597	0.597	0.598	0.607	0.597	0.597

25X1

Although real private consumption remains roughly constant, the government budget surplus falls even further below the baseline levels.

These results suggest that, although increasing investment is immediately beneficial to the economy as a whole, it has little impact on private consumption. A reduction in taxes, however, has a more immediate impact on consumption but little effect on output.

Goal Analysis. The Israeli econometric model can be used to determine the resources, activities, and conditions needed to achieve specific economic goals or to carry out certain policies. Such analyses reveal the feasibility of these goals and policies and obstacles that may impede their achievement and execution. They indicate possible costs and provide a means of comparing these costs with those of alternative goals and policies to arrive at an estimate of the relevant trade-offs.

The baseline projection reveals that labor productivity in Israel declined by 1.5 percent in 1986 and projects it to grow by only 0.6 percent a year in 1987 and 1988. A 2.4-percent decline is projected for 1989 (table 9). This suggests that worker efficiency is falling and that domestic output per capita is under downward pressure.

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Labor productivity might be raised by giving each worker more or better tools. To increase the rate of growth of labor productivity to 1 percent a year in 1988 and 1989, the model suggests that the stock of capital in 1988 would have to be 1 percent above its baseline level and 11 percent above the following year. To do this, however, total real investment would have to be 3.3 million 1980 shekels higher in 1988 and about 28 million higher in 1989—13 and 105 percent above the respective baseline levels.

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Alternatively, worker efficiency might be raised directly with better education, job placement, on-the-job training, and productivity inducements. This effort would be costly and could not be quickly implemented. During 1973-85 a 1-percent increase in labor effort (measured by hours worked) apparently

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Econometric Simulation Models—
Advantages and Limitations

The econometric model greatly facilitates the handling of data concerning the economy of a country and the factors that may affect it. It provides a framework for the collection and storage of these data and permits them to be analyzed by a wide variety of techniques for consistency and relative importance to the functioning of the various sectors of the economy.

The model forces analysts to make explicit their assumptions about factors controlling the economy. These assumptions can then be more easily debated and tested against available empirical evidence and checked for logical consistency. To the extent that the model includes variables describing noneconomic phenomena, it encourages greater interaction of economic analysts with those responsible for political, social, military, and other developments.

Linkages among the various sections of the model reflect linkages in the economy. Results obtained with the model, therefore, include both direct and indirect effects of policies and events affecting the economy and are more comprehensive and internally consistent than those that can be obtained by separate analyses of individual sectors of the economy. This makes the model especially useful for analysis of how a development in one sector of the economy, such as public finance, might affect other areas, such as the balance of payments.

Linkages in the model, however, whether intersectoral or dynamic, allow errors in one section to be transferred to other areas.

The model is dynamic, showing the impact of an event over time. Thus, debt service payments in one year are determined by borrowing in past years. This dynamism allows analysis of the speed with which policies and events affect various components of the economy, making the model especially useful in the assessment of growth prospects.

Models of this type, however, are not without their limitations. Any model contains only those features that the user believes are important to the subject matter. It is suited to certain tasks but not to others. Moreover, the validity of the results depends strongly on the validity of the structure of the model and on the quality of the data inputs.

The econometric simulation model is not well suited to solving questions of optimal performance by the overall Israeli economy. Such analyses require repeated simulations—in each parameter values are varied to determine which combination results in the optimization of some goal. For simple problems of this type, other mathematical models can be applied directly to find an analytical solution.

The econometric model cannot make predictions or forecasts. Instead it makes conditional projections of trends in economic activities based on the specific assumptions and data used. Each projection involves a degree of uncertainty:

- *Those technical and behavioral equations estimated from historical data involve statistical imprecision.*
- *The future values of the exogenous variables must be projected outside the model. Uncertainty is inherently involved in these projections.*

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- *It is also impossible to foresee with certainty future policies of the Israeli and other governments.*

These uncertainties are greater in certain areas than in others. Therefore, the results of the model must be interpreted with care. Where possible, each problem should be examined in the light of alternative possibilities. Computer models greatly simplify the task of testing the implications of different assumptions in a variety of scenarios. Inevitably the result is a range of possible outcomes rather than a point estimate.

The validity of results obtained with the model is no better than that of its structure as a description of the economy and of the quality of data inputs. This is especially true of the behavioral and technological equations in the model, the parameters of which are derived from historical data by econometric analysis. The parameter estimates remain valid only if the historically observed relationships continue to hold during the period over which the model is simulated. The structure of the model and the required data inputs must reflect where the economy is going, not where it has been.

Even if such changes occurred, however, the model would remain useful as a framework that can be used to explore estimates of more valid parameters. Results might then suggest the consistency of such estimates with other known data.

yielded 0.5966 percent more output. If that were raised to 0.5976 percent in 1988 and 0.607 percent in 1989, labor productivity would grow by 1 percent each year. It is reasonable to expect that growth of both human and physical capital would be pursued to raise labor productivity. [redacted] 25X1

Evaluating the Israeli Model

How good is the Israeli model? One measure of its performance is its ability to describe past and present economic activity in Israel. Another measure is the accuracy of old projections. In both cases, model output is compared with actual values. Because the model depends on statistical inputs, we would expect its descriptions and projections of trends and averages over a period of time to be more accurate than its estimates of values in any given year. [redacted] 25X1

Historical Tracking

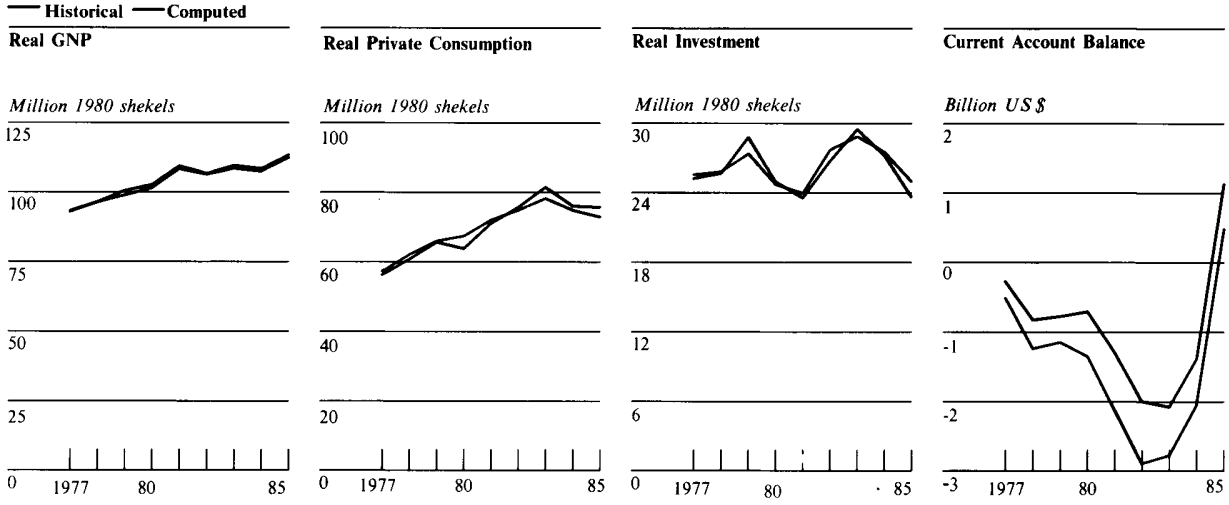
The Israeli model was used to simulate economic activities during 1977-85 to evaluate its ability to describe the Israeli economy. Comparison of the results with the actual values for these activities during that period suggests that the model can approximate recent and current trends as well as year-to-year shifts in these activities quite well (figure 24).

[redacted] 25X1

The components of these aggregates are computed by equations, the parameters of which have been accurately estimated from observations for 1977-85. Individually, these equations closely fit this period. It is not surprising, therefore, that together within the model they generate results close to actual historical values. [redacted] 25X1

A summary evaluation of model performance in describing key Israeli economic activities during 1977-85 is given by the average absolute annual error and

Figure 24
Comparison of 1977-85 Israeli Model Output for Key Variables With Corresponding Actual Values



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the largest annual error for the period (table 10). The errors are relatively small for the national account, labor, government revenues and spending, and foreign trade aggregates but are large for the budget and foreign balances. The balances are residuals that are generally much smaller than their components. Errors that are relatively small in the components are transferred absolutely to the balances where they appear relatively larger.

Even so, estimates for the government finance and foreign balance variables are much better for the more recent past. The average annual error for 1981-85 is only 1.5 percent for government revenues, 1.9 percent for government spending, and 7.8 percent for the budget balance. For the current account balance, it is only 7.2 percent and for the overall balance, 46.3 percent.

Analysis of model performance in portraying past and current developments in the Israeli economy reveals which segments of the model do well in describing the corresponding components of the economy and which do not. We gain some understanding of the nature and size of the errors involved with specific results that must be kept in mind when using the model for projections of future developments. Moreover, the analysis suggests where additional intelligence, research, and modeling efforts are needed to make the greatest contribution to model improvement.

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Past Projections

The ability of the model to describe past events gives no guarantee that it can accurately project future developments. It, however, is possible to gain insights into the accuracy of model projections by looking at past projections of periods that are now history.

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Table 10
Annual Errors in Simulating Key Output, 1977-85

Percent

Output	Average Absolute Error	Largest Absolute Error
National accounts		
Real gross national product	0.4	0.8
Real private consumption	2.7	6.9
Real investment	2.8	6.7
Private residential	8.4	21.5
Private nonresidential	6.0	11.4
Labor supply	0.3	0.5
Government finance		
Revenues	5.4	15.3
Spending	5.6	14.3
Budget balance	14.7	36.5
Foreign trade and finance		
Total imports	0.5	1.0
Energy imports	1.0	2.1
Total exports	1.4	3.6
Current account balance	15.2	56.6
Overall balance	55.8	194.7
Inflation rate	12.0	41.2

Table 11
1984 Model Projections of the Israeli Economy in 1985 and 1986

Variable	Projected Value	Actual Value
Change in real GNP growth (*percent*)		
1985	2.9	2.8
1986	2.2	2.2
Change in real private consumption growth (*percent*)		
1985	4.7	0.0
1986	3.9	14.0
Unemployment rate (*percent*)		
1985	6.8	6.7
1986	7.7	7.1
Financial gap (*billion US $*)		
1985	6.8	3.9
1986	6.9	5.9

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One such projection was published at the beginning of 1985 (table 11).[23] Extrapolating then current trends, the model accurately projected the unemployment rate and growth of real GNP in 1985 and 1986. Its estimate of the financial gap—the sum of the civilian goods and services deficit, self-financed military payments, and debt repayment—was well off the mark in 1985 but more accurate for the following year. Projections of growth in real private consumption were poor for both years.

It is difficult for the model to estimate residual values, such as the financial gap, and to project growth rates with accuracy. The latter can be done only if the model correctly estimates the beginning and ending values of the variable in question or if errors in estimating these values are roughly proportional and in the same direction. The accuracy of growth rate estimates will be poor, however, where errors in the beginning and ending values are not proportional and especially where they are in the opposite direction, even if the absolute size of the errors themselves is small.

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A comparison of Israeli economic activities in 1986 with model projections for that year made in early 1987, before 1986 data were available, reveals relatively small errors in the estimates of real GNP and private consumption (table 12). The projection of real investment is less accurate. Although the estimate for the rate of growth of private consumption is close to the actual value, those for the rates of change of real

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Table 12
Selected 1987 Model Projections of the Israeli Economy in 1986

Variable	Projected Value	Actual Value
Real national account aggregates (*million 1980 shekels*)		
GNP	113.5	116.0
Private consumption	84.3	85.0
Investment	23.9	21.8
Rates of growth (*percent*)		
Real GNP	0.7	2.9
Real private consumption	12.3	14.0
Real investment	1.9	−5.5
GNP inflation (*percent*)	34.4	54.2
Labor		
Supply (*thousands*)	1,502	1,472
Unemployment rate (*percent*)	7.5	7.1
Tax revenues (*billion current shekels*)		
Total	16.3	20.0
Direct	8.6	10.2
From wages	2.7	2.5
From business income	0.9	1.4
From other income	2.4	3.2
From national insurance	2.5	2.7
Indirect	7.7	9.8
From domestic production	4.9	5.9
From imports	2.8	3.9
Trade (*million US $*)		
Current account balance	992	1,371
Commodity trade balance	−2,437	−1,926
Commodity exports	7,026	7,637
Commodity imports	9,463	9,564
Service balance	−1,693	−2,040
Net transfers	5,123	5,337
Financial gap	−4,280	−5,900

GNP and investment are not. The inflation rate is significantly underestimated, although, in comparison to rates in recent years, the projection for 1986 is not bad.

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Labor supply and unemployment rate projections are quite good. Tax revenues, however—especially those from income, production, and imports—are significantly underestimated. The current account surplus was also underestimated, mainly because exports of goods were projected to be much less than they turned out to be. Also somewhat understated was the deficit on service account and, more seriously, the financial gap. In contrast, imports and net transfers were projected quite accurately, but the latter are estimated outside the model.

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In projecting the future, data inputs cannot be known with certainty and must be estimated. Whatever the method used, the estimates may be wrong. Moreover, policies and technological conditions may change. The structure of the economy and society may also change. If it does, equations estimated from historical data may no longer be valid.

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Such changes have been especially critical in the case of Israel. The National Unity government that came to power in 1984 implemented drastic policy changes to solve the serious economic problems that the country then faced. In important ways the structure of the economy shifted. It, therefore, is not surprising to find significant lapses in the model's projections under these conditions. Rather, it is reassuring to find that many estimates turned out to be fairly accurate.

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Moreover, errors in estimates for a given year are not unexpected. The model should operate more accurately in projecting trends for the next several years than in making point estimates for any one of them.

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Appendix

The Israeli Econometric Model

The current version of the Israeli econometric model is written in the TROLL language and includes 197 equations. Each computes the value of one endogenous variable for each year of the simulation. To make these calculations, the model requires the values for 88 exogenous variables for each year of the simulation period. These values are estimated by analysts and provided to the model.

In addition, 20 of the equations contain 94 parameters that are estimated by econometric analysis from historical data and then supplied to the model. Their values remain constant throughout the simulation.

Following is a complete description of the model. The endogenous and exogenous variables are first defined. Then the equations and their definitions are set forth. Finally, the parameters and the most recent estimates of their values are provided.

Variable Definitions

Endogenous

BALANCE	BALANCE OF PAYMENTS (DOLLARS)
CIVDEF	CIVILIAN GOODS AND SERVICES DEFICIT (DOLLARS)
DDCIMD	PERCENTAGE CHANGE IN CIVILIAN IMPORTS IN DOLLARS
DDCUR	PERCENTAGE CHANGE IN CAPACITY UTILIZATION RATE
DDEXDEF	PERCENTAGE CHANGE IN EXPORT DEFLATOR
DDEXR	PERCENTAGE CHANGE IN REAL EXPORTS (EXCLUDING SUBSIDIES)
DDEXTR	PERCENTAGE CHANGE IN TOTAL REAL EXPORTS (GOODS, NON-FACTOR SERVICES, SUBSIDIES)
DDG	PERCENTAGE CHANGE IN GOVERNMENT CONSUMPTION
DDGDEF	PERCENTAGE CHANGE IN GOVERNMENT CONSUMPTION DEFLATOR
DDGR	PERCENTAGE CHANGE IN REAL GOVERNMENT CONSUMPTION
DDG1	PERCENT CHANGE IN REAL GOVERNMENT DOMESTIC NONMILITARY CONSUMPTION

DDG2	PERCENT CHANGE IN REAL TOTAL MILITARY CONSUMPTION (INCLUDING TAXES, EXCLUDING DEFENSE SALES)
DDG3	PERCENT CHANGE IN REAL GOVERNMENT FOREIGN MILITARY CONSUMPTION (INCLUDING TAXES)
DDG4	PERCENT CHANGE IN REAL GOVERNMENT DOMESTIC MILITARY CONSUMPTION
DDG5	PERCENT CHANGE IN REAL GOVERNMENT DEFENSE SALES
DDI	PERCENTAGE CHANGE IN TOTAL INVESTMENT
DDIDEF	PERCENTAGE CHANGE IN INVESTMENT DEFLATOR
DDIMDEFR	PERCENTAGE CHANGE IN REAL DEFENSE IMPORTS
DDIMPDEF	PERCENTAGE CHANGE IN IMPORT DEFLATOR
DDIMPTR	PERCENTAGE CHANGE IN TOTAL REAL IMPORTS (GOODS, NON-FACTOR SERVICES, TAXES)
DDIMR	PERCENTAGE CHANGE IN REAL IMPORTS (EXCLUDING TAXES)
DDIMTR	PERCENTAGE CHANGE IN REAL IMPORT TAXES
DDIR	PERCENTAGE CHANGE IN TOTAL REAL INVESTMENT
DDM2	PERCENTAGE CHANGE IN MONEY SUPPLY, M2
DDM2AVG	PERCENTAGE CHANGE IN AVERAGE MONEY STOCK, M2
DDM4	PERCENTAGE CHANGE IN MONEY SUPPLY, M4
DDPC	PERCENTAGE CHANGE IN PRIVATE CONSUMPTION
DDPCDEF	PERCENTAGE CHANGE IN PRIVATE CONSUMPTION DEFLATOR
DDPCR	PERCENTAGE CHANGE IN REAL PRIVATE CONSUMPTION
DDPENM	PERCENT CHANGE IN THE AVERAGE UNIT PRICE OF ENERGY IMPORTS
DDPRIMLR	PERCENTAGE CHANGE IN REAL PRIVATE IMPORTS (OF GOODS AND NONFACTOR SERVICES)
DDPROD	PERCENTAGE CHANGE IN LABOR PRODUCTIVITY

DDTRDEF	PERCENTAGE CHANGE IN TOTAL RESOURCES DEFLATOR
DDWR	PERCENTAGE CHANGE IN WAGE RATE
DDXR	PERCENTAGE CHANGE IN EXCHANGE RATE
DDY	PERCENTAGE CHANGE IN NOMINAL GNP
DDYDEF	PERCENTAGE CHANGE IN GNP DEFLATOR
DDYR	PERCENTAGE CHANGE IN REAL GNP
DEBT	FOREIGN LIABILITIES LESS COMMERCIAL BANK FOREIGN ASSETS (DOLLARS)
DEBTSERV	DEBT SERVICE PAYMENTS (DOLLARS)
DSRX	DEBT SERVICE—GOODS AND SERVICES EXPORT RATIO
DSRY	DEBT SERVICE—GNP RATIO
DSRZ	DEBT SERVICE—TOTAL RECEIPTS RATIO
EXANDM4	EX ANTE DEMAND FOR NOMINAL MONEY
EXEM4	EXCESS EX ANTE MONEY SUPPLY
EXFUND	NET FOREIGN CAPITAL INFLOWS (EXCLUDING US MILITARY AID) (DOLLARS)
EXMS4	EX ANTE MONEY SUPPLY
FINGAP	FINANCIAL GAP BEFORE CAPITAL INFLOWS (DOLLARS)
INTPAYD	PAYMENT OF INTEREST ON FOREIGN DEBT (DOLLARS)
INTRECD	RECEIPT OF INTEREST FROM FOREIGN ASSETS (DOLLARS)
ISAHWW	AVERAGE HOURS WORKED
ISBOIP	BANK OF ISRAEL CREDIT TO PRIVATE SECTOR
ISBUSSUB	SUBSIDIES TO BUSINESS FOR DOMESTIC PRODUCTION
ISCAB	CURRENT ACCOUNT BALANCE (DOLLARS)
ISCHOA	CHANGES IN FOREIGN ASSETS, EXCEPT THOSE HELD BY COMMERCIAL BANKS (DOLLARS)

ISCIMD	CIVILIAN IMPORTS (DOLLARS)
ISCUR	CAPACITY UTILIZATION RATE
ISDEFDEF	DEFENSE IMPORT DEFLATOR
ISDEFLEV	DEFENSE IMPORT TAXES
ISDEP	DEPRECIATION ALLOWANCE
ISDISP	TOTAL DISPOSABLE INCOME
ISDISPR	TOTAL REAL DISPOSABLE INCOME
ISDT	TOTAL DIRECT TAXES
ISDWELL	THAT PART OF GNP ATTRIBUTABLE TO OWNERSHIP OF DWELLINGS
ISEMP	EMPLOYMENT
ISEX	TOTAL EXPORTS (EXCLUDING SUBSIDIES)
ISEXDEF	EXPORT DEFLATOR
ISEXDID	DIAMOND EXPORTS (DOLLARS)
ISEXDIP	DIAMOND EXPORTS
ISEXFS	EXPORTS OF FACTOR SERVICES
ISEXND	NONDIAMOND EXPORTS
ISEXNDR	REAL NONDIAMOND EXPORTS
ISEXR	TOTAL REAL EXPORTS (EXCLUDING SUBSIDIES)
ISEXSD	EXPORT OF ALL SERVICES
ISEXT	TOTAL EXPORTS (GOODS, NONFACTOR SERVICES, SUBSIDIES)
ISEXTGD	EXPORT OF ALL GOODS (DOLLARS)
ISEXTGSD	TOTAL EXPORTS (EXCLUDING SUBSIDIES) (DOLLARS)
ISEXTR	TOTAL REAL EXPORTS (GOODS, NONFACTOR SERVICES, SUBSIDIES)

ISEXXR	EXCHANGE RATE, EXPORTS
ISFACB	COMMERCIAL BANK FOREIGN ASSETS (DOLLARS)
ISFATOT	TOTAL FOREIGN ASSETS (DOLLARS)
ISFMDID	DIAMOND IMPORTS (FOB DOLLARS)
ISFMDIP	DIAMOND IMPORTS (FOB SHEKELS)
ISFMFULD	FUEL IMPORTS (FOB DOLLARS)
ISFMFULP	FUEL IMPORTS (FOB SHEKELS)
ISFTRANP	PERSONAL TRANSFERS FROM ABROAD
ISG	GOVERNMENT CONSUMPTION
ISGDEBT	GROSS FOREIGN DEBT (DOLLARS)
ISGDEF	GOVERNMENT CONSUMPTION DEFLATOR
ISGDEFIC	OVERALL PUBLIC-SECTOR DEFICIT
ISGDMC	GOVERNMENT DOMESTIC MILITARY CONSUMPTION
ISGEXDEF	DEFENSE SALES
ISGEXPEN	TOTAL GOVERNMENT EXPENDITURE
ISGFM	NET GOVERNMENT FOREIGN BORROWING AND GRANTS
ISGFMC	GOVERNMENT FOREIGN MILITARY SPENDING (EXCLUDING IMPORT TAXES)
ISGFMCR	REAL DEFENSE IMPORTS
ISGFMCR2	REAL GOVERNMENT FOREIGN MILITARY CONSUMPTION (INCLUDING TAXES)
ISGFMD	NET GOVERNMENT FOREIGN BORROWING AND GRANTS (DOLLARS)
ISGNCAB	TOTAL NET CREDIT ABSORPTION BY GOVERNMENT FROM PRIVATE SECTOR
ISGR	REAL GOVERNMENT CONSUMPTION

ISGTMC	GOVERNMENT MILITARY CONSUMPTION (EXCLUDING TAXES AND EXPORTS)
ISGTMCR	REAL TOTAL MILITARY CONSUMPTION (EXCLUDING DEFENSE SALES)
ISGTMCR2	REAL TOTAL MILITARY CONSUMPTION (INCLUDING TAXES, EXCLUDING DEFENSE SALES)
ISGTMC2	TOTAL MILITARY CONSUMPTION (INCLUDING TAXES, EXCLUDING DEFENSE SALES)
ISGTRAN	NET TRANSFERS TO PRIVATE SECTOR
ISI	TOTAL INVESTMENT
ISIDEF	INVESTMENT DEFLATOR
ISIM	TOTAL IMPORTS OF GOODS AND NONFACTOR SERVICES
ISIMDID	IMPORTS OF ROUGH DIAMONDS
ISIMFS	IMPORTS OF FACTOR SERVICES
ISIMFULQ	VOLUME IMPORTS OF ENERGY
ISIMPDEF	IMPORT DEFLATOR
ISIMPT	TOTAL IMPORTS (GOODS, NONFACTOR SERVICES, TAXES)
ISIMPTR	TOTAL REAL IMPORTS (GOODS, NONFACTOR SERVICES, TAXES)
ISIMR	TOTAL REAL IMPORTS (EXCLUDING TAXES)
ISIMSD	IMPORTS OF ALL SERVICES (DOLLARS)
ISIMT	IMPORT TAXES
ISIMTGD	IMPORTS OF ALL GOODS (DOLLARS)
ISIMTGSD	IMPORTS OF GOODS AND SERVICES (DOLLARS)
ISIMTR	REAL IMPORT TAXES
ISIMXR	EXCHANGE RATE, IMPORTS
ISINDT	TOTAL INDIRECT TAXES

ISINH	TOTAL INVESTMENT IN HOUSING (PRIVATE AND PUBLIC)
ISINH1	PRIVATE HOUSING INVESTMENT
ISINH1R	REAL PRIVATE HOUSING INVESTMENT
ISINS	PRIVATE NONRESIDENTIAL INVESTMENT
ISINSR	REAL PRIVATE NONRESIDENTIAL INVESTMENT
ISINSTOK	INCREASE IN STOCKS
ISINTRES	INTERNATIONAL RESERVES
ISINTRSD	INTERNATIONAL RESERVES (DOLLARS)
ISINTRS2	ALTERNATIVE INTERNATIONAL RESERVES
ISIR	TOTAL REAL INVESTMENT
ISKAB	CAPITAL ACCOUNT BALANCE (DOLLARS)
ISKSM2	CAPITAL STOCK, BEGINNING OF PERIOD
ISKSM78	REAL CAPITAL STOCK, BEGINNING OF PERIOD
ISKSM78E	REAL CAPITAL STOCK, END OF PERIOD
ISLS	LABOR SUPPLY
ISMB	MONETARY BASE
ISMSPD	IMPORTS OF SHIPS AND PLANES (DOLLARS)
ISM2AVG	AVERAGE MONEY STOCK, M2
ISNBPROD	NET BUSINESS PRODUCT
ISNETDEF	NET SERVICE IMPORT DEFLATOR
ISNETF	NET IMPORTS OF FACTOR SERVICES
ISNETFR	REAL NET IMPORTS OF FACTOR SERVICES
ISNIT	NATIONAL INSURANCE TAXES
ISNT	TOTAL NET TRANSFER PAYMENTS (DOLLARS)

ISOFTRAN	OFFICIAL TRANSFER PAYMENTS (DOLLARS)
ISOPUB	OTHER PUBLIC-SECTOR SPENDING
ISOPUBR	DOMESTIC PUBLIC-SECTOR REVENUE OTHER THAN TAXES
ISPC	PRIVATE CONSUMPTION
ISPCDEF	PRIVATE CONSUMPTION DEFLATOR
ISPCR	REAL PRIVATE CONSUMPTION
ISPENM	UNIT PRICE OF ENERGY IMPORTS (FOB DOLLARS)
ISPFM	PRIVATE FOREIGN CAPITAL INFLOWS (DOLLARS)
ISPIMOTD	PRIVATE IMPORTS EXCLUDING FUEL AND DIAMONDS (DOLLARS)
ISPIMOTH	PRIVATE IMPORTS EXCLUDING FUEL AND DIAMONDS
ISPIMOTR	REAL PRIVATE IMPORTS EXCLUDING FUEL AND DIAMONDS
ISPRIMD	PRIVATE IMPORTS OF GOODS AND NONFACTOR SERVICES (DOLLARS)
ISPRIMLR	REAL PRIVATE IMPORTS OF GOODS AND NONFACTOR SERVICES
ISPRIMLS	PRIVATE IMPORTS OF GOODS AND NONFACTOR SERVICES
ISPROD	LABOR PRODUCTIVITY
ISPUBH	GOVERNMENT HOUSING INVESTMENT
ISPUBWAG	PUBLIC-SECTOR WAGES
ISPUB1	PUBLIC-SECTOR NONRESIDENTIAL INVESTMENT
ISQG	GOVERNMENT DEFICIT TO BE FINANCED BY BORROWING FROM THE BANK OF ISRAEL
ISQGCUM	ACCUMULATED CREDIT TO GOVERNMENT
ISSB	SERVICE BALANCE (DOLLARS)
ISSTL	SHORT-TERM LIABILITIES (DOLLARS)
ISSUBLON	SUBSIDY COMPONENT IN GOVERNMENT LOANS TO BUSINESS

IST	TOTAL TAXES
ISTB	TRADE BALANCE (DOLLARS)
ISTCI	TAXES ON BUSINESS INCOME
ISTDPFY	TAXES ON DOMESTIC PRODUCTION (INCLUDING VAT)
ISTDR	TOTAL PUBLIC-SECTOR DOMESTIC REVENUE (OTHER DOMESTIC REVENUE, DEFENSE IMPORT TAXES, AND TOTAL CIVILIAN TAXES)
ISTFM	TOTAL FOREIGN MONEY INFLOWS (DOLLARS)
ISTIMFY	IMPORT TAXES, GOVERNMENT ACCOUNT TERMS
ISTOI	TAXES ON INCOME OTHER THAN WAGES AND PROFITS
ISTOTFIN	TOTAL FINANCIAL ASSETS OF THE PUBLIC (USED AS MONEY SUPPLY—M4, FOR SHORT)
ISTR	TOTAL RESOURCES
ISTRDEF	TOTAL RESOURCES DEFLATOR
ISTRR	TOTAL REAL RESOURCES
ISTWFY	TAXES ON WAGES
ISUN	UNADJUSTED UNEMPLOYMENT RATE
ISVSP	INVESTMENT IN SHIPS AND PLANES
ISWR	WAGE RATE
ISWR2	WAGE RATE AFTER DEDUCTING WAGE TAXES
ISW2	WAGE BILL DERIVED FROM ENDOGENOUS WAGE RATES AND EMPLOYMENT
ISW2R	REAL WAGE BILL
ISXR2	EXCHANGE RATE, END OF PERIOD
ISY	NOMINAL GNP
ISYDEF	GNP DEFLATOR
ISYR	REAL GNP

NETDEBT	NET FOREIGN LIABILITIES (DOLLARS)
NONUSIMD	NON-US-FINANCED DIRECT MILITARY IMPORTS (DOLLARS)
YRPOT	POTENTIAL REAL GNP
YRRES	RESIDUAL: REAL GNP
YRRESN	RESIDUAL FOR NOMINAL GNP

Exogenous

BUSSUBR	REAL SUBSIDIES TO BUSINESS FOR DOMESTIC PRODUCTION
DDOPEC	NOMINAL PERCENT CHANGE IN DOLLAR PRICE OF OIL
DDPF2	PERCENTAGE CHANGE IN DOLLAR IMPORT PRICES
DDPF3	PERCENTAGE CHANGE IN DEFENSE IMPORT PRICES
DDPF4	PERCENTAGE CHANGE IN NET SERVICE PRICES
DDWGY	PERCENT CHANGE IN THE WEST GERMAN GDP
DEBTPAY	REPAYMENT OF LONG-TERM LOANS (DOLLARS)
DEFLEVRA	RATIO OF DEFENSE IMPORT TAXES TO DEFENSE IMPORTS
DEP5	SURVIVAL RATE FOR NONDWELLING CAPITAL STOCK
DUM7385	DUMMY FOR 1973-89 = 1
DUM7385E	DUMMY FOR 1985 = 1
DUM7385O	DUMMY FOR 1973-85 = 1
DUM7485	DUMMY FOR 1974-89 = 1
DUM78	DUMMY FOR 1978 = 1
DUM81	DUMMY FOR 1981 = 1
DUM84	DUMMY FOR 1984 = 1
DWELLY	RATIO: DWELLINGS' IMPUTED INCOME/GNP
IMDEFPAY	TOTAL FOREIGN EXCHANGE EXPENDITURES ON DEFENSE (DOLLARS)

IMDEFRES	DEFENSE IMPORT RESIDUAL
IMTRATIO	RATIO: IMPORT TAXES/GROSS TAXES ON CIVILIAN IMPORTS
IR	INTEREST RATE ON FOREIGN LIABILITIES
ISBOIPR	BANK OF ISRAEL REAL CREDIT TO PRIVATE SECTOR
ISCHBA	CHANGES IN FOREIGN ASSETS OF COMMERCIAL BANKS (DOLLARS)
ISCIF	COST, INSURANCE, AND FREIGHT PERCENT OF THE VALUE OF COMMODITY IMPORTS
ISEXDDEF	EXPORT PRICE DEFLATOR FOR POLISHED DIAMONDS
ISEXFSD	EXPORTS OF FACTOR SERVICES (DOLLARS)
ISEXOSD	SERVICE RECEIPTS OTHER THAN INTEREST PAYMENTS (DOLLARS)
ISEXOTH	NONDIAMOND EXPORTS OF GOODS (DOLLARS)
ISEXS	EXPORT SUBSIDIES
ISEXSR	REAL EXPORT SUBSIDIES
ISFBONDS	BONDS ISSUED ABROAD (DOLLARS)
ISFTRAND	PERSONAL TRANSFERS FROM ABROAD (DOLLARS)
ISGBUSIN	PUBLIC-SECTOR BUSINESS INCOME
ISGDMCR	REAL GOVERNMENT DOMESTIC MILITARY CONSUMPTION
ISGDNMCR	REAL GOVERNMENT DOMESTIC NONMILITARY CONSUMPTION
ISGEXR	REAL DEFENSE SALES
ISGGRANT	INTERGOVERNMENTAL GRANTS (DOLLARS)
ISGNCABR	TOTAL REAL NET CREDIT ABSORPTION BY THE GOVERNMENT FROM THE PRIVATE SECTOR
ISGTRANR	REAL NET TRANSFERS TO PRIVATE SECTOR
ISIMDDEF	PRICE DEFLATOR FOR ROUGH DIAMOND IMPORTS
ISIMDEFD	DEFENSE IMPORTS (DOLLARS)

ISIMFSD	IMPORTS OF FACTOR SERVICES (DOLLARS)
ISIMOSD	SERVICE PAYMENTS OTHER THAN INTEREST (DOLLARS)
ISIMOTH	IMPORTS OF GOODS OTHER THAN DIAMONDS, FUEL, AND MILITARY EQUIPMENT (DOLLARS)
ISIMTRES	RESIDUAL: REAL IMPORT TAXES
ISINVT	INVENTORY SURTAX
ISLMBOR	LONG-TERM BORROWING (DOLLARS)
ISMSP	IMPORTS OF SHIPS AND PLANES
ISMSPR	REAL IMPORTS OF SHIPS AND PLANES
ISM2	MONEY SUPPLY, M2
ISNETCL	NET COMPULSORY LOANS (NET OUTFLOWS FROM PRIVATE INCOME)
ISOPUBRR	REAL DOMESTIC PUBLIC-SECTOR REVENUE OTHER THAN TAXES
ISOPUBSR	REAL OTHER PUBLIC-SECTOR SPENDING
ISPOP14	POPULATION OVER AGE 14
ISPUBHR	REAL GOVERNMENT HOUSING INVESTMENT
ISPUB1R	REAL PUBLIC-SECTOR NONRESIDENTIAL INVESTMENT
ISSTC	CHANGES IN SHORT-TERM LIABILITIES
ISSTOKR	REAL INCREASE IN STOCKS
ISUNTRAN	PRIVATE TRANSFERS (DOLLARS)
ISVSPR	REAL INVESTMENT IN SHIPS AND PLANES
ISWRR	REAL WAGE RATE
ISXR	EXCHANGE RATE, SHEKELS PER DOLLAR
KABADJ	CAPITAL ACCOUNT BALANCE ADJUSTMENT FACTOR (DOLLARS)
LOANADJ	FOREIGN BORROWING ADJUSTMENT FACTOR (DOLLARS)

MM4	MONEY MULTIPLIER FOR TOTAL FINANCIAL ASSETS
NONUSAID	NON-US ECONOMIC AID (DOLLARS)
OTHERBO2	OTHER PUBLIC-SECTOR FOREIGN CAPITAL (DOLLARS)
PUBWAGR	REAL PUBLIC-SECTOR WAGES
RESIDIR	RESIDUAL: FOREIGN EXCHANGE RESERVES
RESIDIR2	RESIDUAL: FOREIGN EXCHANGE RESERVES IN DOLLARS
SSTIME	SIN (TIME)
SUBLONR	REAL SUBSIDY COMPONENT IN GOVERNMENT LOANS TO BUSINESS
TCIRATE	TAX RATE ON BUSINESS INCOME
TDPRATE	IMPLICIT TAX RATE ON DOMESTIC PRODUCTION
TIME	AN INDEX FOR YEAR (1960=1)
TIME4	AN INDEX FOR YEAR (1960=1, 1985-90=26)
TIMRATE	IMPLICIT TAX RATE ON NONDEFENSE IMPORTS
TNIRATE	IMPLICIT TAX RATE FOR NATIONAL INSURANCE
TOIRATE	IMPLICIT TAX RATE ON OTHER INCOME
TWRATE	IMPLICIT TAX ON WAGE INCOME
UKY	REAL UNITED KINGDOM GDP
USECAID	US ECONOMIC AID (DOLLARS)
USFMS	US FMS (MILITARY AID) PAYMENTS (DOLLARS)
USY	US GNP (DOLLARS)
WIR	INTEREST RATE ON FOREIGN ASSETS
XRRES2	RESIDUAL: EXCHANGE RATE, END OF PERIOD
XRRES3	RESIDUAL: EXCHANGE RATE, IMPORTS
XRRES4	RESIDUAL: EXCHANGE RATE, EXPORTS

Equations

GNP Aggregates

GNP PRODUCTION FUNCTION (1973−85):

1: LOG(ISYR) = Y0+Y1*DUM81+Y2*DUM84
+Y3*LOG(ISKSM78E)+Y4*LOG(ISEMP)
+(1−Y3−Y4)*LOG(ISGR)

REAL GNP:

2: ISYR = ISPCR+ISIR+ISGR+ISEXR+ISEXSR
− ISIMR− ISIMTR−ISNETFR+YRRES

PERCENTAGE CHANGE IN REAL GNP:

3: DDYR = DEL(1 : ISYR)/ISYR(−1)*100

NOMINAL GNP:

4: ISY = ISPC+ISI+ISG+ISEX+ISEXS−ISIM−ISIMT
− ISNETF+YRRESN

RESIDUAL FOR NOMINAL GNP:

5: YRRESN = YRRES*ISIDEF

PERCENTAGE CHANGE IN NOMINAL GNP:

6: DDY = DEL(1 : ISY)/ISY(−1)*100

GNP DEFLATOR:

7: ISYDEF = ISY/ISYR

PERCENTAGE CHANGE IN GNP DEFLATOR:

8: DDYDEF = DEL(1 : ISYDEF)/ISYDEF(−1)*100

PERCENTAGE CHANGE IN REAL PRIVATE CONSUMPTION:

9: DDPCR = DEL(1 : ISPCR)/ISPCR(−1)*100

REAL PRIVATE CONSUMPTION (1965-85):

10: ISPCR = B1+B2*ISDISPR + B3*ISPCR(−1)
+ B4*DDIMPDEF

NOMINAL PRIVATE CONSUMPTION:

11: ISPCR = ISPC/ISPCDEF

PERCENTAGE CHANGE IN PRIVATE CONSUMPTION:

12: DDPC = DEL(1 : ISPC)/ISPC(−1)*100

PRIVATE CONSUMPTION DEFLATOR:

13: DDPCDEF = DEL(1 : ISPCDEF)/ISPCDEF(−1)*100

PERCENTAGE CHANGE IN CONSUMPTION DEFLATOR (1975-85):

14: DDPCDEF = C1*DUM73850*TIME+C2*DDM2 +C3*DUM7385E+C4*DDG2+C6*DUM78

TOTAL REAL DISPOSABLE INCOME:

15: ISDISPR = ISDISP/ISPCDEF

TOTAL DISPOSABLE INCOME:

16: ISDISP = ISY−ISTDPFY+ISBUSSUB−ISGBUSIN −ISDT−ISNETCL+ISGTRAN+ISFTRANP

NET TRANSFERS TO PRIVATE SECTOR:

17: ISGTRAN = ISGTRANR*ISYDEF

PERSONAL TRANSFERS FROM ABROAD:

18: ISFTRANP = ISFTRAND*ISXR

Investment

TOTAL REAL INVESTMENT:

19: ISIR = ISI/ISIDEF

PERCENTAGE CHANGE IN TOTAL REAL INVESTMENT:

20: DDIR = DEL(1 : ISIR)/ISIR(−1)*100

TOTAL INVESTMENT:

21: ISI = ISINH+ISINS+ISPUB1+ISVSP+ISINSTOK

PERCENTAGE CHANGE IN TOTAL INVESTMENT:

22: DDI = DEL(1 : ISI)/ISI(−1)*100

INVESTMENT DEFLATOR:

23: DDIDEF = DEL(1 : ISIDEF)/ISIDEF(−1)*100

INVESTMENT INFLATION RATE (1975−85):

24: DDIDEF = D1*DDM2+D2*DUM7385E+D3*DDG2 +D4*DUM73850*TIME

TOTAL INVESTMENT IN HOUSING (PRIVATE AND PUBLIC):

25: ISINH = ISINH1+ISPUBH

REAL PRIVATE HOUSING INVESTMENT (1967-85):

26: ISINH1R = E1+E2*DUM7385

$$+E3*\left(\frac{ISFTRANP(-1)}{ISIDEF(-1)}+\frac{ISFTRANP(-2)}{ISIDEF(-2)}\right)$$

$$+E4*\left(\frac{ISGTRAN(-1)}{(ISIDEF(-1)}+\frac{ISGTRAN(-2)}{ISIDEF(-2)}\right)$$

PRIVATE HOUSING INVESTMENT:

27: ISINH1 = ISINH1R*ISIDEF

GOVERNMENT HOUSING INVESTMENT:

28: ISPUBH = ISPUBHR*ISIDEF

REAL PRIVATE NONDWELLING INVESTMENT (1975-85):

29: ISINSR = F0+F1*ISUN+F2*ISUN(−1)+F3*TDPRATE
+F4*ISKSM78E(−2)+F5*TIME4

PRIVATE NONRESIDENTIAL INVESTMENT:

30: ISINS = ISINSR*ISIDEF

PUBLIC-SECTOR NONRESIDENTIAL INVESTMENT:

31: ISPUB1 = ISPUB1R*ISIDEF

INVESTMENT IN SHIPS AND PLANES:

32: ISVSP = ISVSPR*ISIDEF

INCREASE IN STOCKS:

33: ISINSTOK = ISSTOKR*ISIDEF

REAL CAPITAL STOCK, BEGINNING OF PERIOD:

34: ISKSM78 = ISKSM78E(−1)

CAPITAL STOCK, BEGINNING OF PERIOD:

35: ISKSM2 = ISKSM78*(ISIDEF/0.25245)

REAL CAPITAL STOCK, END OF PERIOD:

36: ISKSM78E = ISKSM78*DEP5
+ (ISINS+ISPUB1)*(0.25245/ISIDEF)

DEPRECIATION ALLOWANCE (1961-85):

37: ISDEP/ISIDEF = G1*ISYR(−1)+G2*ISYR(−2)
+G3*ISKSM78(−1)+G4*ISIR(−1)+G5*ISIR(−2)

POTENTIAL GNP (1967-85):

38: YRPOT = EXP((H1+H5*DUM7485)*LOG((ISKSM78
+ISKSM78E)/2)+(H2+H4*DUM7485)*LOG(ISLS))

Labor

EMPLOYMENT (1973-85):

39: ISEMP = V1+V2*ISLS(−1)
+V3*(ISGTMCR+ISGTMCR(−1))/2+V4*SSTIME

CAPACITY UTILIZATION RATE:

40: ISCUR = ISYR/YRPOT

PERCENTAGE CHANGE IN CAPACITY UTILIZATION RATE:

41: DDCUR = DEL(1 : ISCUR)/ISCUR(−1)*100

LABOR PRODUCTIVITY:

42: ISPROD = ISYR/(ISEMP*ISAHWW*0.001)

PERCENTAGE CHANGE IN LABOR PRODUCTIVITY:

43: DDPROD = DEL(1 : ISPROD)/ISPROD(−1)*100

LABOR SUPPLY (1973-85):

44: ISLS = J1+J2*ISPOP14+J3*ISGTMCR(−1)

AVERAGE WORKWEEK IN HOURS (1973-85):

45: ISAHWW = K1+K2*ISWRR(−1)+K3*ISGTMCR(−1)

UNADJUSTED UNEMPLOYMENT RATE:

46: ISUN = 1−ISEMP/ISLS

WAGE RATE:

47: ISWR = ISWRR*ISYDEF

PERCENTAGE CHANGE IN WAGE RATE:

48: DDWR = DEL(1 : ISWR)/ISWR(−1)*100

WAGE BILL DERIVED FROM ENDOGENOUS WAGE RATES AND EMPLOYMENT:

49: ISW2 = ISWR*12*ISEMP*0.001

WAGE RATE AFTER DEDUCTING WAGE TAXES:

50: ISWR2 = (ISW2−ISTWFY)/(ISEMP*12*0.001)

TOTAL REAL RESOURCES:

51: ISTRR = ISPC/ISPCDEF+ISI/ISIDEF+ISG/ISGDEF
+ISEXT/ISEXDEF

TOTAL RESOURCES:

52: ISTR = ISPC+ISI+ISG+ISEX+ISEXS

TOTAL RESOURCES DEFLATOR:

53: ISTRDEF = ISTR/ISTRR

PERCENTAGE CHANGE IN TOTAL RESOURCES DEFLATOR:

54: DDTRDEF = DEL(1 : ISTRDEF)/ISTRDEF(−1)*100

NET BUSINESS PRODUCT:

55: ISNBPROD = ISY−ISDEP−ISTDPFY + ISBUSSUB
+ISSUBLON +ISNETF−ISDWELL−ISPUBWAG

SUBSIDIES TO BUSINESS FOR DOMESTIC PRODUCTION:

56: ISBUSSUB = BUSSUBR*ISYDEF

SUBSIDY COMPONENT IN GOVERNMENT LOANS TO BUSINESS:

57: ISSUBLON = SUBLONR*ISYDEF

THAT PART OF GNP ATTRIBUTABLE TO OWNERSHIP OF DWELLINGS:

58: ISDWELL = DWELLY*ISY

PUBLIC-SECTOR WAGES:

59: ISPUBWAG = PUBWAGR*ISYDEF

Government Sector

PERCENTAGE CHANGE IN REAL GOVERNMENT CONSUMPTION:

60: DDGR = DEL(1 : ISGR)/ISGR(−1)*100

GOVERNMENT CONSUMPTION:

61: ISG = ISGR*ISGDEF

REAL GOVERNMENT CONSUMPTION:

62: ISGR = ISGDNMCR+ISGDMCR + ISGFMCR2
− ISGEXR

PERCENTAGE CHANGE IN GOVERNMENT CONSUMPTION:

63: DDG = DEL(1 : ISG)/ISG(−1)*100

GOVERNMENT CONSUMPTION DEFLATOR:

64: DDGDEF = DEL(1 : ISGDEF)/ISGDEF(−1)*100

PERCENT CHANGE IN GOVERNMENT CONSUMPTION DEFLATOR (1975-85):

65: DDGDEF = M1*DUM7385O*TIME+M2*DDM2
+M3*DUM7385E+M4*DDG2

REAL TOTAL MILITARY CONSUMPTION (INCLUDING TAXES, EXCLUDING DEFENSE SALES):

66: ISGTMCR2 = ISGFMCR2+ISGDMCR−ISGEXR

PERCENT CHANGE IN REAL TOTAL MILITARY CONSUMPTION:

67: DDG2 = DEL(1 : ISGTMCR2)/ISGTMCR2(−1)*100

REAL TOTAL MILITARY CONSUMPTION (EXCLUDING DEFENSE SALES):

68: ISGTMCR = ISGFMCR+ISGDMCR−ISGEXR

TOTAL MILITARY CONSUMPTION (INCLUDING TAXES, EXCLUDING DEFENSE SALES):

69: ISGTMC2 = ISGFMC + ISDEFLEV + ISGDMC − ISGEXDEF

GOVERNMENT TOTAL MILITARY CONSUMPTION (EXCLUDING TAXES AND EXPORTS):

70: ISGTMC = ISGFMC+ISGDMC−ISGEXDEF

REAL GOVERNMENT FOREIGN MILITARY CONSUMPTION (INCLUDING TAXES):

71: ISGFMCR2 = ISGFMCR+ISDEFLEV/ISDEFDEF

PERCENT CHANGE IN REAL GOVERNMENT FOREIGN MILITARY CONSUMPTION:

72: DDG3 = DEL(1 : ISGFMCR2)/ISGFMCR2(−1)*100

PERCENT CHANGE IN REAL GOVERNMENT DOMESTIC MILITARY CONSUMPTION:

73: DDG4 = DEL(1 : ISGDMCR)/ISGDMCR(−1)*100

PERCENT CHANGE IN REAL GOVERNMENT DEFENSE SALES:

74: DDG5 = DEL(1 : ISGEXR)/ISGEXR(−1)*100

PERCENT CHANGE IN REAL GOVERNMENT DOMESTIC NONMILITARY CONSUMPTION:

75: DDG1 = DEL(1 : ISGDNMCR)/ISGDNMCR(−1)*100

GOVERNMENT DOMESTIC MILITARY CONSUMPTION:

76: ISGDMC = ISGDEF*ISGDMCR

DEFENSE SALES:

77: ISGEXDEF = ISGEXR*ISGDEF

OVERALL PUBLIC-SECTOR DEFICIT:

78: ISGDEFIC = ISGEXPEN−ISTDR−ISGGRANT*ISXR

TOTAL GOVERNMENT EXPENDITURE:

79: ISGEXPEN = ISG + ISPUB1 + ISPUBH + ISOPUB + INTPAYD*ISXR

OTHER PUBLIC-SECTOR SPENDING:

80: ISOPUB = ISOPUBSR*ISGDEF

TOTAL PUBLIC-SECTOR DOMESTIC REVENUE (OTHER DOMESTIC REVENUE, DEFENSE IMPORT TAXES, AND TOTAL CIVILIAN TAXES):

81: ISTDR = ISOPUBR+ISDEFLEV+IST

DOMESTIC PUBLIC-SECTOR REVENUE OTHER THAN TAXES:
82: ISOPUBR = ISOPUBRR*ISYDEF

DEFENSE IMPORT TAXES:
83: ISDEFLEV = DEFLEVRA*ISGFMC

TOTAL TAXES:
84: IST = ISDT+ISINDT

TOTAL DIRECT TAXES (TAXES ON WAGES, BUSINESS INCOME, OTHER INCOME, NATIONAL INSURANCE, AND INVENTORY):
85: ISDT = ISTWFY+ISTCI+ISTOI+ISNIT+ISINVT

TAXES ON WAGES (COMPENSATION OF EMPLOYEES IS A PROXY FOR WAGES):
86: ISTWFY = TWRATE*ISW2

TAXES ON BUSINESS INCOME:
87: ISTCI = TCIRATE*ISNBPROD

TAXES ON INCOME OTHER THAN WAGES AND PROFITS:
88: ISTOI = TOIRATE*(ISNBPROD−ISTCI)

NATIONAL INSURANCE TAXES:
89: ISNIT = TNIRATE*ISW2

TOTAL INDIRECT TAXES (TAXES ON DOMESTIC PRODUCTION AND IMPORTS):
90: ISINDT = ISTDPFY+ISTIMFY

TAXES ON DOMESTIC PRODUCTION (INCLUDING VAT):
91: ISTDPFY = TDPRATE*(ISY−ISG)

IMPORT TAXES, GOVERNMENT ACCOUNT TERMS:
92: ISTIMFY = TIMRATE*(ISPRIMLS+ISMSP)

Monetary Sector

MONETARY BASE:
93: ISMB = ISINTRES+ISQGCUM+ISBOIP

PERCENTAGE CHANGE IN MONEY SUPPLY, M2:
94: DDM2 = DEL(1 : ISM2)/ISM2(−1)*100

AVERAGE MONEY STOCK, M2:
95: ISM2AVG = (ISM2+ISM2(−1))/2

PERCENTAGE CHANGE IN AVERAGE MONEY STOCK, M2:
96: DDM2AVG = DEL(1 : ISM2AVG)/ISM2AVG(−1)*100

TOTAL PUBLIC FINANCIAL ASSETS:

97: ISTOTFIN = MM4*(ISINTRES+ISQGCUM+ISBOIP)

PERCENTAGE CHANGE IN MONEY SUPPLY, M4:

98: DDM4 = DEL(1 : ISTOTFIN)/ISTOTFIN(−1)*100

EX ANTE DEMAND FOR NOMINAL MONEY:

99: LOG(EXANDM4) = A1 + A2*LOG(ISYR)
+ A3*LOG(ISYDEF)

EX ANTE MONEY SUPPLY:

100: EXMS4 = ISTOTFIN(−1)
+2.2875*(ISQG+DEL(1 :ISBOIP))

EXCESS EX ANTE MONEY SUPPLY:

101: EXEM4 = EXMS4−EXANDM4

International Position

INTERNATIONAL RESERVES:

102: ISINTRES = ISINTRSD*ISXR2+RESIDIR

ALTERNATIVE INTERNATIONAL RESERVES:

103: ISINTRS2 = ISINTRSD*ISXR

INTERNATIONAL RESERVES IN DOLLARS:

104: ISINTRSD = ISINTRSD(−1)+BALANCE+RESIDIR2

TOTAL FOREIGN MONEY INFLOWS:

105: ISTFM = BALANCE−ISTB−ISSB

NET GOVERNMENT FOREIGN BORROWING AND GRANTS:

106: ISGFM = ISGFMD*ISXR

PRIVATE FOREIGN CAPITAL INFLOWS:

107: ISPFM = ISTFM−ISGFMD

ACCUMULATED CREDIT TO GOVERNMENT:

108: ISQGCUM = ISQGCUM(−1)+ISQG

GOVERNMENT DEFICIT FINANCED BY BORROWING FROM BANK OF ISRAEL:

109: ISQG = ISGDEFIC−ISGNCAB

TOTAL NET CREDIT ABSORPTION BY GOVERNMENT FROM PRIVATE SECTOR:

110: ISGNCAB = ISGNCABR*ISYDEF

BANK OF ISRAEL CREDIT TO PRIVATE SECTOR:

111: ISBOIP = ISBOIPR*ISYDEF

OVERALL BALANCE:

112: BALANCE = ISKAB+ISCAB

CAPITAL ACCOUNT BALANCE:

113: ISKAB = ISLMBOR+ISSTC−DEBTPAY+KABADJ

GROSS FOREIGN DEBT:

114: ISGDEBT = ISGDEBT(−1) + ISLMBOR + ISSTC
− DEBTPAY + LOANADJ

GROSS FOREIGN DEBT LESS FOREIGN ASSETS OF COMMERCIAL BANKS:

115: DEBT = ISGDEBT−ISFACB

GROSS FOREIGN DEBT LESS TOTAL FOREIGN ASSETS:

116: NETDEBT = ISGDEBT−ISFATOT

TOTAL FOREIGN ASSETS (1975-85):

117: ISFATOT = I1+I2*ISLMBOR+I3*ISSTC
+I4*ISSTC(−1) +I5*DEBTPAY
+I6*DEBTPAY(−1)

FOREIGN ASSETS OF COMMERCIAL BANKS:

118: ISFACB = ISFACB(−1)+ISCHBA

CHANGES IN FOREIGN ASSETS OTHER THAN THOSE HELD BY COMMERCIAL BANKS:

119: ISCHOA = DEL(1 : ISFATOT−ISFACB)

DEBT SERVICE PAYMENTS:

120: DEBTSERV = INTPAYD+DEBTPAY

DEBT SERVICE PAYMENTS−EXPORT REVENUE RATIO:

121: DSRX = DEBTSERV/ISEXTGSD

DEBT SERVICE PAYMENTS−GNP RATIO:

122: DSRY = DEBTSERV/(ISY/ISXR)

DEBT SERVICE PAYMENTS−TOTAL RECEIPTS RATIO:

123: DSRZ = DEBTSERV/(ISEXTGSD+ISNT)

CURRENT ACCOUNT BALANCE:

124: ISCAB = ISEXTGSD−ISIMTGSD+ISNT

TRADE BALANCE:

125: ISTB = ISEXTGD−ISIMTGD

TOTAL EXPORTS OF GOODS:
126: ISEXTGD = ISEXDID+ISEXOTH

TOTAL IMPORTS OF GOODS:
127: ISIMTGD = ISIMDEFD + ISFMDID + ISFMFULD
+ ISIMOTH

SERVICE BALANCE:
128: ISSB = ISEXSD−ISIMSD

SERVICE RECEIPTS:
129: ISEXSD = INTRECD+ISEXOSD

INTEREST RECEIPTS FROM FOREIGN ASSETS:
130: INTRECD = WIR*ISFATOT(−1)

SERVICE PAYMENTS:
131: ISIMSD = INTPAYD+ISIMOSD

INTEREST PAYMENTS ON FOREIGN DEBT:
132: INTPAYD = IR*ISGDEBT(−1)

OFFICIAL TRANSFER PAYMENTS:
133: ISOFTRAN = NONUSAID+USECAID

NET TRANSFERS:
134: ISNT = ISUNTRAN+ISOFTRAN

SHORT-TERM LIABILITIES:
135: ISSTL = ISSTL(−1)+ISSTC

PERCENTAGE CHANGE IN EXCHANGE RATE:
136: DDXR = DEL(1 : ISXR)/ISXR(−1)*100

EXCHANGE RATE, END OF PERIOD:
137: ISXR2 = ISXR2(−1)*(1+DDXR/100)+XRRES2

EXCHANGE RATE, IMPORTS:
138: ISIMXR = ISIMXR(−1)*(1+DDXR/100)+XRRES3

EXCHANGE RATE, EXPORTS:
139: ISEXXR = ISEXXR(−1)*(1+DDXR/100)+XRRES4

Exports

TOTAL EXPORTS IN DOLLARS (EXCLUDING SUBSIDIES):
140: ISEXTGSD = ISEXTGD+ISEXSD

TOTAL REAL EXPORTS (EXCLUDING SUBSIDIES):
141: ISEX = ISEXR*ISEXDEF

PERCENTAGE CHANGE IN REAL EXPORTS (EXCLUDING SUBSIDIES):
142: DDEXR = DEL(1 : ISEXR)/ISEXR(−1)*100

TOTAL EXPORTS (EXCLUDING SUBSIDIES):
143: ISEX = ISEXND+ISEXDIP

EXPORT DEFLATOR:
144: DDEXDEF = DEL(1 : ISEXDEF)/ISEXDEF(−1)*100

PERCENTAGE CHANGE IN EXPORT DEFLATOR (1975-85):
145: DDEXDEF = P2*DDM2+P3*DDM2(−1)
+P4*DDG2+P5*DDIMR

EXPORTS OF FACTOR SERVICES:
146: ISEXFS = ISEXFSD*ISEXXR

TOTAL REAL EXPORTS (GOODS, NONFACTOR SERVICES, SUBSIDIES):
147: ISEXTR = ISEX/ISEXDEF+ISEXS/ISEXDEF

PERCENTAGE CHANGE IN TOTAL REAL EXPORTS (GOODS, NONFACTOR SERVICES, SUBSIDIES):
148: DDEXTR = DEL(1 : ISEXTR)/ISEXTR(−1)*100

TOTAL EXPORTS (GOODS, NONFACTOR SERVICES, SUBSIDIES):
149: ISEXT = ISEX+ISEXS

DIAMOND EXPORTS:
150: ISEXDIP = ISEXDID*ISEXXR

DOLLAR VALUE OF IMPORTS OF ROUGH DIAMONDS (1968-85):
151: ISEXDID = Q1+Q2*ISEXDDEF
+Q3*ISIMDID(−1)+Q4*UKY

REAL NONDIAMOND EXPORTS (1974-85):
152: ISEXNDR = R1+R2*USY+R3*DDOPEC
+R4*DDEXDEF(−1)

NONDIAMOND EXPORTS:
153: ISEXND = ISEXNDR*ISEXDEF

Imports

IMPORTS OF GOODS AND SERVICES IN DOLLARS:
154: ISIMTGSD = ISIMTGD+ISIMSD

TOTAL REAL IMPORTS (GOODS, NONFACTOR SERVICES, TAXES):
155: ISIMPTR = ISIMR+ISIMT/ISIMPDEF

PERCENTAGE CHANGE IN TOTAL REAL IMPORTS (GOODS, NONFACTOR SERVICES, TAXES):
156: DDIMPTR = DEL(1 : ISIMPTR)/ISIMPTR(−1)*100

TOTAL IMPORTS (GOODS, NONFACTOR SERVICES, TAXES):
157: ISIMPT = ISIM+ISIMT

TOTAL REAL IMPORTS (EXCLUDING TAXES):
158: ISIMR = ISPRIMLR+ISMSPR+ISGFMCR

PERCENTAGE CHANGE IN REAL IMPORTS (EXCLUDING TAXES):
159: DDIMR = DEL(1 : ISIMR)/ISIMR(−1)*100

TOTAL IMPORTS OF GOODS AND NONFACTOR SERVICES:
160: ISIM = ISPRIMLS+ISMSP+ISGFMC

IMPORT DEFLATOR:
161: ISIMPDEF = ISIMPDEF(−1)*(1 + DDXR/100)
*(1 + DDPF2/100)

PERCENTAGE CHANGE IN IMPORT DEFLATOR:
162: DDIMPDEF = DEL(1 : ISIMPDEF)/ISIMPDEF(−1)*100

REAL PRIVATE IMPORTS OF GOODS AND NONFACTOR SERVICES:
163: ISPRIMLS = ISPRIMLR*ISIMPDEF

PERCENTAGE CHANGE IN REAL PRIVATE IMPORTS (OF GOODS AND NONFACTOR SERVICES):
164: DDPRIMLR = DEL(1 : IPRIMLR)/ISPRIMLR(−1)*100

PRIVATE IMPORTS OF GOODS AND NONFACTOR SERVICES:
165: ISPRIMLS = ISPIMOTH+ISFMFULP+ISFMDIP

PRIVATE IMPORTS OF GOODS AND NONFACTOR SERVICES IN DOLLARS:
166: ISPRIMD = ISPRIMLS/ISIMXR

REAL PRIVATE IMPORTS (EXCLUDING FUEL AND DIAMONDS) (1975-85):
167: ISPIMOTR = S1*ISPIMOTR(−1) + S2*ISDISPR
+ S3*ISIR + S4*ISIR(−1)

PRIVATE IMPORTS EXCLUDING FUEL AND DIAMONDS:

168: ISPIMOTH = ISPIMOTR*ISIMPDEF

PRIVATE IMPORTS EXCLUDING FUEL AND DIAMONDS IN DOLLARS:

169: ISPIMOTD = ISPIMOTH/ISIMXR

VOLUME IMPORTS OF FUEL (1975-85):

170: ISIMFULQ = U1+U2*ISYR+U3*ISYR(−1)
+U4*ISPENM+U5*ISPENM(−1)+U6*ISKSM78

FOB DOLLAR VALUE OF FUEL IMPORTS:

171: ISFMFULD = ISIMFULQ*ISPENM/1000

UNIT PRICE OF FUEL IMPORTS:

172: ISPENM = ISPENM(−1)*(1+DDPENM/100)

INFLATION RATE FOR ISRAELI ENERGY IMPORTS (1976-85):

173: DDPENM = O0+O1*DDOPEC
+O2*DDOPEC(−1)+O3*DDWGY

FOB SHEKEL VALUE OF FUEL IMPORTS:

174: ISFMFULP = ISFMFULD*ISIMXR

IMPORTS OF ROUGH DIAMONDS:

175: ISFMDIP = ISFMDID*ISIMXR

FOB DOLLAR VALUE OF DIAMOND IMPORTS:

176: ISFMDID = ISIMDID*(1−ISCIF)

IMPORTS OF ROUGH DIAMONDS IN DOLLARS (1967-85):

177: ISIMDID = T1+T2*UKY(−1)
+T3*(DDOPEC+DDOPEC(−1))/2
+T4*ISYDEF(−1)+T6*ISIMDDEF
+T7*ISIMDDEF(−1)+T8*ISINSR

IMPORTS OF SHIPS AND PLANES IN DOLLARS:

178: ISMSPD = ISMSP/ISIMXR

REAL DEFENSE IMPORTS:

179: ISGFMCR = ISGFMC/ISDEFDEF

PERCENTAGE CHANGE IN REAL DEFENSE IMPORTS:

180: DDIMDEFR = DEL(1 : ISGFMCR)/ISGFMCR(−1)*100

DEFENSE IMPORTS:

181: ISGFMC = ISIMDEFD*ISXR+IMDEFRES

DEFENSE IMPORT DEFLATOR:

182: ISDEFDEF = ISDEFDEF(−1)*(1+DDXR/100)
*(1+DDPF3/100)

REAL IMPORT TAXES:

183: ISIMTR = ISIMT/ISIMPDEF+ISIMTRES

PERCENTAGE CHANGE IN REAL IMPORT TAXES:

184: DDIMTR = DEL(1 : ISIMTR)/ISIMTR(−1)*100

IMPORT TAXES, LINKING EQUATION (IMPORT TAXES AS REPORTED IN NATIONAL INCOME ACCOUNTS DIFFER FROM IMPORT TAX RECEIPTS REPORTED BY THE GOVERNMENT):

185: ISIMT = IMTRATIO*ISTIMFY

REAL NET IMPORTS OF FACTOR SERVICES:

186: ISNETFR = ISNETF/ISNETDEF

NET IMPORTS OF FACTOR SERVICES:

187: ISNETF = ISIMFS−ISEXFS

NET SERVICE IMPORT DEFLATOR:

188: ISNETDEF = ISNETDEF(−1)*(1+DDXR/100)
*(1+DDPF4/100)

IMPORTS OF FACTOR SERVICES:

189: ISIMFS = ISIMFSD*ISIMXR

CIVILIAN IMPORTS IN DOLLARS:

190: ISCIMD = ISIMTGSD−ISIMDEFD

PERCENTAGE CHANGE IN CIVILIAN IMPORTS IN DOLLARS:

191: DDCIMD = DEL(1 : ISCIMD)/ISCIMD(−1)*100

FINANCIAL GAPS BEFORE CAPITAL FLOWS:

192: FINGAP = CIVDEF−NONUSIMD−DEBTPAY

CIVILIAN GOODS AND SERVICES DEFICIT IN DOLLARS:

193: CIVDEF = ISEXTGSD−ISCIMD

NON-US-FINANCED DIRECT MILITARY IMPORTS:

194: NONUSIMD = IMDEFPAY−USFMS

NET FOREIGN CAPITAL INFLOWS, EXCEPT US MILITARY AID:

195: EXFUND = ISUNTRAN+ISFBONDS+USECAID
+ISSTC

NET FOREIGN SECTOR BORROWING AND GRANTS IN DOLLARS:

196: ISGFMD = USECAID+USFMS
−(IMDEFPAY−ISIMDEFD)+OTHERBO2−DEBTPAY

REAL WAGE BILL:

197: ISW2R = ISWRR*12*ISEMP*0.001

Parameter Estimates

A1	−4.29491	A2	2.	A3	1.04967
B1	−2.73997	B2	0.216491	B3	0.825365
B4	−0.028585				
C1	0.76742	C2	0.696727	C3	143.395
C4	1.21639	C6	−21.3628		
D1	0.685288	D2	104.67	D3	1.36934
D4	0.840969				
E1	−2.93955	E2	−2.17403	E3	0.569038
E4	0.127056				
F0	3.85983	F1	−145.976	F2	44.4445
F3	12.9819	F4	−1.14639	F5	3.6754
G1	−0.058557	G2	−0.088594	G3	0.425356
G4	0.098915	G5	0.051904		
H1	1.01662	H2	0.09019	H4	0.298216
H5	−0.562892				
I1	−4628.04	I2	0.604826	I3	−1.70053
I4	2.36455	I5	5.55086	I6	7.57856
J1	−71.9784	J2	0.546538	J3	−2.81209
K1	44.3487	K2	−3.4174	K3	0.082237
M1	0.593101	M2	0.751967	M3	97.0036
M4	0.950286				
O0	−6.87726	O1	1.04311	O2	−0.11258
O3	2.17133				
P2	0.612834	P3	0.31082	P4	1.28286
P5	−0.841583				

Q1	−1430.45	Q2	7.1334	Q3	0.378234
Q4	7.79503				
R1	−30.1061	R2	0.0246	R3	−0.008511
R4	0.01438				
S1	0.356387	S2	0.257672	S3	0.904934
S4	−0.836469				
T1	−3017.33	T2	21.2695	T3	−1.74001
T4	4.76559	T6	14.8288	T7	−17.6635
T8	−60.9258				
U1	−10547.6	U2	153.719	U3	201.299
U4	4.19162	U5	−13.0147	U6	−249.982
V1	375.161	V2	0.789759	V3	−5.80228
V4	−7.19274				
Y0	−1.28804	Y1	0.040375	Y2	−0.031158
Y3	0.36645	Y4	0.596644	Y5	6.83856

25X1