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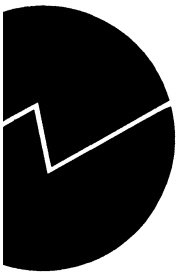

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The Selection Model of Saudi Arabia. Revised Version 1998

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The Selection Model of Saudi Arabia. Revised Version 1998

Abstract:
The Selection Model was developed by the Research Department of Statistics Norway for the Ministry of Planning of Saudi Arabia under a contract with United Nations. This report gives a documentation of a revised version of the model, which is part of a system of macroeconomic models, designed to be used in the preparation and monitoring of Development Plans. The Selection Model belongs to the class of computable general equilibrium models, and includes an input-output core. The report gives a complete documentation of the equations of the model. Main elements of the model is illuminated in commented graphs. The report also comprises an application of the model in the study of consequences of Saudi Arabian membership in WTO.

Keywords: Saudi Arabia, CGE-model, macroeconomic planning

JEL classification: O53, O21, E17

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1. Introduction

The Selection Model is an applied general equilibrium model developed by Statistics Norway for the Ministry of Planning in Saudi Arabia. It is part of a system of macroeconomic models, designed to be used in the preparation and monitoring of Development Plans. Since the first version was completed, see Cappelen and Magnussen (1996), there have been substantial changes in the model, and this report documents the present version of the model.

The Selection Model is designed to be used as a tool in the preparation of Saudi Arabia's Development Plans, of particular importance is to analyse consequences of investment programmes, whether undertaken by the government or the private sector. Accordingly, available resources are assumed to be fully utilized, so that e.g. a reduction of government expenditures will leave more resources for an expansion of the private sector. Although based on weak empirical foundations and strong assumptions connected with the production side of the industries, the modelling of different production sectors makes the model suitable for analysing composition of investment programs.

The model specification is based on the same input-output core as developed for the Implementation Model, along with other equations from that model, see Johansen and Magnussen (1996). In consequence a close connection between the two models is forged, which is regarded to be important as the models will complement each other in covering the needs for macro analyses related to the Development Plans. However, a set of disaggregated production functions with derived labour demand and capital stock relations put the emphasis in the Selection Model more on the supply side of the economy. The overall mode of operation of the Selection Model is accordingly very different from that of the Implementation Model, which have Keynesian features.

A summary of the role of computable general equilibrium (CGE) models is given in chapter 2, while the details of the Selection Model are examined in chapter 3. Chapter 4 gives an illustrative outline of the working of a simple CGE model. In chapter 5 we illustrate how the model can be used as an analytical tool. In this example we study possible effects of Saudi Arabia's desire to join the World Trade Organisation (WTO). Chapter 6 offers some thoughts on further work with the model. The annexes comprise a complete list of the variables, a documentation of the establishment of coefficients and time series to be used in production functions, the econometric equations and the equations in the model.

2. The role of a computable general equilibrium model

A general equilibrium model usually focuses on three features of an economy. First, the behaviour of economic agents (producers and households/consumers) is modelled according to standard microeconomic theory, i.e. maximizing behaviour, taking prices as given parameters. Second, resources are fully utilized implying that unemployment and idle productive capacity are not addressed explicitly. By resources we understand the available labour force, the stock of real capital, net foreign assets, natural resources and productivity levels. Third, all or most markets are interconnected through the input-output structure, the competition for scarce resources, and income and price effects linking different markets by consumer and producer behaviour.

The role of a computable general equilibrium model is twofold. It can be used for analysing potential growth in output of the economy and to study effects from changes in policy variables affecting the efficiency of a market economy. Specially in the latter role, the literature is full of CGE model-based studies of tax reforms, import tariffs and trade policy, subsidies and so on. Studies like this focus on distortions and market inefficiencies resulting from policy interventions or other institutional aspects interfering with the operation of a market economy. CGE models does not necessarily state that these market imperfections should be avoided. Many of them are in place for sound economic reasons while

others are based on moral and ethical values regarded superior to economic calculations. On the other side, a CGE model may help a government to evaluate the costs of pursuing these other objectives.

CGE models are often argued to be based on firm microeconomic theory while macroeconometric models, emphasizing fitting equations to historical time series, are more ad hoc. In our view, this is not a well founded description of the differences between the two kinds of models. First of all, microeconomic theory cannot be regarded as a unique body of theory that leaves no options open for discretionary choice by the modeller. Microeconomic theory suggest several possible ways to analyse market behaviour. Empirical evaluation should not be excluded when deciding which methodology to adapt. Most CGE models are based on parameters calibrated from benchmark data or «guesstimates» guided by theoretical considerations, not on econometric studies. Although there are equations whose coefficients have been estimated from time series, calibration from scanty data have been used to a considerable extent in determination of the parameters in the Selection Model.

There are alternative ways of «closing» a CGE model. This may be based on ad hoc arguments or by an «arm chair» approach considering how the economy operates in the long run. In addition the decision is usually influenced by the intended use of the model. Closing the model involves choosing e.g. whether to impose a balanced budget in the simulations or letting the budget balance be endogenous. Another example is whether or not to impose a flexible exchange rate to secure a current account balance. A third example is deciding how the volume of investments should be determined. In the present versions of the model the rate of return in private sectors are set equal to a common rate of return determining capital stock and investment. It should also be mentioned that the consumption function is omitted, leaving private consumption to be residually determined for fulfilment of the general budget equation.

There are no obvious way to close the Selection Model. A decision on a closure rule should be based on experience from use of the model as well as suitability and consistency concerning the planning context. The decision will influence the set of possible solutions (for the model) but not the actual interrelations between variables in the model. Different closure rules are worth trying and in experimenting, specially during a planning situation, knowledge will be acquired.

3. The Structure of the Selection Model

3.1. Main features

Although the planning process is currently centred around five-year plans, the period 1995 to 2000 covering the sixth consecutive plan, each plan needs to be considered in a somewhat more long-term perspective. As an illustration, an investment programme undertaken during the current five year period will lead to increased production capacity that can only be fully utilized during the following five year period. In a planning context, both aspects of the investment process (capacity building and capacity utilization) should be analysed. Thus a model that focuses on more long-term effects and the utilization of resources is needed. This does not mean that only the supply side of the economy is highlighted; our main interest is to study the interaction between supply and demand.

3.1.1. Outline of the model

The economic structure of the Selection Model is different from the Implementation Model. These differences results from the additional assumptions made in the Selection Model. In the first place, we assume exogenous labour supply that equals total labour demand so that unemployment is ruled out. This essential feature considerably changes the behaviour of the model compared with the Implementation Model when subjected to an economic shock. Second, not all sectors are modelled in the same way. The most important production sectors of the Saudi economy, those related to the extraction and processing of oil, are linked to the world market in a way that cause their behaviour to differ com-

pared to other private industries. For these sectors gross investment is exogenous, assumed to be an important policy variable (given by the plan), while export prices are assumed to be determined on the world market, thus exogenous in the model. Exports for each of these oil-related commodities are endogenous. Third, capital is assumed mobile between private sectors of the economy, and allocation of capital and thereby investment is determined by profitability. The rate of return is assumed to be given at the world market so that the rate of return acts as return on alternative investments abroad.

The way the labour market has been modelled is crucial to the functioning of the model. Supply of Saudi labour is related to the size of the population, while non-Saudi labour supply is exogenous. The latter assumption is not considered plausible in a strict sense. The point is rather that the model user must adjust this variable according to what he thinks is a reasonable estimate. Except for some small groups of experts, most foreign labour is non-skilled and employed in the service sectors. Supply of this non-skilled labour is probably highly elastic and affected by immigration regulations, although to what extent is uncertain. On the demand side however, there is no distinction between Saudi and non-Saudi labour. The nominal wage rate is assumed exogenous, but can to some extent be considered a numeraire in the model.

3.1.2. Data

The greater part of the data base is the same as for the Implementation Model, so the main source is the annual National Accounts. Additional data for the Selection Model are essentially those related to the production functions and the demand for labour and capital. Figures for employment and investment by sector are taken from the Sixth Development Plan (for a detailed discussion see Appendix D). Parameters in the model are almost exclusively calibrated based on data covering the base year 1994. The only variables estimated from time series are non-oil exports, market share for imports, private investment in housing, and the «budget equations».

We must draw attention to the fact that the capital stock data are of inferior quality and based on weak information and strong assumptions about rates of depreciation etc. Work on capital data by sectors should accordingly be given high priority in the future in order to improve the model. Likewise we stress the need for an improvement of the employment statistics, in particular providing information on sectoral employment for Saudis and non-Saudis, as well as labour divided by skills.

The most important policy variables include government consumption, fixed capital formation, net taxes and controlled prices which enter directly into the price equations. These controlled prices include export prices for petrochemicals and petroleum refining, and import duties. The import price is assumed determined on the world market. Also investment and production in the oil-related sectors (Oil and gas, Petroleum refining and Petrochemicals) are important policy variables. It should be underlined that government net transfers to households, usually an important policy variable, do not have a significant role in this model. This is because the consumption function, where these transfers should entered into, is left out of the model.

Apart from private investment in housing, determined from an econometric equation dependent on i.a. investment credit for housing, investment is mainly determined from the supply side. This makes disbursement of investment credits from the government (or any other financing issue) of no importance in this model.

3.1.3. Aggregation level

The disaggregation of the Selection Model is founded on the input-output table. This specifies 17 sectors of production and 22 components of final demand. The industries specified in the Selection Model are (abbreviations in parenthesis):

Production sectors:
1. Agriculture, forestry and fishing (AG)
2. Other mining, quarrying (MI)
3. Petrochemicals (PS)
4. Other manufacturing (MA)
5. Electricity, gas and water (EW)
6. Construction (CN)
7. Wholesale and retail trade (TD)
8. Transport and communication (TC)
9. Real estate (RE)
10. Finance, insurance (FI)
11. Community services (CS)
12. Government services (GS)
13. Imputed bank charges (BC)
14. Crude oil and natural gas (OG)
15. Petroleum refining (PR)
16. Import duties (ID)

Private consumption expenditures are allocated to nine consumer items by means of a linear expenditure system. The consumption items are those defined in the National Accounts. The consumption groups coincides with the components of the Cost of Living Index.

Consumption items:
1. Food, beverage and tobacco (FOO)
2. Clothing and footwear (CLO)
3. Rent, fuel and power (REN)
4. Furniture and household equipment (FUR)
5. Medical health care (MED)
6. Transport and communication (TRA)
7. Entertainment and education (ENT)
8. Other goods and services (OTH)
9. Resident direct purchase abroad (ABR)

Gross fixed capital formation is specified by production sector in the Selection Model, despite the lack of such data in the National Accounts. The 13 sectors includes the production sectors mentioned above except Government services, Import duties and Imputed bank charges. Gross fixed capital formation is also subdivided by institutional sector: Government, Oil and Private non-oil. For the Government and the Oil sectors, two sub-categories are defined (2 and 3 below), while investments in Private non-oil sector in addition includes residential buildings.

Categories of gross fixed capital formation:
1. Residential buildings (H)
2. Non-residential buildings (B)
3. Transport and machinery equipment (TM)

Employment and capital stock are disaggregated to the same sectors as investment. Exports are divided into five categories;

Export categories:
1. Crude oil and natural gas (OG)
2. Petroleum refining (PR)
3. Petrochemicals (PS)

4. Non-resident direct purchase (CPN)
5. Other non-oil exports (XX)

3.2. Consumer demand

Without a macro consumption function in the model total private consumption is determined residually to balance supply and demand. Consumption by resident households is divided into nine consumer items by a linear expenditure system (LES). In this way we take into consideration both income effects, as well as direct and indirect price effects.

An increase in the price of one consumer item, e.g. due to an increase in indirect taxes, will reduce consumption of this item and increase consumption of all other items. The consumer consider each group as a gross substitute for the others. This is a reasonable assumption for groups at the aggregation level specified in the National Accounts. Complementary goods will tend to be included in the same item. The income effects show which consumption groups that can be considered as luxury goods i.e. with an income elasticity above one, and which are necessities with elasticities less than one.

Due to lack of genuine time series data the coefficients in the LES have not been estimated, but calibrated based on information from an international study of consumer behaviour, see Theil et al. (1989). Direct price elasticities were taken from this study for countries where budget shares seems to coincide with those in Saudi Arabia, and income elasticities were calculated in order to force the LES system to reproduce actual consumption for each category in the base year. See AppendixB.3 for more information on the LES system.

Private consumption by item i can be written as

$$CPR_i = CPR_i.1 + \frac{CPR_i.2}{PCP_i}\left(VCPR - \sum_i CPR_i.1 \cdot PCP_i\right), \quad \text{i=(FOO, CLO, REN, FUR, MED, TRA, ENT, OTH, APB),}$$

where

VCPR	consumption by residents, current value
CPR_i	consumption by residents of consumption item i
PCP_i	price index for consumption item i
$CPR_i.j$	coefficients term, j=1,2

Table 3-1 shows the direct price elasticities (Cournot elasticities) and expenditure elasticities (Engel elasticities) for each consumer group. Cross price elasticities can also be derived from the linear expenditure system.

Table 3-1 Expenditure and direct price elasticities

Consumer group	Expenditure elasticities	Direct price elasticities
1. Food, beverage and tobacco	0.64	-0.60
2. Clothing and footwear	0.90	-0.70
3. Rent, fuel and power	1.10	-0.85
4. Furniture and household equipment	1.17	-0.90
5. Medical health care	1.30	-1.00
6. Transport and communication	1.33	-1.00
7. Entertainment and education	1.17	-0.90
8. Other goods and services	1.32	-1.00
9. Resident direct purchase abroad	1.33	-1.00

From the table we see that two items can be characterized as necessities: Food, beverage and tobacco, and Clothing and footwear. The other items are luxury items.

The linear expenditure system determines consumption by resident households by item. Consumption by non-residents, which in the National Accounts is considered as exports, is distributed over five of the consumer items by fixed weights: 7 per cent of non-residential consumption is Food, beverage and tobacco, 6 per cent is Clothing and footwear, 22 per cent is Furniture and household equipment, 1 per cent is Transport and communication and the remaining 64 per cent is Other goods and services.

3.3. Labour supply

Saudi labour supply is included in the model, based on information from the Sixth Development Plan, which incorporates labour supply estimates for the years 1989 and 1994 (see Appendix D). Labour supply is linked up with total population in Saudi Arabia:

ES = LRRATE*POPSA

where

ES	Saudi labour supply
LRRATE	participation rate
POPSA	Saudi population

3.4. Imports

Total imports is determined by weighting together imported final demand components, using the input-output coefficients connecting imports to the respective final demand category as weights. Imports is adjusted to allow for variation in the import share subsequent to the base year. The import equation can be written as:

$$M = MS \cdot \sum_j \alpha_{Mj} \cdot X_j, \qquad j=(CP_i, CG, J_{kl}, X_m, DS)$$

where

M	total imports
X_j	final demand, cathegory j
MS	import market share relative to the share in the base year
CP_i	private resident and non-resident consumption by item i
CG	government final consumption
J_{kl}	gross fixed capital formation by institutional sector k and type l
X_m	exports by category
DS	change in inventories
α_{Mj}	input-output coefficient, share of imports in final demand category j

i	consumption groups (see section 3.1.3)
k	institutional sectors, Government, Private, Oil
l	Housing, Building, Transport and machinery
m	Oil and Gas, Petrochemicals, Petroleum refining, Non-oil exports

The market share for imports is included to take into account changes in imports not caused by changes in the composition of final demand. The market share is estimated as a function of relative prices. The price index for import, inclusive of import duties, is defined as:

$$PMID = \frac{VM}{VM + VYID} PM + \left(1 - \frac{VM}{VM + VYID}\right) PYID$$

where
PMID imports, inclusive duties, price index
VM imports in current value
PM imports, price index
VYID value of import duties in current prices
PYID import duties, price index

The significant price variable is indicative of import substitution in the Saudi economy. This should be interpreted as gross substitution, not as competitive imports for homogenous goods. An increase in import price, given domestic prices, will reduce the market share for imports while demand for domestic goods is stimulated. Ignoring the short-term dynamics the import share function can be written as:

$$MS = f\left(\frac{PMID}{PYP}\right),$$

where
PYP GDP private sector deflator

For more information on the input-output table and the import share equation see Appendix B.2 and Appendix C.1.1 respectively.

3.5. Exports

Non-oil exports is modelled by an Armington equation assuming that world market demand and relative prices are of importance for this (composite) export category. A market indicator for export has been constructed[1]. Export markets developments are approximated by GDP for each country. Four main export areas are defined and weighted together:

- OECD-countries (30 per cent)
- Africa (7 per cent)
- Asia, except GCC-countries (22 per cent)
- GCC-countries (41 per cent)

The import price index is used as an indicator of competitive prices on the export markets, so a relative price term is included in the equation. Disregarding the dynamics, the non-oil export equation can be written as:

$$XX = g\left(MIX, \frac{PXX}{PM}\right),$$

where
XX non-oil exports
PXX price index for non-oil exports
PM price index for imports
MIX market indicator for exports

For more information on the estimated equation for non-oil exports see Appendix C.1.2.

[1] Based on data on country composition of Saudi exports, provided by Ministry of Planning, Saudi Arabia.

3.6. Gross domestic product - Demand

Gross domestic product by sector is related to final demand by category through the input-output coefficients, where final demand components are weighted together using the input-output coefficients as weights:

$$Y_i = \sum_{j \in \rho} \alpha_{ij} \frac{1 - MS \cdot \alpha_{Mj}}{1 - \alpha_{Mj}} X_j, \qquad j=(CP_i, CG, J_{kl}, X_m, DS)$$

where

Y_i value added in sector i

X_j final demand, component j

α_{ij} the input-output coefficient giving the share of value added from sector i in final demand category j

The input-output coefficients will be adjusted due to changes in the import market share. In the import function the market share variable is entered «outside» the expression, in the value added relations it is connected to each input-output coefficient. This is because the coefficients for imports and domestic production (value added) have to add up to one for each of the final demand categories. The effect of reduced market share on domestic production, final demand being equal, is positive. The effects on total supply will, in some measure, be levelled out by reduced imports. It should be noticed that the total effect is uncertain, depending upon, among other things, the effects on final demand.

3.7. Final demand prices

Final demand prices are determined by input-output equations corresponding to the value added equations presented in the previous section. The import share variable enters the price equations in a similar way, adjusting the coefficients according to market share changes. All final demand prices are dependent upon the prices of imports and value added:

$$PX_j = MS \cdot \alpha_{Mj} \cdot PM + \sum_i \alpha_{ij} \frac{1 - MS \cdot \alpha_{Mj}}{1 - \alpha_{Mj}} PY_i,$$

i = (AG, MI, PS, MA, EW, CN, TD, TC, RE, FI, CS, OG, PR, GS)

where

PX_j final demand price, category j

PY_i value added price, sector i

where

j final demand categories

k Government, Private, Oil

l Housing, Building, Transport and machinery

m Oil and Gas, Petrochemicals, Petroleum Refining, non-oil exports

The price index for change in stocks is determined from the general budget equation, and thus defined as:

PDS = (VY + VM - VCPR - VCG - VJ - VX)/DS

where

DS change in stocks, at constant prices

PDS price index for change in stocks
VY GDP at current value
VM imports at current value
VCPR private final consumption by residents at current value
VJ total gross fixed capital formation at current value
VCG government consumption at current value
VX total exports at current value

The remaining price index to be determined is for consumption by non-residents. Here estimates of the composition of non-resident consumption by item are employed. The five relevant price indices are given weights equal to those used when adding non-resident consumption to resident consumption by item:

PCPN = 0.07*PCPFOO + 0.06*PCPCLO + 0.22*PCPFUR + 0.01*PCPTRA + 0.64*PCOTH

where
PCPN price index for consumption by non-residents. The various consumption items are defined in section 3.1.3.

3.8. Gross Domestic Product - Supply

This section describes the producer behaviour in the model. Various assumptions applied to the different sectors are summariZed in section 3.8.5. Labour and capital data needed for modelling the sectoral supply functions exist only at an aggregate level, but by utilizing a number of simplifying assumptions, we have constructed sector data (for documentation see Appendix D).

3.8.1. Production functions

Production functions are specified for all the 13 private sectors. They all have the same structure in the way they relate value added by industry (Y_i) to employment (E_i) and capital stock (K_i). The functional form chosen is Cobb-Douglas with constant returns to scale, so that the sectoral production functions can be expressed as:

$$Y_i = TFP_i \cdot E_i^{\alpha_i} \cdot K_i^{1-\alpha_i}$$

where α_i is the marginal elasticity of production with respect to employment in sector i.

Total factor productivity is usually an exogenous variable. However, in the oil and gas industry it is endogenous since value added for this sector is assumed exogenous.

3.8.2. Labour demand

From standard marginal conditions for profit maximization for all private sectors, we deduce the conditional demand functions for labour:

$$E_i = \alpha_i \frac{PYF_i}{W_i} Y_i$$

where
PYF_i price index, net of indirect taxes, for value added in sector i
W_i wage rate in sector i

The wage rates in each sectors (W_i) are assumed proportionate to average wage rate in private sector (WP):

$W_i = W_{.i} \cdot WP$,

where $W_{.i}$ is the factor of proportionality.

Due to the limited information on sectoral wages the model does not attempt to explain the structure of relative wages in the economy. In order to obtain this, information on employment and wages by sector and education and/or skills is required.

About two thirds of the labour force in Saudi Arabia are expatriate workers. Better data about the expatriate labour force, and its role and significance in different sectors would further improve labour market modelling. In the present version of the Selection Model the wage rate in the private sector is exogenous.

3.8.3. Capital accumulation

The conditional capital demand equations are derived from profit maximizing conditions corresponding to those for the labour market:

$$K_i = (1 - \alpha_i) \frac{PYF_i}{PK_i} Y_i$$

where PK_i is the user cost of capital defined as $PK_i = PJP \cdot (IR_i + \delta_i)$, PJP is the price index for gross investment, IR_i is the real rate of return of capital in sector i and δ_i is the depreciation rate for sector i. The real rate of return by sector is related to the average real rate of return in the private sector, except for the sectors oil and gas, petroleum refining, petrochemicals and electricity, gas and water. For these sectors investment is exogenous[2] and the capital stock is determined by the standard accumulation equation relating stock and flow; $J_i = K_i - (1-\delta_i) \cdot K_{i-1}$. The user cost follows from the capital demand equations and the rate of return follows from the definition of the user cost. For all other private sectors the real rate of return is linked to the exogenous average real rate of return. Since the depreciation rates are predetermined constants and the gross investment price is determined elsewhere in the model, the user cost is determined. This in turn, determines the capital demand, and finally, investment is determined from the stock/flow equations.

3.8.4. Producer prices

Producer prices (price indices for value added, net of indirect taxes) are not explicit defined by equations in the model. By inserting the first order conditions for profit maximum into the production functions we realize that they are determined implicit in the model. This gives us:

$$Y_i = TFP \cdot \left(\alpha_i \frac{PYF_i}{W_i} Y_i \right)^{\alpha_i} \left((1 - \alpha_i) \frac{PYF_i}{PK_i} Y_i \right)^{1-\alpha_i}$$

Solving for PYF_i gives

$$PYF_i = W_i^{\alpha_i} \cdot PK_i^{1-\alpha_i} (TFP_i \cdot C)^{-1}, \text{ where } C = \alpha_i^{\alpha_i} \cdot (1-\alpha_i)^{1-\alpha_i}$$

From this implied price equation we find that producer prices are independent of output, implying a horizontal supply function. This follows from the assumption of constant returns to scale.

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[2] To be precise, investment in the oil and gas sector is endogenous, determined by the sum of two exogenous variables; investment in «buildings» and in «transport and machinery».

In those sectors where investment is exogenous and output endogenous (Electricity, gas and water, Petroleum refining, Petrochemicals), the capital stock should be viewed as predetermined. Inserting into the production function the labour demand equation results in a more familiar upward sloping supply function:

$$Y_i = f(TFP_i, \frac{PYF_i}{W_i}, K_i), \; i = EW, PR, PS$$

In this function the partial derivatives with respect to all variables except for the wage rates are positive. In general we could say that producer prices are determined by the demand equations for value added through the input-output structure, the production functions and the factor demand equations.

3.8.5. Different assumptions among sectors

This section describes how various sectors are modelled in the Selection Model. Table 3-2 below summarizes some important aspects of the various sectors in the model. We start with the oil and

Table 3-2 Modelling the different sectors in the Selection Model

Sector	*Price*	*Supply*	*Demand*	*Exports*	*Investment*
Oil and gas	n	x	n	n	n
Petrochemicals	x	n	n	n	x
Petroleum refining	n	n	n	n	n
Electricity, water	n	n	n	-	x
Other private sectors	n	n	n	n	n
Governm. services	n	n	x	-	x

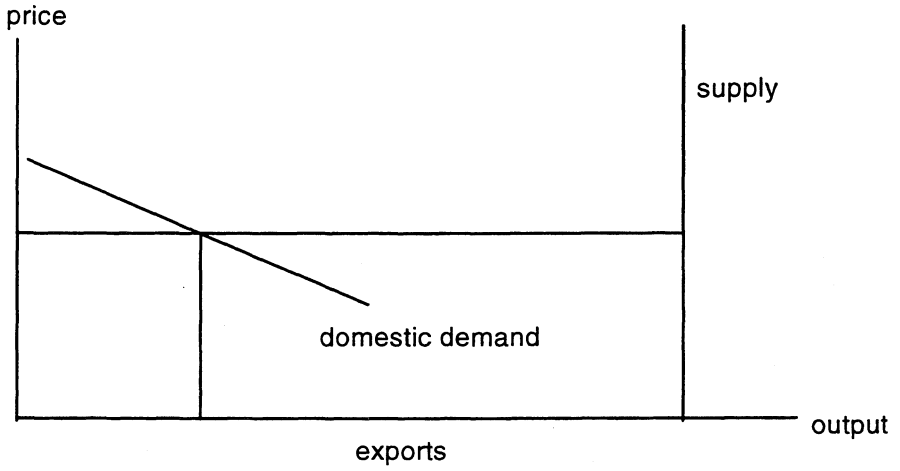
x=exogenous, n=endogenous

gas industry, which is of course the dominating sector in the Saudi Arabian economy, as the country is by far the world leading producer and exporter of crude oil (Saudi Arabia also possesses large reserves of natural gas). In its capacity of being the world's leading oil exporter, even though attached to OPEC, the Kingdom has considerable power to influence the market price by controlling the production volume. However, our ambitions are not to model the world oil-market, hence production is exogenous in this model[3]. For given output, producer price-user cost ratio and investment, the capital stock is determined, implying the real rate of return is determined residually. Employment is determined from the producer price-wage ratio, as described in section 3.8.2.

A graphic representation of the market for oil and gas is shown in Figure 3-1 below. Output is exogenous and consequently represented by a vertical line. Output price is formally endogenous and not related to output, thus represented by a horizontal line (geared to the export price). Domestic demand for oil and gas is negatively related to price, making the demand curve downward sloping. The point of intersection between the demand curve and the price line determines domestic demand for oil and gas. The residual quantity between total output and domestic demand is exported. It should be emphasized that an increase in the output of oil and gas will not only change the quantity of exports but also domestic demand. Demand will decrease in all final demand categories endogenous in the model, but impact is slight: A 5% increase in oil and gas production will increase exports with 5.6% the first year (5.4% after 20 years), while private consumption decreases with 0.03% the first year (0.07% after 20 years). The effect is due to the employment being constant, thus for the oil sector to expand its production, resources have to be transferred from other sectors leading to a decline in their output.

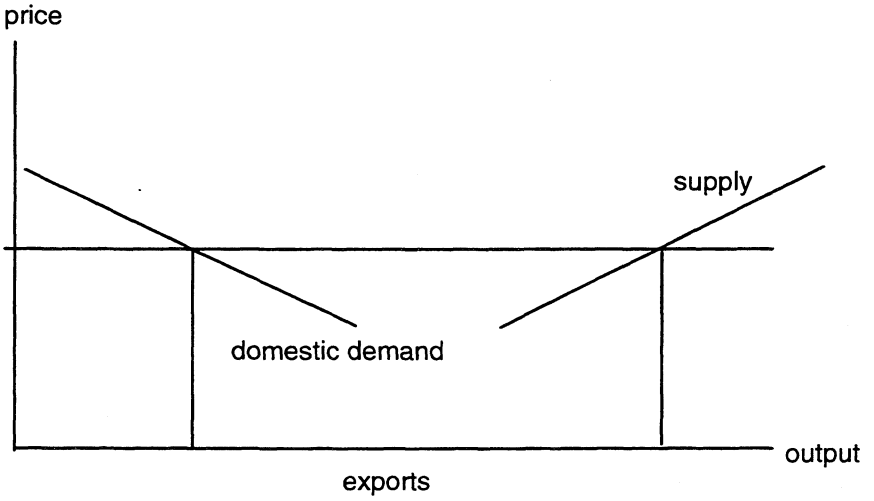
[3] Technically this is done by endogenizing «total factor productivity» in the production function for the oil and gas sector, in effect neutralizing the impact from this equation on the rest of the variables in the model.

Figure 3-1 Partial equilibrium in the Oil and gas industry



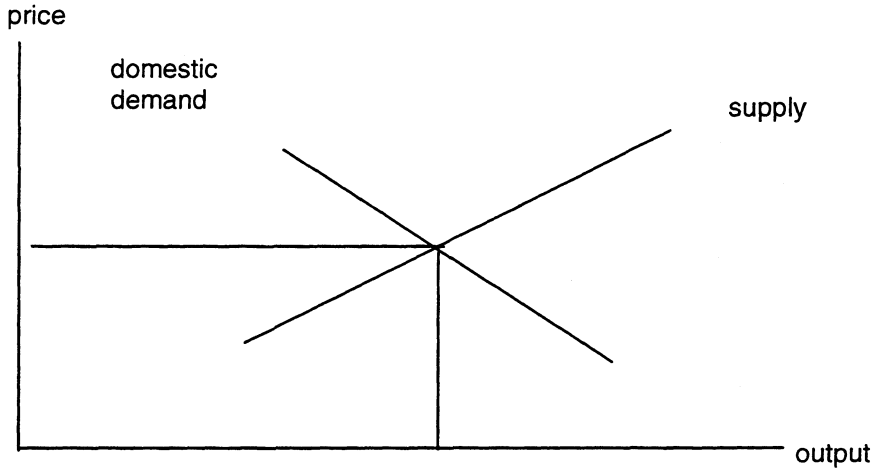
The markets for petrochemicals and refined products are illustrated in Figure 3-2. The situation is representative for a «small open economy»-model where prices are determined on the world market and the supply curve is upward sloping, assuming a fixed capital stock. This latter assumption follows from the exogenous investment assumption. Again exports is endogenous in both sectors determined as the residual between total output and domestic demand. Note that there are no mechanism in the model preventing exports from becoming negative in these sectors (or in the oil and gas sector). This will result from an increase in domestic demand or reduction in supply sufficient to crowd out exports. Although unlikely, should this happen the country will become an importer of the commodity. Thus this kind of model cannot explain both imports and exports of the same commodity as they are assumed to be homogeneous and the «law of one price» prevails; within a single market identical goods must sell at identical prices.

Figure 3-2 Partial equilibrium in the Petrochemicals and Petroleum refining industries



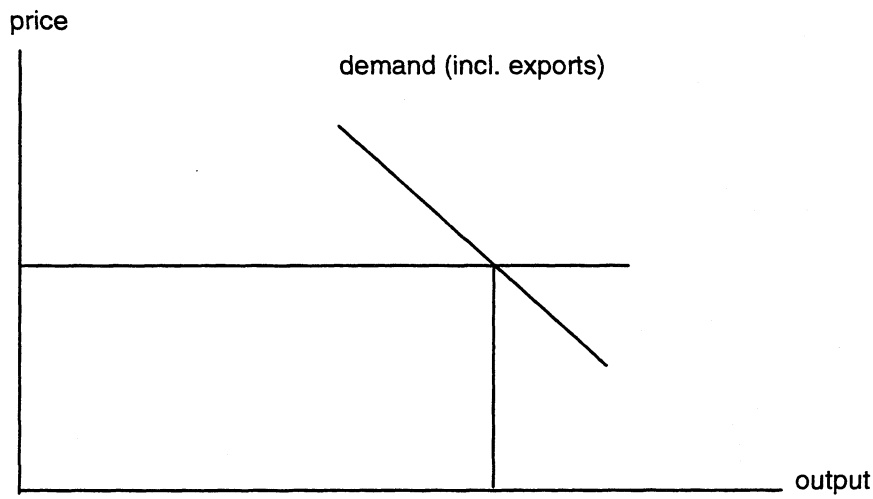
The sector producing electricity, gas and water produces non-tradaebles i.e there is no exports or imports. Price and output quantity are determined by domestic factors like the textbook description of a market. The predetermined capital stock, resulting from exogenous gross investment, results in an upward sloping supply curve. In Figure 3-3 the intersection between the demand and the supply curves determines price and output since there are no net exports.

Figure 3-3 Partial equilibrium in the Electricity, gas and water sector



For the remaining private sectors output is determined from the demand side. Endogenous capital stock and employment, together with the assumption of constant return to scale, implies no relation between price and output (cf. section 3.8.4). For these sectors exports are aggregated into the group «non-oil private sector» and specified as an Armington function, with a GDP-indicator for the main countries of export destination (see section 3.5), and import price reflecting competitiveness, is the most important explanatory variables. The market for the non-oil sectors is presented in Figure 3-4.

Figure 3-4 Partial equilibrium in «private non-oil sectors»



The private sector's role as a whole in the Selection Model is not well represented in Figure 3-4. The reason is the assumption that total employment is in effect exogenous (geared to population which is exogenous). Increase in demand in one of the sectors will transfer resources from other sectors leaving the overall employment unaffected. Private consumption will always adjust, or «close the model», to absorb output resulting from full employment.

4. Outline of the Selection Model

In this chapter we presents some of the main characteristics for the model by means of key charts. To make the presentation lucid we assume one aggregate product throughout this section.

Figure 4-1 Structure of the model

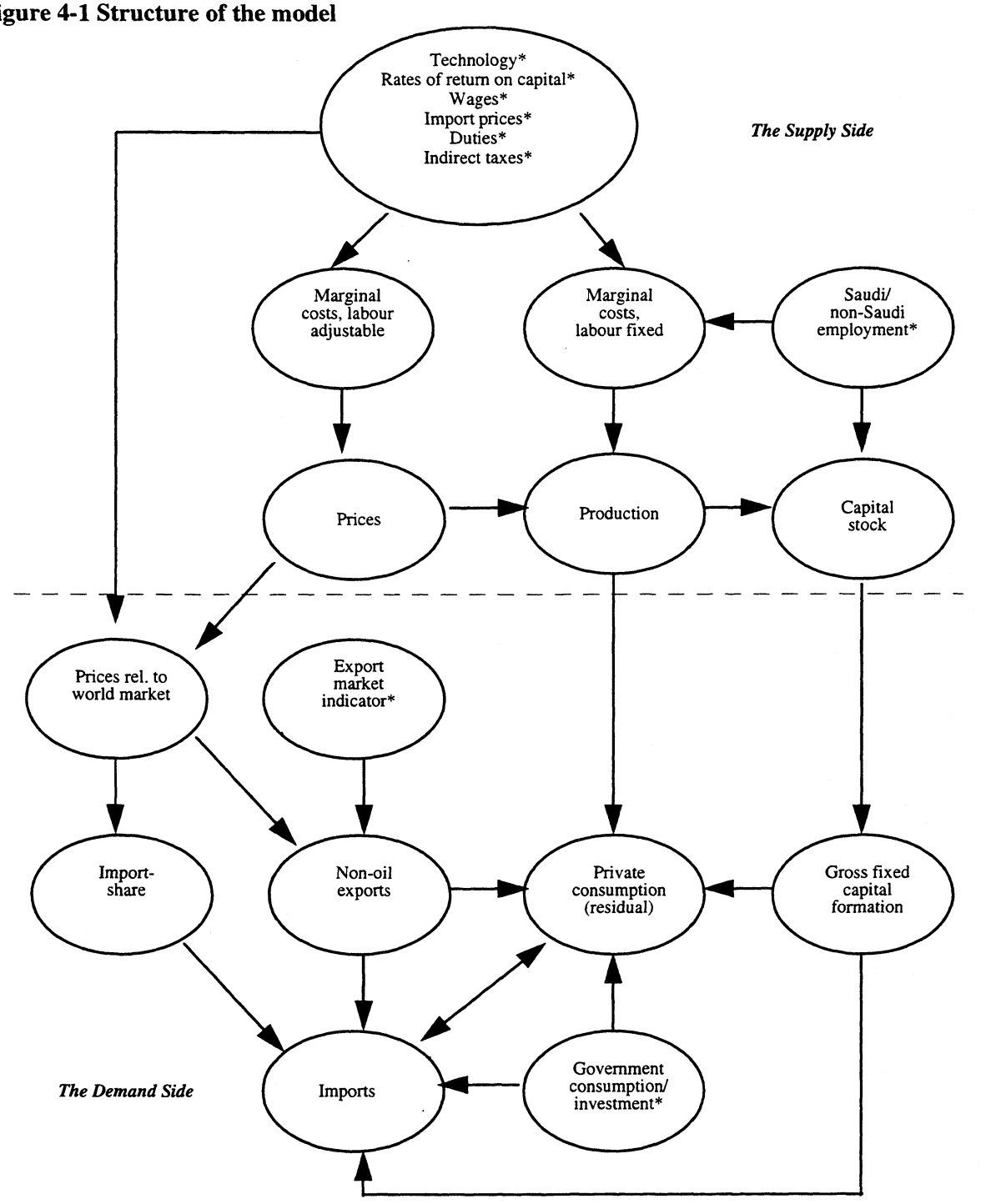


Figure 4-1 presents an overview of the structure of the Selection Model. The chart is divided into two, the upper half illustrates the supply side, the lower half the demand side. Take notice of the role of private consumption to "close" the model. Variables marked with an asterix «*» are exogenous.

Figure 4-2 Producer behaviour - factor inputs

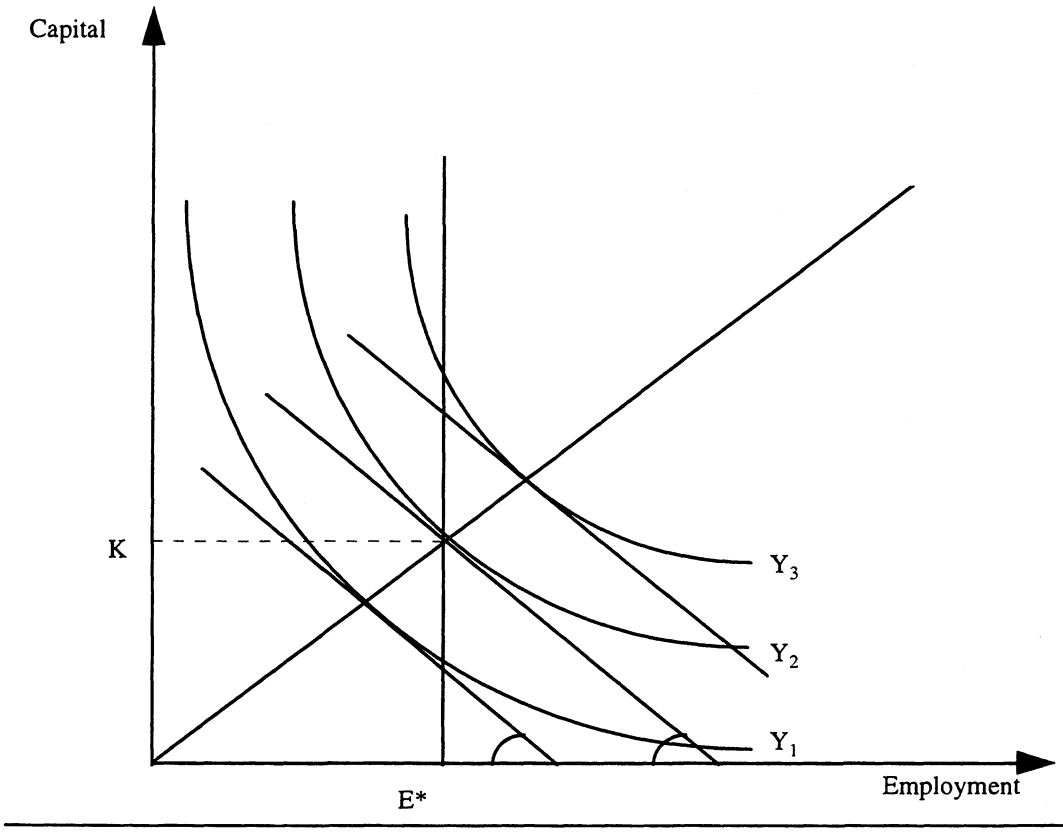
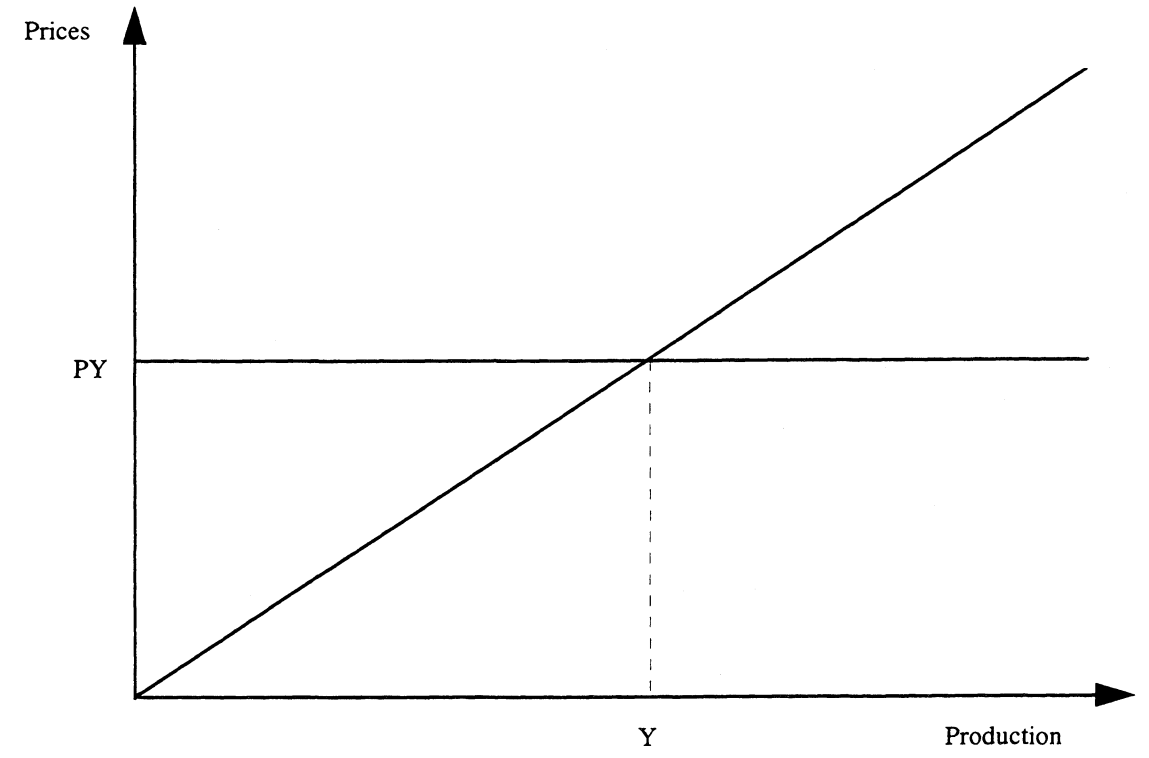


Figure 4-2 illustrates the producer behavior and the use of capital when labour is kept constant, in the Selection Model. The isoquants (Y-lines) are convex towards the origin reflecting an increasing rate of technical substitution; a reduction in labour will require more additional capital to keep the production level constant the lower is the level of employment. The vertical line E* represents fixed employment, while the line intersecting through the origin represents the output expansion line when both labour and capital is flexible with constant returns to scale. The isocost curves have inclinations given by the negative of the wage rate-user cost ratio, -W/PK. Production is determined by the isoquant going through the point of intersection between the expansion line and the vertical line showing the given level of employment.

Figure 4-3 Supply and demand of domestic goods



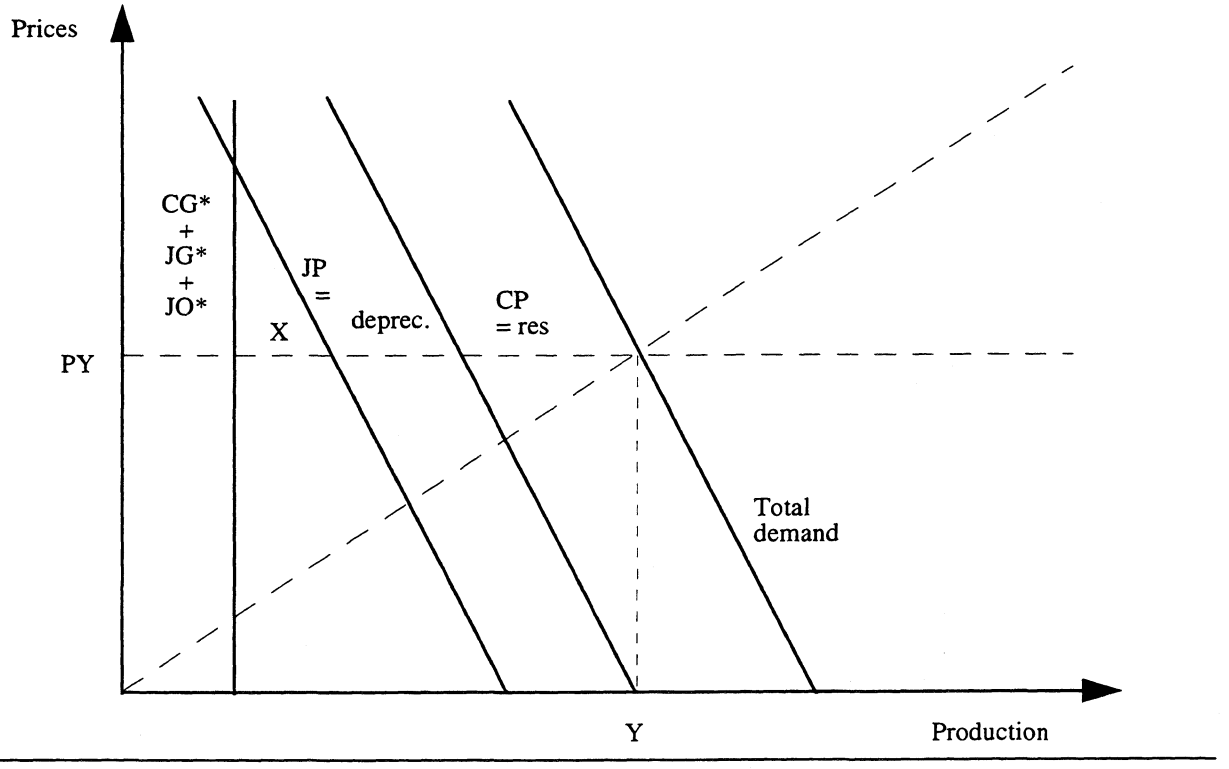


Figure 4-3 illustrates how supply and demand for domestic goods are determined. At the top we show that supply is determined by setting marginal costs equal to price. If both factors are fully adjustable marginal costs are independent of output, hence represented by a horisontal line. This marginal cost will determine the price on the product. The upward sloping line represents marginal costs when employment is constant, and consequently there is increasing marginal costs and decreasing marginal productivity. In this case it will be profitable for the producers to increase production until marginal costs equals the price.

At the bottom is an illustration of demand for domestic goods. Government consumption and investments, together with oil investments are exogenous, hence independent of the price. Non-oil exports and private investments are downward sloping, while private consumption is determined residually as the difference between the remaining final demand categories and total supply.

Figure 4-4 Reduced user costs of capital (1)

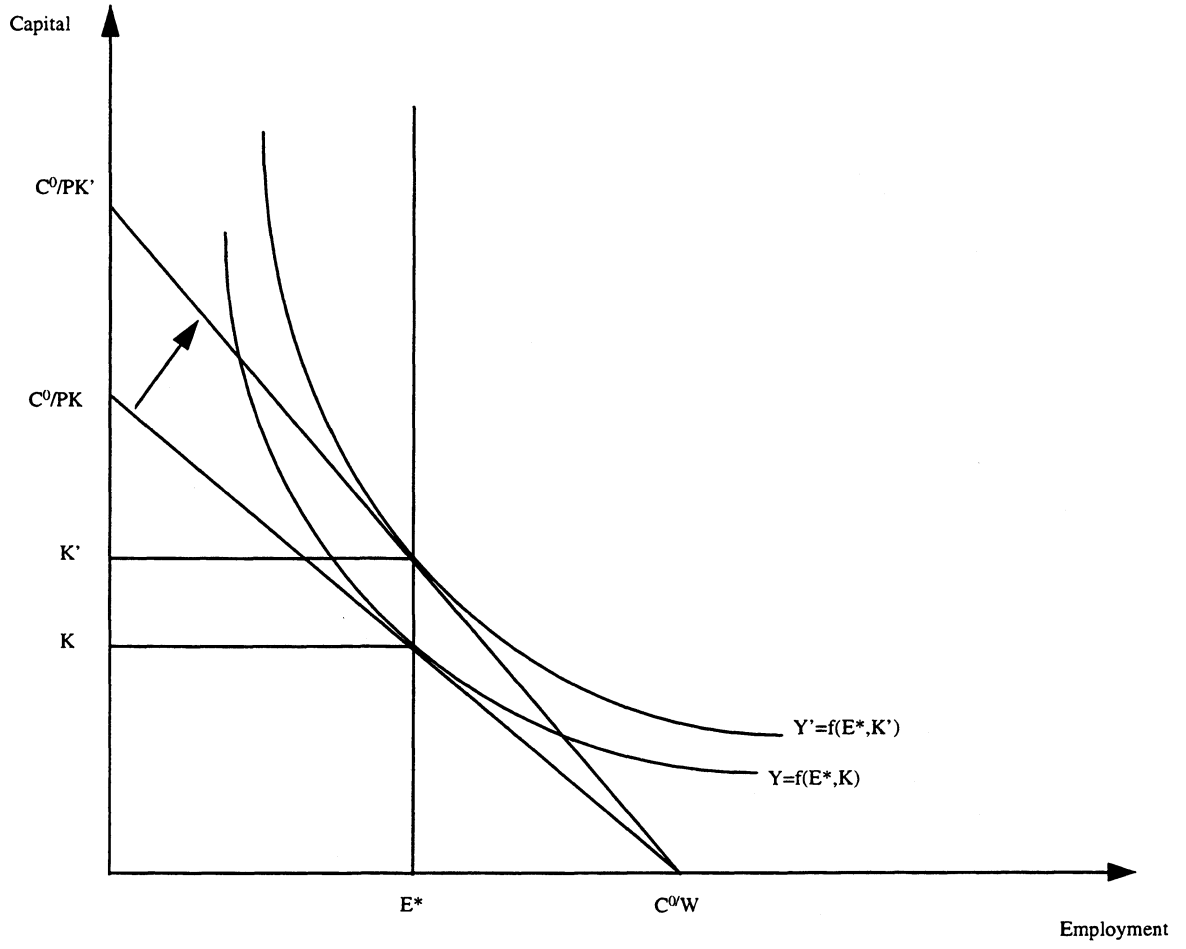
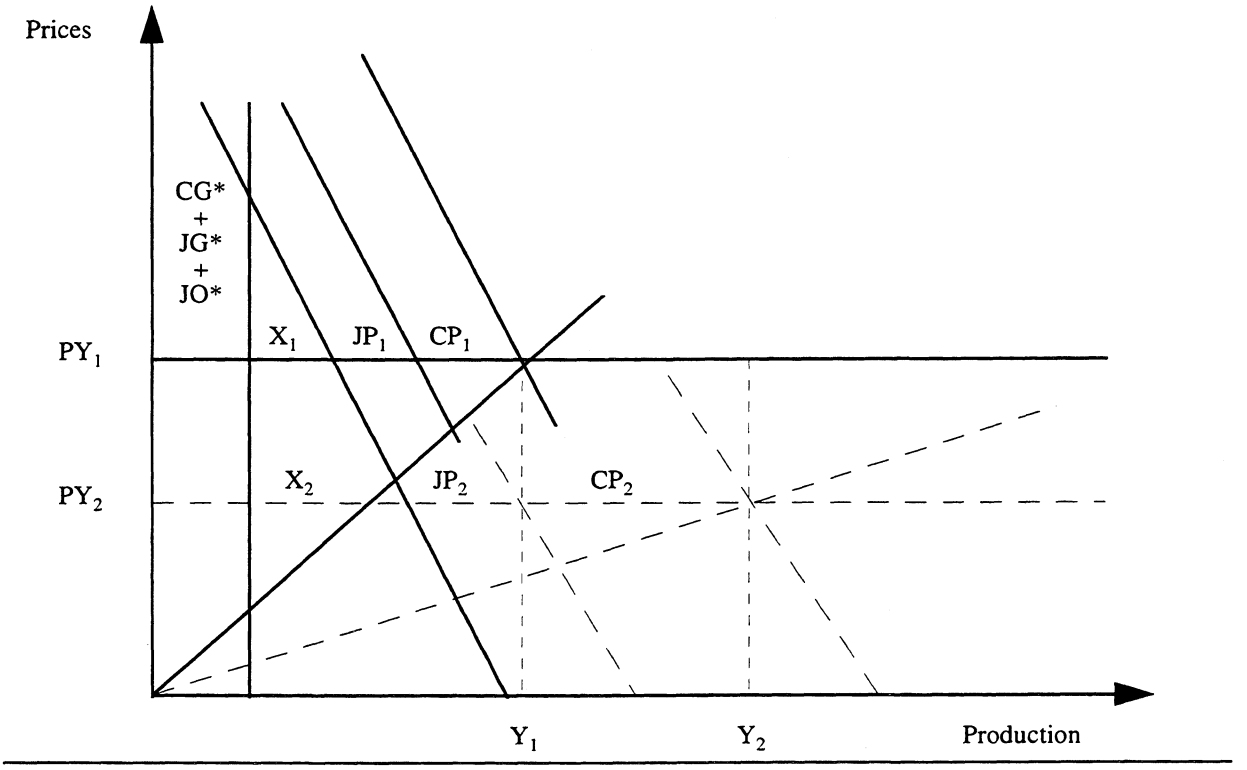


Figure 4-4 illustrates the effects of reduced user costs of capital in a factor diagram. The initial solution is where the isoquant Y=f(E*,K) is tangent to the budget line between the two points C^0/PK and C^0/W. The slope of the budget line is given by the negative of the wage rate - user cost ratio, -W/PK, so reduced user costs of capital will steepen the budget line, rotating the line in the point C^0/W. The output expansion line S shows all points of tangency between isoquant curves and budget lines in the initial situation. The new expansion line is S'. The assumptions of Cobb-Douglas production functions (implying constant budget shares) and exogenous employment and wages,

implies that total costs are fixed. The new budget line is given by the line between C^0/PK' and C^0/W, where the use of capital and consequently output has increased. In the model the effects will vary between sectors, depending on the input structure and the importance of imports.

Figure 4-5 Reduced user costs of capital (2)



In Figure 4-5 we once more illustrate the effects from reduced user costs of capital in a price - production diagram. The upward sloping lines going through the origin represent the marginal cost curves when labour is fixed. In this situation, marginal cost is increasing and marginal productivity decreasing. The horisontal lines PY_1 and PY_2 show the marginal cost lines when both labour and capital are flexible, and will determine the producer price. Reduced user costs of capital will reduce marginal costs and consequently the output price. This is indicated by the shift from PY_1 to PY_2, or by the shift from the solid line to the dotted line going through the origin. Exports and private investments are dependent on output price, hence they will both increase. Total supply will increase more than the sum of exports and private investments, allowing private consumption to increase as well.

Figure 4-6 Reduced labour supply

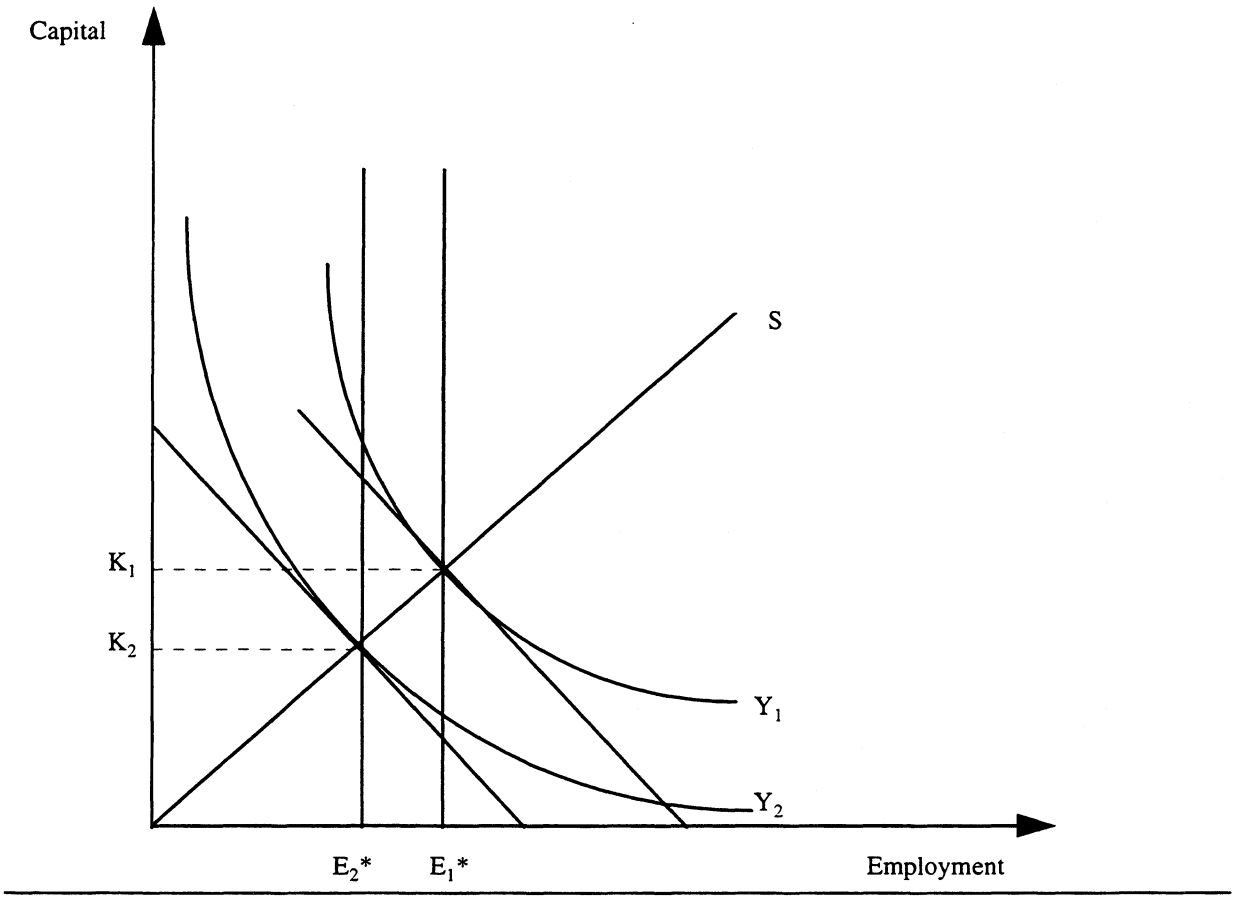


Figure 4-6 illustrates the effects of reduced labour supply. Since the capital-labour ratio is independent of total output, the output expansion line S will be a straight line through the origin. Optimal input combinations must lie on this line, implying that a reduction in employment from E_1* to E_2* will reduce the use of capital from K_1 to K_2 and consequently output from Y_1 to Y_2.

Figure 4-7 Reduced labour supply and increased nominal wage rate (1)

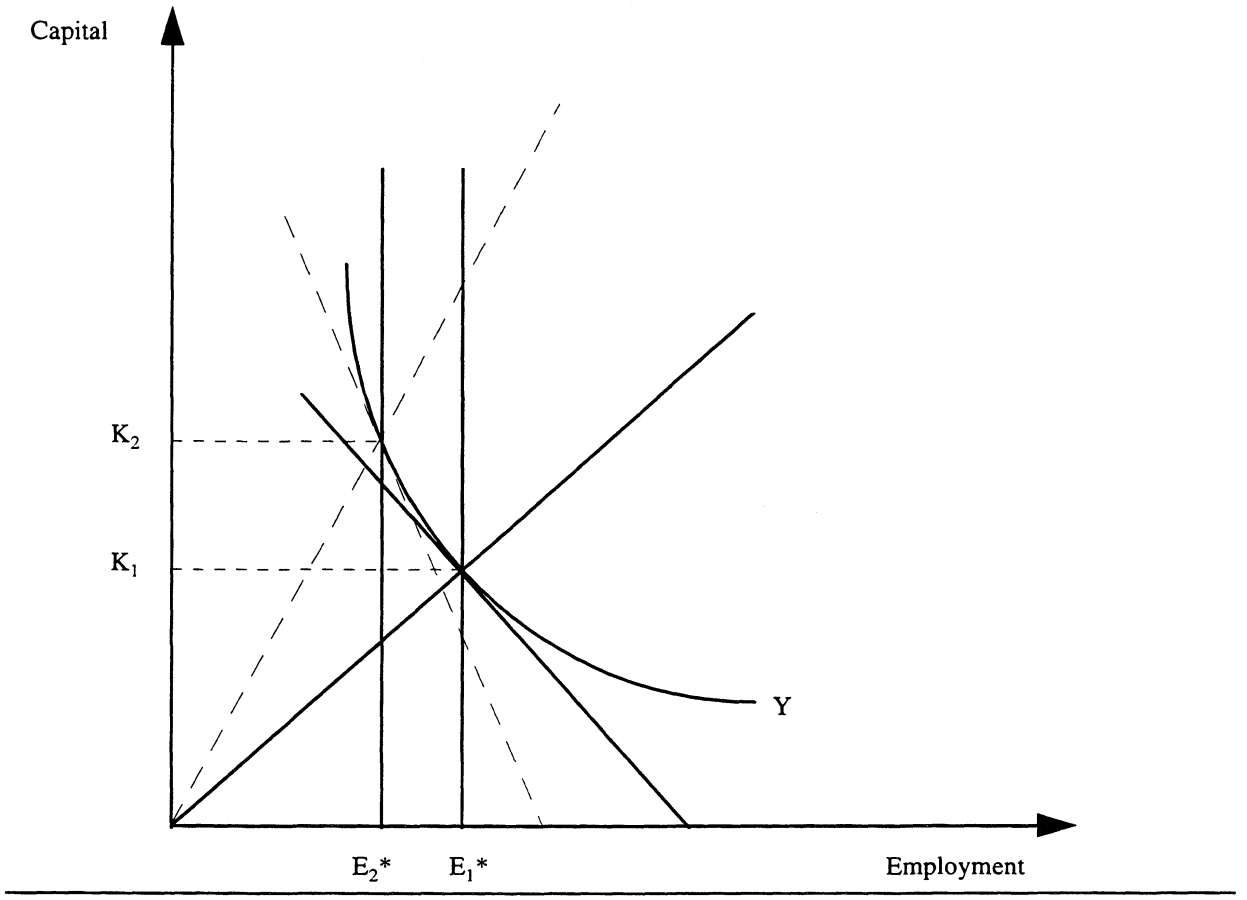
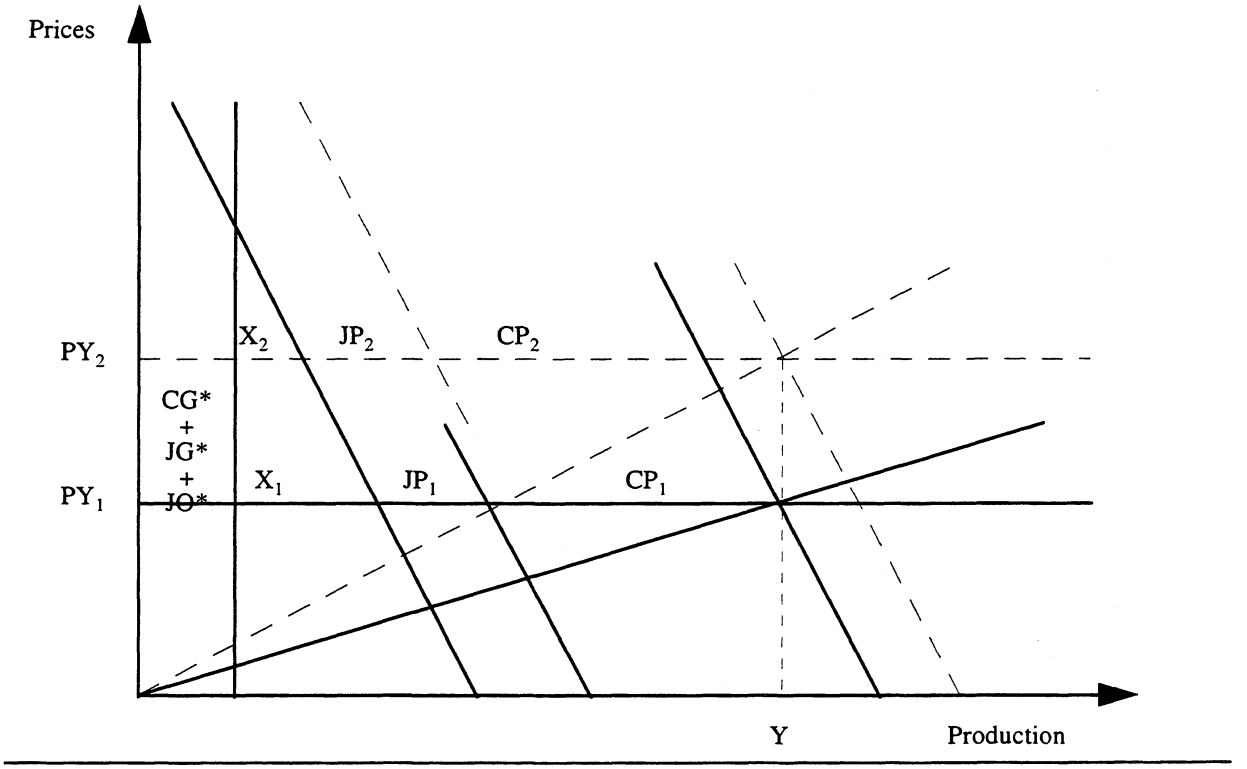


Figure 4-7 illustrates a situation where the labour supply is reduced. In addition we assume an increase in the nominal wage rate, sufficient to keep the production level constant. The initial production level is on the isoquant Y, determined by the point of tangency between the solid budget line and the isoquant Y. To produce this quantity the use of labour and capital is E_1* and K_1 respectively. Increased nominal wages will steepen the budget line, from the solid line to the dotted line, reducing the use of labour from E_1* to E_2* and increasing the use of capital from K_1 to K_2. Total costs have increased, implying increased unit costs (marginal/average). The output expansion line will shift upward, implying more capital intensive production for all output levels.

Figure 4-8 Reduced labour supply and increased nominal wage rate (2)



In Figure 4-8 labour supply is reduced while the nominal wage rate is increased. Output is assumed fixed. This will increase the marginal costs and the output price from PY_1 to PY_2, indicated by an upward shift in the marginal cost curve. Higher price will worsen competitiveness and thereby reduce exports. After an initial jump to attain the higher level on the capital stock, investments adjust to the new level of depreciation. The effect on private consumption depends on the net effect of higher investments and lower exports. If the sum of exports and investments in the new situation exceeds the initial level, private consumption will decline.

5. Effects of joining the WTO

5.1. Introduction

In a highly simultaneous model like the Selection Model it is important to perform multiplier analyses to study the properties of the model. This is typically done by changing exogenous variables relative to a reference scenario and comparing the results from the two simulations. In this section we will however, take it a little bit further and demonstrate how the model can be used as a tool in analysing an issue of current interest; the effect on the Saudi economy of joining the WTO (World Trade Organisation). Saudi Arabia is among the countries currently considering membership in WTO.

A membership in the WTO will generally involve open trade, free markets and deregulations. In this illustration of the use of the model we will assess the impact on the Saudi economy resulting from four different effects of membership. The four channels of effects may depend on whether the effects

Table 5-1 Four alternative channels of effects from joining the WTO

	Tariff barriers	*Non-tariff barriers*
Domestic markets	Reduced tariffs of imported goods WTO-1	Reduced producer subsidies WTO-3
International markets	Reduced tariffs on Saudi exports WTO-2	Increased access to foreign markets WTO-4

come through domestic or international markets, and whether the effects result from reduced tariffs or non-tariff barriers. Table 5-1 lists the four combined effects.

The first effect comes through lower import duties in Saudi Arabia. In the Selection Model there is an indicator of import duties that can be reduced in order to simulate possible effects of lower import duties. This scenario will be referred to as WTO-1. The second effect comes via similar reductions in import duties in countries receiving exports from Saudi Arabia. This scenario will be referred to as WTO-2. The third scenario analyses effects of removing some non-tariff barriers in the Saudi economy. In principle one could look at many possible non-tariff barriers. We shall however focus on producer subsidies. Goods that are banned and consequently not imported into the Kingdom, are not effected by a decision to join the WTO. Also there are few consumer price subsidies in the economy so we focus entirely on lower producer subsidies in this scenario, called WTO-3. Finally, in the fourth scenario, referred to as WTO-4, we assume that Saudi non-oil related exports gain access to new international markets that until now have been limited by non-tariff barriers.

5.2. The reference scenario

The reference scenario should be viewed as a «high growth scenario». The main assumptions underlying this growth is associated with the population growth rate, the participation rate of labour and the real rate of return of capital. Another important source of growth is the total factor productivity, which is assumed to grow by 2 per cent annually. The population growth rate is assumed to be 3.9 per cent while the participation rate for Saudi labour is growing by 1.1 per cent in the periode 1996 - 2005, after this it is assumed to grow at 0.4 per cent annually. This may be unrealistic seeing that the participation rate of the population in the labour market is a sluggish variable which changes slowly. Non-Saudi employment has a negative growth of 1.5 per cent until 1999, then held at a constant level. Other important exogenous assumptions are government consumption and wage rates in both private and government sectors, all of them assumed to grow at an annual rate of 3 per cent. Further we have assumed 1 per cent annual growth in import price, while GDP in the oil and gas sector is assumed to grow at 7 per cent in 1998, thereafter at 4 per cent.

The Saudi currency is pegged to the dollar so that the exchange rate and the oil price, which is measured in dollars, is of great importance for the Saudi economy. Since 1987 the official exchange rate against the dollar has been constant at 3.745 Saudi Riyals buying 1 dollar (IMF, 1996). The export price of oil is assumed to drop 17 per cent in 1998 from the previous year, while in 1999 it is assumed to recover, increasing by 24 per cent. In 2000 and 2001 the growth rate is assumed to be 8 and 4 per cent, respectively, after this 3 per cent.

The main results from the reference scenario are shown in Table 5-2. We notice the high and stable growth in GDP, the rise in private sector being steeper than the total. Total supply to the economy, measured as the volume of GDP and imports, has an average annual growth rate at 4.4 per cent over the periode 1998 to 2005. Private investments is affected by the needs for a higher capital stock to comply with the increase in demand. The steep rise in 2000 is, in addition to the general need for a higher capital stock, caused by a drop in the real rate of return of capital making the use of capital more profitable by reducing its user costs. From the table we see that this scenario makes considerable room for private consumption, growing at an annual rate of more than 5 per cent after 2000.

These assumptions contribute to reversing the current account balance from a deficit, constituting 9.2 per cent of current GDP in 1998, into a 2 per cent surplus in 1999, increasing to 10 per cent of current

Table 5-2 Main variables in the reference scenario

	1998	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	***2010***	***2015***	***2020***
Per cent annual growth											
GDP	4.0	3.8	4.7	4.6	4.7	4.7	4.8	4.9	4.6	4.8	5.0
GDP private sector	3.6	3.5	6.2	6.1	6.1	6.1	6.2	6.3	5.6	5.9	6.1
Imports	10.3	-0.2	6.9	5.5	3.7	3.0	3.2	3.7	3.9	4.2	4.6
Private consumption	7.3	2.6	3.7	5.0	5.1	5.0	5.1	5.3	5.4	5.7	6.1
Private investments	10.9	1.0	19.8	11.1	6.8	5.9	6.1	7.0	5.1	5.4	5.5
Capital stock, private	2.5	2.3	3.8	4.4	4.6	4.6	4.7	4.9	4.1	4.4	4.6
Exports	5.5	5.2	4.2	4.0	4.0	4.1	4.1	4.2	4.0	4.1	4.2
Non-oil exports	8.8	7.5	7.4	7.5	7.7	7.9	8.0	8.0	5.2	5.1	5.1
Deflator, private consumption	0.2	0.7	0.3	0.1	0.0	-0.1	-0.1	-0.1	0.3	0.3	0.4
Per cent of current GDP											
Current account balance	-9.2	2.0	4.4	5.6	7.0	8.5	10.0	11.3	17.8	22.5	26.6
Government budget surplus	-10.0	-6.2	-1.5	0.6	1.8	2.8	3.9	4.9	10.4	16.0	21.8
Priv. sect. net. fin. investment	0.8	8.1	5.9	5.1	5.2	5.7	6.1	6.3	7.5	6.5	4.7
Private savings	16.1	20.6	19.6	19.3	19.4	19.8	20.1	20.3	19.3	17.3	14.3
Government savings	-3.1	-0.1	4.3	6.1	7.1	8.0	8.9	9.8	14.5	19.5	24.8
Net foreign assets	-17.3	-13.3	-7.9	-1.8	5.3	13.5	22.7	32.7	93.7	161.4	229.0

GDP in 2004. This rapid improvement in the the current accounts results from improvements in both the private sectors net financial investments and in the government budget. The SR 53 billions government budget deficit in 1998, constituting 10 per cent of current GDP, is turned into a SR 4 billions surplus in 2001. This improvement is explained by strong growth in the oil revenues, growing at more than 15 per cent on average over the years 1999-01, then growing at 8 per cent. The increase in private savings is reflecting the increase in fixed and financial net investments.

5.3. WTO-1. Effects of reduced Saudi import duties

In this first scenario we analyse the effects on the Saudi economy from reducing all import duties by 50 per cent from 1998 compared to the assumed levels in the reference scenario for the Saudi economy. Since a membership in the WTO probably will affect the various import duties in specific ways our scenario should be viewed as a qualitative indication of the effects. Changes in the import duties are implemented by altering their price indices. This variable is multiplied by all base year

import duty levels so that they change by the same per cent keeping their base year relative levels constant. The import price excludes duties and consequently is not influenced, however, the «import» prices faced by the Saudi buyers, the final demand prices, will of course be affected . The aggregate import share is price elastic. One per cent increase in relative prices will reduce the import share with 0.69 per cent in the long run. Since imported goods have become cheaper the import share will increase resulting in increased total supply. The resulting increase in import share is 1.3 per cent, while the impact on total supply, imports plus GDP, is 0.66 per cent in the short run and 0.37 in the long run.

The macroeconomic results are shown in Table 5-3. The increase in supply will allow for more private consumption, and this in turn will motivate the domestic industries to invest in order to build up their capital stock to enable higher output. When the new capital stock is installed, lower import duties allow for permanently higher consumption.

Reduced import duties will of course lead to lower consumer prices as most import duties are levied on consumer goods. The immediate increase in import volume is 2.4 per cent, the long run effect reaching 1.6 per cent at the end of the simulation periode. The change amounts to SR 5.1 billions in the first year. The increase in imports will reduce the surplus on the trade balance and the current account balance which in turn will feed into lower net foreign assets for the economy as a whole. In 1998 the current account deficit increases from 9.2 per cent of nominal GDP in the reference scenario to 10.2 per cent. In 2005, now a surplus, the corresponding figures are 11.3 and 10.7 per cent of nominal GDP. However, it should be notified that the main reason for the considerable deficit in 1998 is a sharp decrease in government revenues from the oil sector, down 6.6 per cent from the previous year. A relative small part of the SR 36 billion reduction in foreign assets in 2005 is used for financing higher investments. In fact, the increase in the private sector capital stock is merely SR 5 billions, or 0.5 per cent.

Table 5-3 Main results from WTO-1. Deviation from reference scenario

	1998	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	***2010***	***2015***	***2020***
Per cent deviation											
GDP	0.07	0.05	0.05	0.05	0.04	0.04	0.03	0.03	0.04	0.03	0.03
GDP private sector	0.22	0.17	0.14	0.13	0.12	0.11	0.10	0.10	0.09	0.07	0.05
Imports	2.43	1.82	1.56	1.61	1.71	1.76	1.77	1.76	1.71	1.65	1.60
Private consumption	0.80	0.98	1.03	1.12	1.18	1.21	1.19	1.17	1.05	0.95	0.86
Private investments	3.88	1.58	0.76	0.58	0.53	0.48	0.45	0.44	0.43	0.40	0.36
Capital stock, private	0.36	0.48	0.51	0.52	0.53	0.53	0.52	0.52	0.52	0.51	0.49
Exports	0.00	-0.02	-0.02	-0.03	-0.03	-0.04	-0.04	-0.05	-0.06	-0.07	-0.08
Non-oil exports	-0.11	-0.14	-0.15	-0.17	-0.21	-0.25	-0.29	-0.33	-0.45	-0.55	-0.65
Deflator, private consumption	-1.01	-1.05	-1.07	-1.07	-1.07	-1.08	-1.10	-1.11	-1.19	-1.25	-1.31
Absolute deviation (SR mill.)											
Current account balance	-5071	-3882	-3634	-4002	-4453	-4767	-4988	-5203	-6252	-7833	-9913
Government budget surplus	-3955	-3888	-4147	-4383	-4619	-4881	-5172	-5487	-7357	-10006	-13879
Priv. sect. net. fin. investment	-1116	5	513	381	166	114	184	284	1105	2173	3967
Private savings	1188	509	488	274	62	13	100	236	1251	2609	4772
Government savings	-3918	-3860	-4121	-4349	-4575	-4827	-5111	-5419	-7258	-9868	-13696
Net foreign assets	-5071	-8953	-12587	-16589	-21042	-25809	-30797	-36000	-64913	-100761	-145928

The effects in 1998 on net foreign assets is an increased deficit, from 17.3 to 18.4 per cent of nominal GDP. In 2005 net foreign assets decreased from 32.7 to to 28.8 per cent of nominal GDP surplus.

5.4. WTO-2. Effects of reduced tariffs on Saudi exports

Membership in the WTO is not merely a question of easy access to the Saudi market by foreigners. Such an agreement is give and take on both sides, providing easier access to foreign markets for Saudi exporters. In 1995 crude oil exports constituted 69 per cent of total export volume. Petrochemicals and non-oil exports both constituted around 5 per cent, while refined products constituted 13 per cent (the remaining 8 per cent was non-resident consumption, defined as exports in the National Accounts).

We assume Saudi export of petrochemicals are met with tariff barriers abroad. Based on this assumption the price faced by the buyers in these countries includes a (protective) duty and consequently is higher than the price obtained by Saudi Arabian exporters. In this part we will analyse the effects of a reduction in customs tariffs facing this Saudi exports. Further we assume the wedge between the price obtained by Saudi Arabian exporters and the export price is reduced by increasing the former by 10 per cent. The interpretation is that some of the income from customs duty now falls to the exporters rather than to the authorities of the destinating countries.

We also assume an increase in non-oil export volume. Reduced tariffs abroad will also improve the competitiveness of Saudi non-oil exports. In the equation for non-oil exports the relative price term is PM/PXX, the ratio of import price to non-oil export price. The intention is that import price to Saudi Arabia is an useful indicator for the competitiveness abroad. Import price competition implies higher

Table 5-4 Main results from WTO-2. Deviation from reference scenario

	1998	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	***2010***	***2015***	***2020***
Per cent deviation											
GDP	0.13	0.16	0.17	0.18	0.19	0.20	0.21	0.22	0.26	0.29	0.31
GDP private sector	0.34	0.41	0.43	0.45	0.47	0.49	0.51	0.52	0.59	0.62	0.63
Imports	0.68	0.91	0.93	0.87	0.84	0.86	0.90	0.95	1.16	1.42	1.73
Private consumption	-0.38	-0.45	-0.44	-0.46	-0.49	-0.50	-0.51	-0.51	-0.43	-0.31	-0.17
Private investments	1.42	1.41	0.94	0.66	0.56	0.53	0.52	0.50	0.40	0.31	0.19
Capital stock, private	0.13	0.24	0.31	0.35	0.37	0.38	0.40	0.41	0.41	0.35	0.26
Exports	0.80	1.07	1.22	1.31	1.39	1.45	1.51	1.58	1.81	2.00	2.21
Non-oil exports	9.39	13.45	15.15	15.85	16.14	16.25	16.28	16.28	16.17	15.99	15.73
Deflator, private consumption	0.02	0.03	0.03	0.03	0.03	0.03	0.04	0.05	0.09	0.15	0.23
Export of petrochemicals	9.11	9.19	9.25	9.31	9.37	9.42	9.46	9.50	9.67	9.78	9.86
Export of oil and gas	-0.41	-0.45	-0.48	-0.51	-0.55	-0.58	-0.62	-0.66	-0.90	-1.21	-1.63
GDP Petrochemicals	9.17	9.23	9.29	9.35	9.40	9.45	9.49	9.53	9.69	9.79	9.86
Deflator, exports of petroch.	4.44	3.97	3.83	3.79	3.77	3.74	3.72	3.70	3.59	3.48	3.37
Productivity, private sector	0.33	0.40	0.42	0.44	0.46	0.48	0.50	0.51	0.57	0.60	0.60
Absolute deviation (SR mill.)											
Current account balance	1852	2453	3007	3647	4242	4758	5250	5767	9138	14212	22555
Government budget surplus	38	628	746	822	898	994	1107	1233	2094	3540	6014
Priv. sect. net. fin. investment	1815	1825	2260	2825	3344	3765	4143	4534	7044	10673	16541
Private savings	2292	2153	2239	2487	2803	3084	3330	3576	4861	6449	8670
Government savings	48	643	763	838	916	1014	1130	1261	2149	3645	6203
Net foreign assets	1852	4305	7312	10959	15200	19959	25209	30976	69463	129405	223811

foreign prices, or increased PM in this equation. Since PM is the import price to Saudi Arabia, and we do not want to affect the final demand prices, we have manipulated the error term of the export equation in order to simulate more competitive exports from Saudi Arabia. The results are presented in Table 5-4.

The direct effect is an increase in both exports of petrochemicals and non-oil products with approximately 9 per cent. This increase amounts to about SR 2.5 and 1.4 billions respectively. Since exports of petrochemicals is supplied almost entirely (99.6 per cent) from the industries Petrochemicals and Oil and gas, and since production in the latter sector is fixed, the increase has to come from increased production in the petrochemical sector and reduced exports in the oil and gas sector. To achieve this expansion there has to be an increase in the factors of production. Investment in the petrochemical sector is exogenous so the rise in production has to come from increase in labour, which is increased by 19 per cent. From the table we see that the increase in production is about 9 per cent, and the reduction in oil export 0.4 per cent in the short run and 1.6 per cent in the long run. In magnitude, the contribution to the increase in petrochemical exports is SR 0.68 billions resulting from reduced oil exports, and SR 1.2 billions from increased petrochemical production. Note also the increase in productivity in the private sector, resulting from an initial SR 0.74 billion increase in value added in the private sector while private sector employment is almost unchanged.

From the table it is evident that reduced tariffs on Saudi exports is favourable for the current account surplus accumulating into enormous net financial assets. In 1998 the current acount balance increase from a deficit of 9.2 per cent of nominal GDP in the reference scenario, to a deficit of 8.8 per cent. In 2005 the corresponding results are 11.3 and 11.9 per cent deficit of nominal GDP. Also private sector net financial investments and private savings is higher in this scenario.

5.5. WTO-3. Effects from reduced producer subsidies

Since the early 1970s when the Saudi government introduced a comprehensive welfare system, the country's population have been able to buy electricity and water at highly subsidised rates. In the period following the Gulf crisis costs of electricity and water was cut to reduce the burden of the living cost of the Saudi population. In the budget for 1995 though, the government undertook a quite comprehensive revision of the prices charged for these utilities and services, resulting in, among other things, that prices for water and electricity were raised.

Open markets and free trade may involve subsidies coming to an end, or at least reduced drastically. In Saudi Arabia the industries most heavily subsidized by the government are Agriculture, forestry and fishing and Electricity, gas and water. In this section we will analyse the effects on the economy from removing subsidies in these two sectors. The results are presented in Table 5-5. The prices in the two sectors of interest includes net indirect taxes, in such a way that removing the subsidies will immediately lead to a steep rise in prices. The prices in the Agriculture sector and the Electricity sector increases with 9 respective 36 per cent from the reference scenario. Higher prices on agricultural products will increase the consumer prices for food, from Table 5-5 we see that the price index has increased by almost 3.3 per cent. Even though total consumption has increased, demand for food is down almost 0.4 per cent (SR 0.58 billions) the first year.

Out of the modest increase in total supply, reaching almost SR 1.9 billions, import constituted SR 2.7 billions and GDP SR -0.8 billions. On the demand side private consumption has increased with 1 per cent (SR 2.3 billions) while investments have been reduced with SR 0.4. billions.

Lower demand for agricultural products lead to a small decline in production volume, outweighed by the increase in value. The volume is down 1.4 per cent in the long run while the value has increased by nearly 7.6 per cent, or SR 6.4 billions. Adjustment to the new production level is done by reducing the capital stock and the use of labour. The adjustment of the capital stock is instantaneous by disinvestments in the first year. The immediate decrease in the use of labour in the agriculture sector is 0.77 per cent, while the long term use of labour is 1.23 per cent less than in the reference scenario.

The increase in net imports causes the current account balance to decrease with SR 3,2 billions the first year, from a 9.2 per cent of nominal GDP deficit to 9.8 per cent. From 1999 onwards the current

account shows a surplus in both scenarios, the larger in the reference scenario. As share of nominal GDP this is virtually unchanged; between 0.3 percentage point difference in 1999, reaching maximum deviation of 0.5 percentage points in 2002/2003.

The improvement in the government budget is small relative to the magnitude of the surplus. The surplus consistute 22 per cent of nominal GDP in 2020.

Table 5-5 Main results from WTO-3. Deviation from reference scenario

	1998	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	***2010***	***2015***	***2020***
Per cent deviation											
GDP	-0.16	-0.14	-0.14	-0.16	-0.17	-0.18	-0.18	-0.19	-0.22	-0.25	-0.29
GDP private sector	-0.29	-0.27	-0.28	-0.30	-0.32	-0.33	-0.34	-0.35	-0.40	-0.45	-0.49
Imports	1.57	0.95	1.05	1.27	1.36	1.35	1.31	1.28	1.24	1.22	1.22
Private consumption	1.01	0.57	0.60	0.73	0.78	0.77	0.72	0.68	0.54	0.46	0.40
Private investments	-0.58	-0.59	-0.33	-0.26	-0.31	-0.38	-0.42	-0.43	-0.49	-0.57	-0.66
Capital stock, private	-0.05	-0.09	-0.11	-0.12	-0.14	-0.16	-0.18	-0.21	-0.30	-0.40	-0.50
Exports	-0.03	-0.03	-0.03	-0.04	-0.05	-0.05	-0.05	-0.06	-0.07	-0.08	-0.09
Non-oil exports	-0.13	-0.18	-0.21	-0.26	-0.31	-0.35	-0.39	-0.41	-0.52	-0.63	-0.73
Deflator, private consumption	1.37	1.33	1.33	1.34	1.36	1.36	1.37	1.37	1.40	1.44	1.50
Deflator, Priv. cons. food	3.27	3.25	3.24	3.25	3.26	3.28	3.29	3.30	3.34	3.34	3.34
Investments, agriculture	-10.07	-1.89	-1.13	-0.97	-1.10	-1.26	-1.35	-1.38	-1.52	-1.61	-1.65
Value added price, agriculture	9.04	9.01	9.03	9.05	9.06	9.07	9.07	9.08	9.11	9.13	9.16
Value added price, electricity	35.60	35.26	35.26	35.34	35.37	35.32	35.26	35.20	34.93	34.68	34.40
Absolute deviation (SR mill.)											
Current account balance	-3235	-1976	-2377	-3073	-3453	-3563	-3609	-3692	-4443	-5663	-7522
Government budget surplus	3613	3412	3516	3692	3862	4017	4178	4351	5541	7275	9897
Priv. sect. net. fin. investment	-6848	-5388	-5894	-6766	-7315	-7581	-7788	-8042	-9984	-12939	-17419
Private savings	-7023	-5605	-5920	-6709	-7299	-7631	-7885	-8160	-10179	-13317	-18076
Government savings	3665	3451	3563	3751	3932	4095	4262	4440	5666	7444	10122
Net foreign assets	-3235	-5211	-7588	-10662	-14115	-17678	-21287	-24979	-45521	-71216	-104778

5.6. WTO-4. Effects of market growth

In this section we analyse the effects from increased access to export markets for non-oil products. Saudi export market growth could result from various reasons, for instance increased import quotas or a general improvement in trade, in receiving countries. In this analysis we increase the market indicator for exports with 10 per cent in 1998. Non-oil exports being such a minor component of final demand, with an average share of GDP of 1.4 per cent in 1984-94, it is not surprisingly with this small effects. First, we notice there is no effect the first year. This is because the market indicator for Saudi exports is lagged one year, assuming a fluctuations in trading partners income will affect demand for Saudi exports only after one year. From Table 5-6 we see the impact is 5.8 per cent for non-oil exports, while the long-term elasticity is restricted to equal 1 with respect to the market indicator, so that the 10 per cent increase in the market indicator leads to a permanent 10 per cent higher level in non-oil related exports.

From the input-output table we know that the main supplier of non-oil exports is the sectors Finance and insurance and Imputed bank charges. From Table 5-6 we see that output volumes increase and that the annual growth rates stabilize at nearly 5 per cent. The finance sector is not labour intensive, the elasticity with respect to output being 0.15. To achieve the expansion in production investments is increased by 24 per cent the first year, gradually declining to 5 per cent annual growth, to add to the capital stock. Labour is increased by 2.6 per cent the first year, and 5.1 per cent in the long run.

With regard to the current account balance and the government budget there are relatively small deviations from the reference scenario. In both scenarios the 9 per cent deficit of nominal GDP in the current account balance is turned into a 2 per cent surplus in 1999, growing to more than 25 per cent. We see from the table that the moderate improvement of the current account balance will accumulate into considerable net foreign assets.

Table 5-6 Main results from WTO-4. Deviation from reference scenario

	1998	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	***2010***	***2015***	***2020***
Per cent deviation											
GDP	0	0.04	0.05	0.05	0.06	0.07	0.07	0.08	0.09	0.11	0.12
GDP private sector	0	0.10	0.13	0.14	0.15	0.17	0.18	0.18	0.21	0.22	0.23
Imports	0	0.24	0.43	0.40	0.32	0.28	0.27	0.27	0.27	0.26	0.26
Private consumption	0	-0.37	-0.36	-0.37	-0.41	-0.45	-0.46	-0.47	-0.47	-0.45	-0.42
Private investments	0	0.95	0.81	0.56	0.42	0.38	0.36	0.35	0.31	0.30	0.29
Capital stock, private	0	0.09	0.16	0.21	0.23	0.25	0.27	0.28	0.31	0.32	0.32
Exports	0	0.36	0.53	0.61	0.66	0.70	0.73	0.76	0.84	0.88	0.92
Non-oil exports	0	5.80	8.26	9.27	9.70	9.88	9.96	10.00	10.03	10.04	10.05
Deflator, private consumption	0	0.00	0.01	0.01	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.02
Value added, finance	0	2.55	3.50	3.93	4.19	4.36	4.48	4.56	4.83	4.91	4.96
Value added, Imputed bank charges	0	2.48	3.41	3.84	4.10	4.27	4.39	4.49	4.76	4.86	4.93
Absolute deviation (SR mill.)											
Current account balance	0	500	550	840	1205	1475	1650	1787	2451	3148	4022
Government budget surplus	0	-16	102	130	125	122	127	135	173	207	247
Priv. sect. net. fin. investment	0	516	448	710	1080	1353	1523	1652	2278	2941	3774
Private savings	0	1214	1144	1209	1449	1676	1840	1976	2578	3304	4224
Government savings	0	-14	107	135	127	122	126	134	169	200	237
Net foreign assets	0	500	1049	1889	3095	4570	6220	8006	18947	33243	51522

6. Concluding remarks

Since the Selection Model was first developed, there has been some improvements in the data quality. However, the lack of actual time series data for capital, investments and labour by producing sector is still a major obstruction for improving the model, especially the production functions and the demand functions for labour and capital.

The labour market as specified in the current version of the model is problematic. If more information on employment and wages by Saudis and non-Saudis were available, an assumption of imperfect substitutability between different groups of labour could have been implemented. A more reasonable assumption would then be to consider the wage rate of immigrants as given in the world market while the wage rate for Saudis to be determined in the domestic labour market. In future work and extensions of the Selection Model the introduction of different kinds of labour would make the model both more realistic as well as more suitable for analysing an important aspect of Saudi economic policy, that of Saudiization; the replacement of foreign labour with domestic supply. Some promising work in this area has not yet been implemented into the model. Providing the necessary information for installing this new labour module is essential for improving the model.

The input-output structure of the model is based on an old Ministry of Planning study (Coopers & Lybrand, 1981) not adequate for the prevailing relations in the Saudi economy. To get full value out of the model, this suggest a new input-output table should be calculated.

The budget relationships in the model has been examined and redefined. However, in the capacity of being a medium to long term model of the Saudi economy, aiming at evaluating the sustainability of the government policy etc., the development of financial assets is important. In order to include such variables figures for public debt and foreign assets must be obtained, at least for the base year. Financial assets of the private sector would also contribute to enhance the use of the model.

The variable representing demand by the government sector is a very broad outline of the variety of the expenditure side. It would improve the model if government consumption could be divided into labour costs and demand for intermediate goods and services. This extension will require an adjustment of the input-output table of the model.

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List of variables

The variable list includes the variables in the model as well as variables used in the data generation. In general, a variable whose first letter is a «P» is a price index. If the first letter is a «V» the variable is in current prices. A residual has a «R» as its first letter. If the first letter in nono of these, tha variable is measured in constant prices. Following the «P», «V» or «R» is the name code of the variable. For example; YAG is GDP in the «Agriculture, forestry and fishing» sector, measured in constant prices. VYAG is the same variable measured in current prices, and PYAG is the corresponding price index. RYAG is the residual term for YAG.

A.1. Variables in constant prices

A.1.1 GDP by economic activity

- Private, non-oil sector	YP
- Agriculture, forestry and fishing	YAG
- Other mining, quarrying	YMI
- Petrochemicals	YPS
- Other manufacturing	YMA
- Electricity, gas and water	YEW
- Construction	YCN
- Wholesale and retail trade	YTD
- Transport and communication	YTC
- Finance, insurance, real estate	YFR
- Real estate	YRE
- Finance, insurance	YFI
- Community services	YCS
- Imputed bank charges	YBC
- Government sector	YG
- Government services	YGS
- Oil sectors	YO
- Crude oil and natural gas	YOG
- Petroleum refining	YPR
- Import duties	YID
- GDP	Y

A.1.2 GFCF by sector and type of capital

- Private, non-oil sector	JP
- Agriculture, forestry and fishing	JAG
- Other mining, quarrying	JMI
- Petrochemicals	JPS
- Other manufacturing	JMA
- Electricity, gas and water	JEW
- Construction	JCN
- Wholesale and retail trade	JTD
- Transport and communication	JTC
- Real estate	JRE
- Finance, insurance	JFI
- Community services	JCS
- Private non-oil, residential building	JPH
- Private non-oil, non-residential building	JPB
- Private non-oil, transport and machinery equipment	JPTM

- Government sector	JG
- Government investment, non-residential building	JGB
- Government investment, transport and machinery equipment	JGTM
- Oil sectors	JO
- Oil sectors, non-residential building	JOB
- Oil sectors, transport and machinery equipment	JOTM
- Crude oil and natural gas	JOG
- Crude oil and natural gas, non-residential building	JOGB
- Crude oil and natural gas, transport and machinery equipment	JOGTM
- Petroleum refining	JPR
- Petroleum refining, non-residential building	JPRB
- Petroleum refining, transport and machinery equipment	JPRTM
- GFCF, total	J

A.1.3 Capital stock by sector

- Private, non-oil sector	KP
- Agriculture, forestry and fishing	KAG
- Other mining, quarrying	KMI
- Petrochemicals	KPS
- Other manufacturing	KMA
- Electricity, gas and water	KEW
- Construction	KCN
- Wholesale and retail trade	KTD
- Transport and communication	KTC
- Real estate	KRE
- Finance, insurance	KFI
- Community services	KCS
- Crude oil and natural gas	KOG
- Petroleum refining	KPR

A.1.4 Private consumption by object of expenditure

- Food, beverage, tobacco	CPFOO
- Clothing and footwear	CPCLO
- Rent, fuel and power	CPREN
- Furniture and household equipment	CPFUR
- Medical health care	CPMED
- Transport and communication	CPTRA
- Entertainment and education	CPENT
- Other goods and services	CPOTH
- Non-resident direct purchase	CPN
- Resident direct purchase abroad	CPABR
- Private final consumption	CP

A.1.5 Private resident consumption by object of expenditure

- Food, beverage, tobacco	CPRFOO
- Clothing and footwear	CPRCLO
- Rent, fuel and power	CPRREN
- Furniture and household equipment	CPRFUR
- Medical health care	CPRMED
- Transport and communication	CPRTRA
- Entertainment and education	CPRENT
- Other goods and services	CPROTH
- Resident direct purchase abroad	CPRABR
- Resident, total	CPR

A.1.6 GDP by type of expenditure n.e.s

- Imports of goods and services	M
- Import share	MS
- Exports of goods and services	X
- Exports of oil and gas	XOG
- Exports of refined products	XPR
- Exports of petrochemicals	XPS
- Exports of goods and services, less export of oil and gas, refined products, petrochemicals and non-resident direct purchase	XX
- Government final consumption	CG
- Increase in stocks	DS
- Domestic absorption	DA

A.2. Variables in current prices

A.2.1 Value of GDP by economic activity

- Private non-oil sector	VYP
- Agriculture, forestry and fishing	VYAG
- Other mining, quarrying	VYMI
- Petrochemicals	VYPS
- Other manufacturing	VYMA
- Electricity, gas and water	VYEW
- Construction	VYCN
- Wholesale and retail trade	VYTD
- Transport and communication	VYTC
- Finance, insurance, real estate	VYFR
- Real estate	VYRE
- Finance, insurance	VYFI
- Community services	VYCS
- Imputed bank charges	VYBC
- Government sector	VYG
- Government services	VYGS
- Oil sector	VYO
- Crude oil and natural gas	VYOG
- Petroleum refining	VYPR
- Import duties	VYID
- GDP	VY

A.2.2 Operating surplus by economic activity

- Gross operating surplus, private non-oil sector	VYSP
- Agriculture, forestry and fishing	VYSAG
- Other mining, quarrying	VYSMI
- Petrochemicals	VYSPS
- Other manufacturing	VYSMA
- Electricity, gas and water	VYSEW
- Construction	VYSCN
- Wholesale and retail trade	VYSTD
- Transport and communication	VYSTC
- Finance, insurance, real estate	VYSFR
- Real estate	VYSRE
- Finance, insurance	VYSFI
- Community services	VYSCS

- Imputed bank charges	VYSBC
- Government sector	VYSG
- Government services	VYSGS
- Oil sectors	VYSO
- Crude oil and natural gas	VYSOG
- Petroleum refining	VYSPR
- Total operating surplus	VYS
- Gross operating surplus, household sector	VYSH
- Household share of VYSP	VYSSHARE
- Gross operating surplus, corporate sector	VYSC

A.2.3 Compensation of employees by economic activity

- Private non-oil sector	VYWP
- Agriculture, forestry and fishing	VYWAG
- Other mining, quarrying	VYWMI
- Petrochemicals	VYWPS
- Other manufacturing	VYWMA
- Electricity, gas and water	VYWEW
- Construction	VYWCN
- Wholesale and retail trade	VYWTD
- Transport and communication	VYWTC
- Finance, insurance, real estate	VYWFR
- Real estate	VYWRE
- Finance, insurance	VYWFI
- Community services	VYWCS
- Imputed bank charges	VYWBC
- Government sector	VYWG
- Government services	VYWGS
- Oil sectors	VYWO
- Crude oil and natural gas	VYWOG
- Petroleum refining	VYWPR
- Total compensation of employees	VYW

A.2.4 Indirect taxes less subsidies by economic activity

- Private non-oil sector	VYTP
- Agriculture, forestry and fishing	VYTAG
- Other mining, quarrying	VYTMI
- Petrochemicals	VYTPS
- Other manufacturing	VYTMA
- Electricity, gas and water	VYTEW
- Construction	VYTCN
- Wholesale and retail trade	VYTTD
- Transport and communication	VYTTC
- Finance, insurance, real estate	VYTFR
- Real estate	VYTRE
- Finance, insurance	VYTFI
- Community services	VYTCS
- Imputed bank charges	VYTBC
- Government sector	VYTG
- Government services	VYTGS
- Oil sectors	VYTO
- Crude oil and natural gas	VYTOG
- Petroleum refining	VYTPR

- Total net indirect taxes	VYT

A.2.5 GDP by type of expenditure n.e.s

- Private consumption	VCP
- Private consumption, non-residential	VCPN
- Private consumption, residential	VCPR
- Government final consumption	VCG
- Total investment	VJ
- Investment, government sector	VJG
- Investment, oil sector	VJO
- Investment, private non-oil sector	VJP
- Imports of goods and services	VM
- Exports of goods and services	VX
- Exports of oil and gas	VXOG
- Exports of petrochemicals	VXPS
- Exports of refined products	VXPR
- Exports of goods and services, less export of oil and gas, refined products petrochemicals, and non-resident direct purchase	VXX

A.3. Price indices (1994=1)

- Crude oil price, Arabian light	POIL

A.3.1 GDP by economic activity

- Private non-oil sector	PYP
- Agriculture, forestry and fishing	PYAG
- Other mining, quarrying	PYMI
- Petrochemicals	PYPS
- Other manufacturing	PYMA
- Electricity, gas and water	PYEW
- Construction	PYCN
- Wholesale and retail trade	PYTD
- Transport and communication	PYTC
- Finance, insurance, real estate	PYFR
- Real estate	PYRE
- Finance, insurance	PYFI
- Community services	PYCS
- Imputed bank charges	PYBC
- Government sector	PYG
- Government services	PYGS
- Oil sectors	PYO
- Crude oil and natural gas	PYOG
- Petroleum refining	PYPR
- Import duties	PYID
- Total GDP	PY

A.3.2 GDP by type of expenditure

- Imports	PM
- Exports	PX
- Exports of oil and gas	PXOG
- Exports of petrochemicals	PXPS
- Exports of refined products	PXPR
- Exports of goods and services, less export of oil and gas,	

refined products petrochemicals and non-resident direct purchase	PXX
- Government final consumption	PCG
- Increase in stocks	PDS

A.3.3 GFCF by sector and type of capital

- Private non-oil investment	PJP
- Private non-oil, residential building	PJPH
- Private non-oil, non-residential building	PJPB
- Private non-oil, transport and machinery equipment	PJPTM
- Government investment	PJG
- Government investment, non-residential building	PJGB
- Government investment, transport and machinery equipment	PJGTM
- Oil-sector investment	PJO
- Oil-sector investment, non-residential building	PJOB
- Oil-sector investment, transport and machinery equipment	PJOTM
- GFCF, total	PJ

A.3.4 Private consumption by object of expenditure

- Food, beverage, tobacco	PCPFOO
- Clothing and footwear	PCPCLO
- Rent, fuel and power	PCPREN
- Furniture and household equipment	PCPFUR
- Medical health care	PCPMED
- Transport and communication	PCPTRA
- Entertainment and education	PCPENT
- Other goods and services	PCPOTH
- Non-resident direct purchase	PCPN
- Resident direct purchase abroad	PCPABR
- Private final consumption	PCP
- Resident , total	PCPR

A.3.5 Factor prices, excl. of net indirect taxes

- Agriculture, forestry and fishing	PYFAG
- Other mining, quarrying	PYFMI
- Petrochemicals	PYFPS
- Other manufacturing	PYFMA
- Electricity, gas and water	PYFEW
- Construction	PYFCN
- Wholesale and retail trade	PYFTD
- Transport and communication	PYFTC
- Real estate	PYFRE
- Finance, insurance	PYFFI
- Community services	PYFCS
- Government services	PYFGS
- Imputed bank charges	PYFBC
- Crude oil and natural gas	PYFOG
- Petroleum refining	PYFPR

A.4. Employment, wages etc.

A.4.1 Employment and labour supply

- Private, non-oil sector	EP

- Agriculture, forestry and fishing	EAG
- Other mining, quarrying	EMI
- Petrochemicals	EPS
- Other manufacturing	EMA
- Electricity, gas and water	EEW
- Construction	ECN
- Wholesale and retail trade	ETD
- Transport and communication	ETC
- Real estate	ERE
- Finance, insurance	EFI
- Community services	ECS
- Government sector	EG
- Crude oil and natural gas	EOG
- Petroleum refining	EPR
- Employment total	E
- Employment, Saudis	ES
- Employment, Saudis, private non-oil sector	ESP
- Employment, Saudis, government sector	ESG
- Employment, non-Saudis	EN
- Employment, non-Saudis private non-oil sector	ENP
- Employment, non-Saudis government sector	ENG
- Participation rate, out of total population	LRRATE

A.4.2. Wage rates and productivity

- Private, non-oil sector	WP
- Agriculture, forestry and fishing	WAG
- Other mining, quarrying	WMI
- Petrochemicals	WPS
- Other manufacturing	WMA
- Electricity, gas and water	WEW
- Construction	WCN
- Wholesale and retail trade	WTD
- Transport and communication	WTC
- Real estate	WRE
- Finance, insurance	WFI
- Community services	WCS
- Government sector	WG
- Crude oil and natural gas	WOG
- Petroleum refining	WPR
- Productivity, private non-oil sector	QP
- Productivity, government sector	QG

A.4.3 User cost of capital

- Agriculture, forestry and fishing	PKAG
- Other mining, quarrying	PKMI
- Petrochemicals	PKPS
- Other manufacturing	PKMA
- Construction	PKCN
- Wholesale and retail trade	PKTD
- Transport and communication	PKTC
- Real estate	PKRE
- Finance, insurance	PKFI
- Community services	PKCS

- Crude oil and natural gas	PKOG
- Petroleum refining	PKPR

A.4.4 Real rate of return of capital by sector

- Real rate of return	IR
- Agriculture, forestry and fishing	IRAG
- Other mining, quarrying	IRMI
- Other manufacturing	IRMA
- Construction	IRCN
- Wholesale and retail trade	IRTD
- Transport and communication	IRTC
- Real estate	IRRE
- Finance, insurance	IRFI
- Community services	IRCS

A.4.5 Household sector etc.

- Disposable income, households	HR
- Tax-rate, household income	THR
- Net financial wealth, households	HW
- Money supply, currency outside banks	M0
- Money supply, M0 + demand and time deposits	M2
- Banks claims on private sector	LIABP
- Private sector net financial investment	ZP
- Private savings	SP

A.4.6 Net indirect taxes

- Agriculture, forestry and fishing	TAG
- Other mining, quarrying	TMI
- Petrochemicals	TPS
- Other manufacturing	TMA
- Electricity, gas and water	TEW
- Construction	TCN
- Wholesale and retail trade	TTD
- Transport and communication	TTC
- Real estate	TRE
- Finance, insurance	TFI
- Community services	TCS
- Government services	TGS
- Imputed bank charges	TBC
- Crude oil and natural gas	TOG
- Petroleum refining	TPR

A.4.7 Government sector

- Government budget surplus	ZG
- Government, total revenues	GRTOT
- Government, oil revenues	GROIL
- Governmnet, other revenues	GROTH
- Government, oil revenues as share of VYSO	GROSHARE
- Government, total expenditure	GETOT
- Government expenditure, chapter 1	GECH1
- Government expenditure, chapter 2	GECH2
- Government expenditure, chapter 3	GECH3
- Government expenditure, social security services	GESS

- Government expenditure, chapter 4	GECH4
- Government expenditure, sum of chapter 1 and chapter 2	GECH12
- Gevernment savings	SG

A.4.8 Current account balance

- Current account balance	Z
- Net transfers and primary income	ZR
- Ner foreign assets	NFA

A.4.9 Total factor productivity

- Agriculture, forestry and fishing	TFPAG
- Other mining, quarrying	TFPMI
- Petrochemicals	TFPPS
- Other manufacturing	TFPMA
- Electricity, gas and water	TFPEW
- Construction	TFPCN
- Wholesale and retail trade	TFPTD
- Transport and communication	TFPTC
- Real estate	TFPRE
- Finance, insurance	TFPFI
- Community services	TFPCS
- Crude oil and natural gas	TFPOG
- Petroleum refining	TFPPR

A.5. Miscellaneous

- Dummy, equal to 1 in 1990, 0 otherwise	D90
- Dummy, equal to 1 in 1994, 0 otherwise	D94
- Investment credit, housing	ICH
- Competitive imports	MC
- Indicator for import competition	MSC
- Import price index, including import duties	PMID
- Market indicator for exports	MIX
- Saudi Population	POPSA
- Compound subsidies	VYTNEG
- Compound taxes	VYTPOS

A.6. Residuals

All variables where the first letter is an «R» is a residual attached to the variables defined by the remaining letters.

Rebasing the model

The Selection model was first developed using 1989 as base year. The model was afterwards rebased with 1994 as base year. This Appendix explains how the time series, the input-output table and the linear expenditure system has been adjusted to the new base year.

B.1. Time series

Updating the base year to 1994 implies changing all price indices and fixed price series. To achieve this we use the old data base (measured in 1989 prices) as basis.

How to update a particular time serie depends on whether or not the time serie is defined explicit (by actual numbers) or by some definition (equation). The variables defined explicit, which are variables at the lowest level of aggregation, are updated by rescaling. The variables defined by an expressions are assigned values, implying that all terms included in the expression must previously have been rescaled.

Since the price indices are used for rescaling the constant price time series they have to be rescaled first. Then the fixed price series are calculated.

B.1.1. Price indices

The price indices is updated, or rescaled, to equal one in the new base year 1994. The updating formula for the price indices p is

$$p_t^{94} = \frac{p_t^{89}}{p_{94}^{89}} \text{ , where}$$

p_t^{94} is the new price indices, equal to one for t = 94

p_t^{89} is the old price indices, equal to one for t = 89

p_{94}^{89} is the value of the price indices measured in 1989-prices in the year 1994

Note that all the 1989-price series must include observations covering at least 1994. It should also be noticed that some of the price indices are created elsewhere by dividing the current price series by the constant price series.

B.1.2. Constant price series

The time series measured in constant prices (the volume series) is calculated as

$$y_t^{94} = \frac{vy_t}{p_t^{94}} \text{ , where}$$

y_t^{94} is the new constant price series

vy_t is the series measured in current values

B.2. The Input-Output matrix

Both Implementation Model and Selection Model were developed with 1989 as base year for price indices and constant price (volume) series. This implies, for one thing, that the input-output table is adjusted to final demand and value added components for that year. This section describes how the input-output table have been updated to the new base year 1994. We also present the new matrix, as well as the difference between the two matrixes.

Based on the old input-output matrix we use an iterative procedure to adjust the matrix to correspond to value added and final demand. After the matrix has been transferred into levels, the first iteration adjust the matrix to fit value added, implying that the line sums equals value added. In iteration number 2 the matrix is adjusted to fit final demand, implying that the row sums equals final demand. This second iteration disarrange the balance achieved in the first iteration so that the sum of the lines no longer equals value added. The next iteration thus again adjust the matrix to correspond with value added, but making the column sums different from final demand. This process, adjusting lines and columns, continues until an acceptable level on the errors occurs. In practice these errors are zero in the base year.

Let α denote the 1989 input-output (coefficient) matrix (size 17 by 22), F^{AN} a 1 by 22 vector consisting of final demand components and Y^{EA} a 17 by 1 vector consisting of value added components. The superscript AN indicates that the numbers in these vectors are those from the National Accounts. Since the elements in the α matrix are measured as shares of final demand and the elements in the vectors are measured in million Saudi Riyals we bring the matrix into million Saudi Riyals by postmultiplying it with the diagonalized final demand vector for 1994, $\hat{F}^{NA}$: $A^0 = \alpha \cdot \hat{F}^{NA}$. In the first iteration the elements in each line in this matrix should be adjusted to make the sum of this elements correspond with value added figures from the National Accounts. To accomplish this we define a vector consisting of these sums as $Y = A^0 \cdot I_{22}$, where I_{22} is a 22 by 1 vector consisting of ones. The resulting vector Y is of size 17 by 1. Now we can define the difference between value added according to the National Accounts and the line sums in the input-output matrix to be adjusted (now measured in million Saudi Riyals) as $DY = Y^{EA} - Y$.

Let A^1 denote the adjusted matrix after the first iteration. The first step is to adjust the elements in A^0 to attain $Y = Y^{EA}$. This is obtained (in 1 iteration) by the following adjustment:
$A^1 = A^0 + \hat{DY} \cdot \hat{Y}^{-1} \cdot A^0$, where $\hat{Y}^{-1}$ is Y diagonalized and inverted and $\hat{DY}$ is DY diagonalized.

As mentioned above, this adjustment is undertaken without considering how the column sums will correspond to actual final demand. The next step thus is to adjust the matrix to final demand.

We define the sum of the columns in A^1 as $F = I_{17} * A^1$, where I_{17} is a 1 by 17 vector consisting of ones, and we define the difference between final demand according to the National Accounts and according to the column sums in the matrix as $DF = F^{AN} - F$. The resulting F will be a 1 by 22 vector. Adjusting the matrix to arrive at $F^{AN} = F$ (in 1 iteration) we calculate A^2, the matrix resulting from iteration number 2, as
$A^2 = A^1 + A^1 \cdot \hat{DF} \cdot \hat{F}^{-1}$, where $\hat{F}^{-1}$ is the diagonalized and inverted final demand vector and $\hat{DF}$ is DF diagonalized.

This procedure is continued till there is an acceptable deviation between the sum of the row/column elements and the value added/final demand from the National Accounts. For all practical purposes these deviations could be ignored.

Table B.2-1 1994 input-output table

	cpfoo	cpclo	cpren	cpfur	cpmed	cptra	cpent	cpoth	cpabr	jph	jpb	jptm	jgb	jgtm	job	jotm	cg	ds	xog	xpr	xps	xx
yag	0,403	0,001	0,047	0,001	0,000	0,003	0,001	0,039	0,009	0,008	0,008	0,000	0,000	0,000	0,001	0,001	0,001	0,008	0,000	0,000	0,000	0,000
ymi	0,000	0,000	0,008	0,017	0,000	0,001	0,000	0,000	0,001	0,025	0,025	0,000	0,010	0,000	0,027	0,000	0,001	0,024	0,000	0,000	0,000	0,000
yps	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,424	0,000
yma	0,045	0,125	0,027	0,111	0,035	0,049	0,077	0,062	0,009	0,021	0,021	0,151	0,054	0,143	0,072	0,125	0,021	0,084	0,000	0,001	0,000	0,027
yew	0,000	0,000	0,024	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
ycn	0,002	0,003	0,134	0,004	0,003	0,020	0,004	0,007	0,056	0,603	0,604	0,002	0,449	0,002	0,220	0,006	0,048	0,001	0,000	0,000	0,000	0,002
ytd	0,174	0,162	0,067	0,220	0,069	0,132	0,147	0,241	0,013	0,032	0,032	0,031	0,012	0,007	0,017	0,015	0,014	0,003	0,000	0,000	0,000	0,002
ytc	0,016	0,017	0,095	0,022	0,012	0,210	0,019	0,035	0,644	0,018	0,018	0,005	0,012	0,004	0,053	0,051	0,044	0,003	0,000	0,002	0,001	0,006
yre	0,001	0,001	0,252	0,001	0,001	0,002	0,002	0,002	0,002	0,001	0,001	0,000	0,000	0,000	0,001	0,000	0,001	0,000	0,000	0,000	0,000	0,000
yfi	0,005	0,006	0,033	0,006	0,005	0,012	0,006	0,011	0,021	0,083	0,083	0,025	0,125	0,094	0,145	0,132	0,037	0,003	0,000	0,003	0,000	0,768
ycs	0,001	0,028	0,003	0,002	0,283	0,155	0,322	0,245	0,003	0,002	0,002	0,001	0,002	0,001	0,002	0,001	0,020	0,001	0,000	0,001	0,001	0,002
ygs	0,002	0,003	0,001	0,004	0,001	0,001	0,002	0,002	0,000	0,002	0,002	0,004	0,002	0,003	0,003	0,003	0,665	0,004	0,000	0,000	0,000	0,001
ybc	-0,001	-0,002	-0,010	-0,002	-0,002	-0,003	-0,002	-0,003	-0,006	-0,025	-0,025	-0,007	-0,037	-0,028	-0,043	-0,039	-0,011	-0,001	0,000	-0,001	0,000	-0,227
yog	0,002	0,001	0,020	0,002	0,201	0,048	0,004	0,004	0,012	0,003	0,003	0,001	0,002	0,001	0,002	0,001	0,007	0,391	0,999	0,495	0,570	0,001
ypr	0,002	0,001	0,019	0,002	0,190	0,045	0,004	0,004	0,011	0,002	0,002	0,001	0,002	0,000	0,002	0,001	0,007	0,000	0,000	0,468	0,000	0,001
yid	0,031	0,002	0,081	0,002	0,002	0,031	0,003	0,005	0,065	0,002	0,002	0,001	0,001	0,001	0,002	0,001	0,011	0,001	0,000	0,001	0,000	0,001
m	0,317	0,650	0,199	0,607	0,200	0,296	0,411	0,345	0,159	0,223	0,222	0,785	0,366	0,771	0,495	0,699	0,133	0,478	0,000	0,029	0,003	0,416

Table B.2-2 The difference between the 1994 and the 1989 matrixes

	cpfoo	cpclo	cpren	cpfur	cpmed	cptra	cpent	cpoth	cpabr	jph	jpb	jptm	jgb	jgtm	job	jotm	cg	ds	xog	xpr	xps	xx
yag	0,011	0,000	-0,001	0,000	0,000	-0,001	0,000	-0,001	-0,002	-0,001	-0,001	0,000	0,000	0,000	0,000	0,000	-0,001	-0,004	0,000	0,000	0,000	0,000
ymi	0,000	0,000	-0,001	0,000	0,000	0,000	0,000	0,000	0,000	-0,003	-0,003	0,000	-0,001	0,000	-0,001	0,000	-0,001	-0,012	0,000	-0,001	0,000	0,000
yps	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	-0,043	0,000
yma	0,015	0,045	0,008	0,039	-0,003	0,010	0,024	0,019	0,001	0,006	0,006	0,056	0,016	0,053	0,023	0,044	-0,002	0,001	0,000	-0,004	-0,001	0,009
yew	0,000	0,000	-0,008	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
ycn	0,000	0,001	0,016	0,001	-0,001	0,000	0,001	0,001	-0,004	0,045	0,045	0,000	0,049	0,000	0,031	0,001	-0,018	0,000	0,000	-0,002	-0,003	0,000
ytd	0,006	0,011	-0,001	0,014	-0,040	-0,019	0,000	-0,001	-0,003	-0,002	-0,002	0,003	0,000	0,001	0,000	0,001	-0,008	-0,001	0,000	-0,001	-0,001	0,000
ytc	0,005	0,005	0,025	0,007	-0,002	0,035	0,005	0,009	0,069	0,004	0,004	0,002	0,003	0,001	0,015	0,016	-0,006	0,000	-0,001	-0,012	-0,012	0,002
yre	0,000	0,000	-0,042	0,000	-0,001	-0,001	0,000	0,000	-0,001	0,000	0,000	0,000	0,000	0,000	0,000	0,000	-0,001	0,000	0,000	0,000	0,000	0,000
yfi	0,001	0,001	0,005	0,001	-0,002	0,001	0,001	0,002	0,000	0,010	0,010	0,006	0,019	0,022	0,026	0,029	-0,011	-0,001	-0,002	-0,018	-0,002	0,134
ycs	0,000	0,005	0,000	0,000	-0,107	0,001	0,041	0,031	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	-0,007	0,000	-0,001	-0,007	-0,008	0,000
ygs	0,001	0,002	0,001	0,002	0,000	0,001	0,001	0,001	0,000	0,001	0,001	0,002	0,001	0,002	0,002	0,002	0,161	0,001	0,000	0,000	0,000	0,000
ybc	0,000	-0,001	-0,003	-0,001	0,000	-0,001	-0,001	-0,001	-0,001	-0,006	-0,006	-0,003	-0,011	-0,010	-0,013	-0,014	0,001	0,000	0,000	0,004	0,000	-0,070
yog	0,002	0,001	0,018	0,002	0,182	0,044	0,004	0,004	0,011	0,002	0,002	0,001	0,002	0,000	0,002	0,001	0,006	0,358	0,010	0,271	0,111	0,001
ypr	0,002	0,001	0,016	0,002	0,153	0,039	0,004	0,003	0,010	0,002	0,002	0,000	0,002	0,000	0,002	0,001	0,005	0,000	0,000	0,013	0,000	0,001
yid	0,005	0,000	0,008	0,000	-0,001	0,000	0,000	0,001	-0,006	0,000	0,000	0,000	0,000	0,000	0,000	0,000	-0,004	0,000	0,000	-0,003	0,000	0,000
m	-0,047	-0,072	-0,042	-0,069	-0,178	-0,108	-0,080	-0,068	-0,073	-0,059	-0,058	-0,068	-0,079	-0,070	-0,086	-0,082	-0,115	-0,341	-0,005	-0,238	-0,041	-0,076

B.3. The Linear Expenditure System

The linear expenditure system (LES) has not been estimated but the parameters are determined by using consumption data for the base year and price elasticities from Theil et al. 1989. The income elasticities are determined by minimizing the deviations between actual and estimated consumption in the base year implying there will be residuals in other years. The LES determines resident consumption for nine consumer groups as

$$CPR_i = CPR_i.1 + \frac{CPR_i.2}{PCP_i}\left(VCPR - \sum_{i\in\varepsilon} CPR_i.1 \cdot PCP_i\right), \quad \varepsilon=(FOO, CLO, REN, FUR, MED, TRA, ENT, OTH, APB)$$

To calibrate the LES-coefficients we first calculate the multiplicative term as

$CPR_i.2 = E_i * CPR_i/CPR$, where

CPR is total private consumption by residents
CPR_i is private consumption of item i by residents
CPN is total private consumption by non-residents.
E_i is the income elasticity

Then we calculate the constant term as

$CPR_i.1 = CPR_i * (1+e_i)/(1-CPR_i.2)$, where e_i is the price elasticity.

B.3.1 Results

The table below shows LES-coefficients calibrated against 1994 values as well as the 1989 values. i = 1 is the constant term while i = 2 is the slope coefficient.

Table B.3.1

	1989		*1994*	
	i = 1	*i = 2*	*i = 1*	*i = 2*
CPRFOO.i	36559.5	0.2394	26762.55	0.23
CPRCLO.i	4931.5	0.0737	4064.82	0.08
CPRREN.i	5019.7	0.1653	3251.08	0.14
CPRFUR.i	1560.7	0.0894	1339	0.1
CPRMED.i	0	0.0128	0	0.01
CPRTRA.i	0	0.2147	0	0.21
CPRENT.i	439.5	0.0269	326.06	0.03
CPROTH.i	0	0.0272	0	0.06
CPRABR.i	0	0.1358	0	0.15

Reestimation and respecification of econometric equations

This note describes new and revised econometric equations for the Selection Model and is divided into two parts; volume equations and budget equations. Some new equations have been added as they have been found to improve the model's ability to describe the Saudi economy. Other equations have been revised, partly due to the new available information (data from 1992-1994/95) and partly due to an attempt to improve model properties.

C.1. Volume equations

New equations for imports and exports have been estimates and included in the model. In addition, volume equations have been improved by;

1) including separate dummies for the years 1990, 1991 and 1992 (Gulf war-dummies), taking values of 1 in the respective years
2) imposing restrictions on long-term elasticities in investment equations
3) minor adjustments of the short run dynamics

Compared to the documentation in Johansen and Magnussen (1996) of the econometric equations, we here include a set of specification tests used in the evaluation of different equations as well as plots of estimated (fitted) and actual values for each of the variables. Note that the plot includes estimation with the last observation being 1994 (not 1995 as in the model), the specification is exactly the same.

C.1.1. Imports

An aggregate import demand function has been estimated. It relates the import share (MS) to relative prices. Since this price term is significant, it indicates that there is import substitution in the Saudi Arabian economy. However, one should not interpret this as competitive imports for homogenous goods, but rather as gross substitution. Higher import prices depress demand for imports and stimulates domestic demand.

MS is defined as the share of imports not affected by changes in the composition of final demand. Accordingly, MS should be affected by e.g. changes in import prices relative to prices of domestically produced goods, and this is the basis for our econometric equation.

Define the following import price index, including import duties:

PMID=VM/(VM+VYID)*PM + (1-VM/(VM+VYID))*PYID;

The relevant domestic price is the deflator for non-oil GDP; PYP.

Accordingly, a general import share equation can be written:

MS = f(PMID/PYP)

This is basis for the long-run solution in the import demand equation.

In addition, we allow for short run effects of relative prices and from changes in non-competitive imports, i.e. import determined by composition of final demand only [MS*M] .

As for other econometric equations, we have chosen the log-linear error-correction specification, which can be written as follows;

log(MS) - log(MS(-1)) = constant + a log(MS(-1) + b log(PMID(-1)/PYP(-1)) + dynamics

where -b/a is the price elasticity.

The estimated equations is:

```
ORDINARY LEAST SQUARES

DEL(1: LOG(MS)) = MS.1+
MS.2*DEL(1: LOG(PMID/PYP))+
MS.3*DEL(1: LOG(PMID(-1)/PYP(-1)))+
MS.4*DEL(1: LOG(M(-1)/MS(-1)))+
MS.5*LOG(MS(-1))+
MS.6*LOG(PMID(-1)/PYP(-1))+
MS.7*D94

25 observations used for estimation from   71 to   95

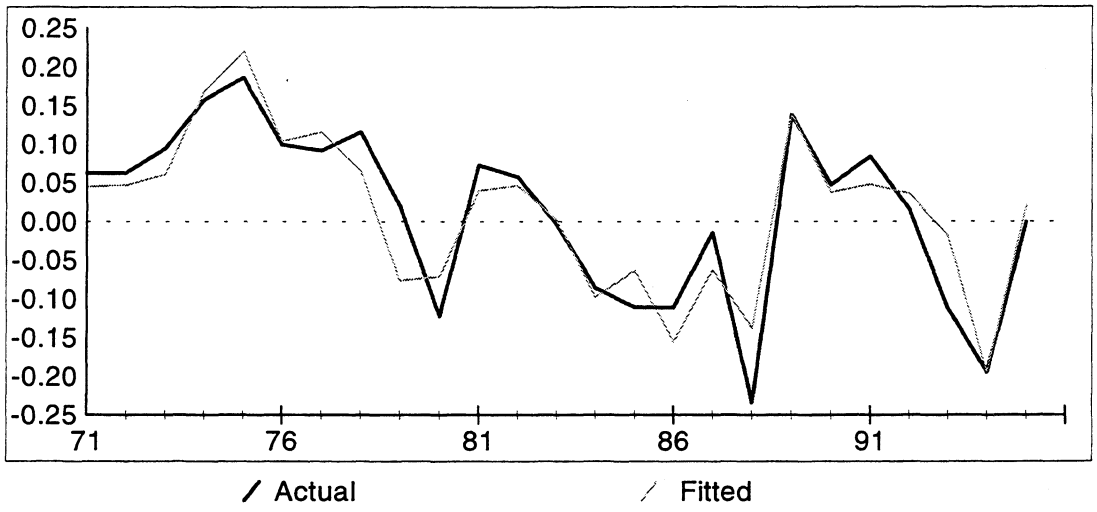
Regressor              Coefficient       Standard Error         T-Ratio[Prob]
MS.1                      .14830            .047772             3.1043[.006]
MS.2                     -.73195            .15045             -4.8652[.000]
MS.3                      .33134            .13612              2.4341[.026]
MS.4                      .39684            .12437              3.1909[.005]
MS.5                     -.48165            .13825             -3.4840[.003]
MS.6                     -.33387            .12175             -2.7422[.013]
MS.7                     -.25628            .055206            -4.6422[.000]

*******************************************************************************
 R-Squared                        .84261   R-Bar-Squared                  .79015
 S.E. of Regression               .050726  F-stat.    F(  6,  18)   16.0613[.000]
 Mean of Dependent Variable       .012876  S.D. of Dependent Variable     .11073
 Residual Sum of Squares          .046317  Equation Log-likelihood       43.1657
 Akaike Info. Criterion          36.1657   Schwarz Bayesian Criterion    31.8996
 DW-statistic                     2.2112
*******************************************************************************

                              Diagnostic Tests
*******************************************************************************
*    Test Statistics  *        LM Version        *         F Version            *
*******************************************************************************
*                     *                          *                              *
* A:Serial Correlation*CHSQ(   1)=   .62145[.431]*F(   1,  17)=   .43336[.519]*
*                     *                          *                              *
* B:Functional Form   *CHSQ(   1)=  1.0006[.317]*F(   1,  17)=   .70880[.412]*
*                     *                          *                              *
* C:Normality         *CHSQ(   2)=   .55293[.758]*       Not applicable         *
*                     *                          *                              *
* D:Heteroscedasticity*CHSQ(   1)=   .11868[.730]*F(   1,  23)=   .10971[.743]*
*******************************************************************************
   A:Lagrange multiplier test of residual serial correlation
   B:Ramsey's RESET test using the square of the fitted values
   C:Based on a test of skewness and kurtosis of residuals
   D:Based on the regression of squared residuals on squared fitted values
```

As results show, three short term dynamic terms are found to be significant; current and lagged changes in relative prices and lagged changes in the domestic demand variable. In addition, a dummy variable for 1994 was found vital for the results (even though we have no explanation for any special event that took place in that year). The long run price elasticity is equal to -0.33/0.48 = -0.69. The diagnostic tests are satisfying and the equation is stable over the period 1990-95.

Figure C.1. Import share. Actual and fitted values



C.1.2. Exports

Exports of other goods (XX) is modelled by an Armington equation, assuming that foreign demand and relative prices are of importance for this export category. An export market indicator (MIX) has been calculated based on data provided by MOP, Saudi Arabia for export of goods by country. Export market developments are approximated by the use of GDP for each country. Four main export areas are defined and weighted together (weights in parenthesis);

- OECD-countries (30 per cent)
- Africa (7 per cent)
- Asia, except GCC-countries (22 per cent)
- GCC-countries, except Saudi Arabia (41 per cent)

The import price index, PM, is used as an indicator of competitive prices on export markets, so that the relative price term included in the equation is PXX/PM. The long run equation can then be written:

XX = g(MIX, PXX/PM)

As for other econometric equations, we have chosen the log-linear error-correction specification, which can be written as follows;

log(XX) - log(XX(-1)) = constant + a log(XX(-1) + b log(PXX(-1)/PM(-1)) + dynamics where -b/a is the price elasticity.

```
ORDINARY LEAST SQUARES

DEL(1: LOG(XX)) = XX.1+
XX.2*DEL(1: LOG(PM/PXX))+
XX.3*LOG(MIX(-1)/XX(-1))+
XX.4*LOG(PM(-1)/PXX(-1))

NOB = 18     NOVAR = 4  NCOEF = 4
RANGE: 1978A to 1995A
RSQ =              0.804403        CRSQ =             0.762489
F(3/14) =         19.191899        PROB>F =           0
SER =              0.16499         SSR =              0.381105
DW(0) =            1.919361        COND =            55.324087
MAX:HAT =          0.578586        RSTUDENT =        -2.072796
DFFITS =           1.890627
```

COEF	ESTIMATE	STER	TSTAT	PROB>|T|
XX.1	5.528367	0.945969	5.844132	4.26223679e-005
XX.2	0.820234	0.140799	5.825571	4.40232189e-005
XX.3	0.592093	0.102983	5.749447	5.02916113e-005
XX.4	0.974116	0.226786	4.295318	0.00074

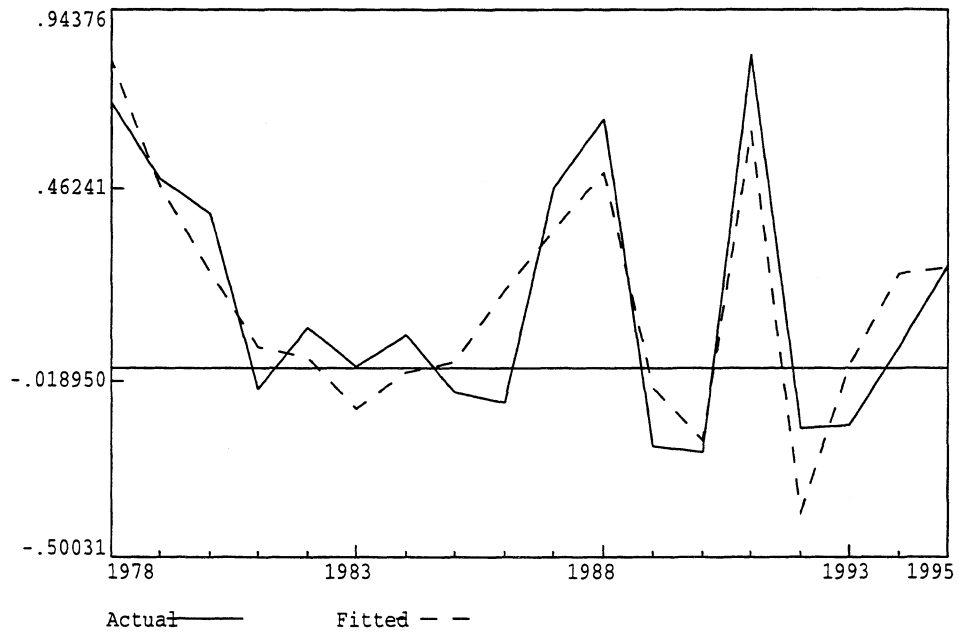
Diagnostic Tests

Test Statistics	LM Version	F Version
A:Serial Correlation	CHI-SQ(1)= .012059[.913]	F(1, 13)= .0087153[.927]
B:Functional Form	CHI-SQ(1)= 1.9156[.166]	F(1, 13)= 1.5482[.235]
C:Normality	CHI-SQ(2)= .95670[.620]	Not applicable
D:Heteroscedasticity	CHI-SQ(1)= .0040921[.949]	F(1, 16)= .0036382[.953]

A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values

As can be seen, both short term dynamic terms is found to be significant. The long run price elasticity is equal to -0.974/0.592 = -1.645. The diagnostic tests are satisfying and the coefficients in the equation is found to be stable over time.

Figure C.2. Exports of other goods. Actual and fitted values



C.1.3. Housing investments

In this equation the investment credit variable dropped out of the long term solution of the model, i.e. it is now only included on difference form. A long term elasticity of 1 wrt. real disposable income for households was imposed. In addition a dummy variable for 1990 is found to be significant, with a negative sign indicating that the war depressed housing investments in that year. The tracking of the equation deteriorated somewhat, despite these changes. As can be seen from Figure C.3, this is in particular due to bad tracking in 1994.

```
ORDINARY LEAST SQUARES

LOG(JPH)-LOG(JPH(-1)) = JPH.1+
JPH.2*(LOG(ICH/PJPH)-LOG(ICH(-1)/PJPH(-1)))+
JPH.3*(LOG(HR/PJPH)-LOG(HR(-1)/PJPH(-1)))+
JPH.4*(LOG(JPH(-1))-LOG(HR(-1)/PJPH(-1)))+
JPH.5*D90

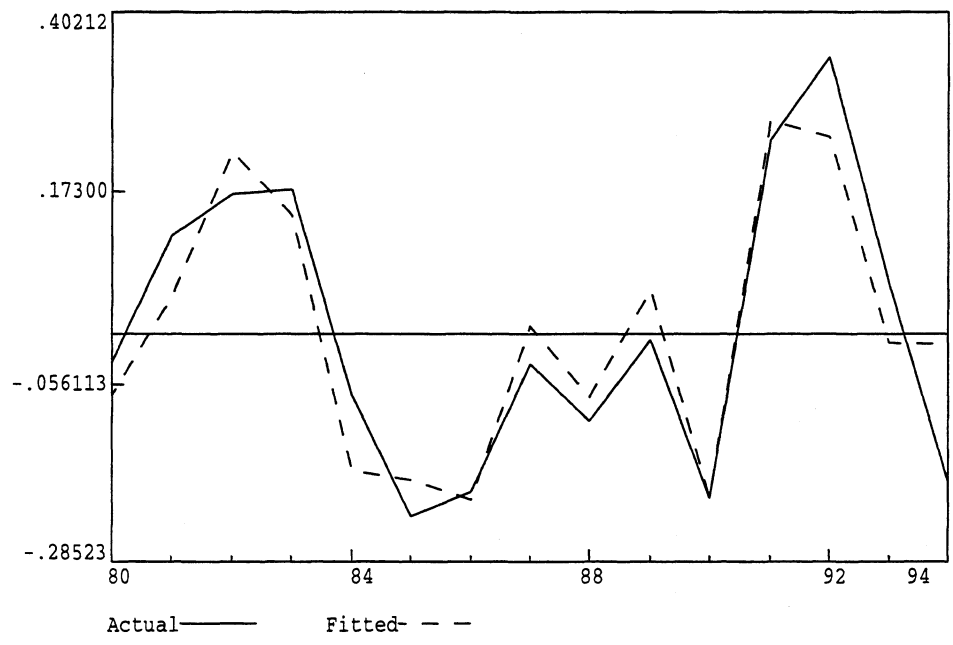
NOB = 16     NOVAR = 5  NCOEF = 5
RANGE: 1980A to 1995A
RSQ =              0.825477        CRSQ =             0.762014
F(4/11) =         13.007246        PROB>F =           0.000375
SER =              0.084017        SSR =              0.077648
DW(0) =            2.434497        COND =            35.115477
MAX:HAT =          1               RSTUDENT =        NA
DFFITS =          NA

   COEF      ESTIMATE          STER           TSTAT          PROB>|T|

JPH.1         -1.79437        0.336731       -5.328793        0.000242
JPH.2          0.323901       0.098653        3.283231        0.007292
JPH.3          0.783814       0.218311        3.590356        0.004241
JPH.4         -0.621431       0.114464       -5.429067        0.000207
JPH.5         -0.383221       0.09836        -3.896124        0.002493

Diagnostic Tests
*************************************************************************
*    Test Statistics  *        LM Version        *         F Version
*************************************************************************
* A:Serial Correlation*CHSQ(   1)=   .63599[.425]*F(   1,   9)=   .39849[.544]
* B:Functional Form   *CHSQ(   1)=   .61599[.433]*F(   1,   9)=   .38542[.550]
* C:Normality         *CHSQ(   2)=   .68765[.709]*       Not applicable
* D:Heteroscedasticity*CHSQ(   1)=  1.0300[.310]*F(   1,  13)=   .95846[.345]
*************************************************************************
```

Figure C.3. Housing investment. Actual and fitted values



C.2. Budget equations

In the former version of the model, government revenues and expenditures were not linked to model variables in a more satisfying way. Now, these equations have been estimated econometrically, in order to get a better relationship to actual model variables.

First there are two equations defining which part of net indirect taxes which are positive (i.e. taxes) and which are negative (i.e. subsidies). Taxes and subsidies in the various industries are collected into VYTPOS and VYTNEG respectively.

```
VYTPOS = (IF (VYTAG > 0) THEN VYTAG ELSE 0)+(IF (VYTCN > 0) THEN VYTCN ELSE 0)+
       (IF (VYTEW > 0) THEN VYTEW ELSE 0)+(IF (VYTTD > 0) THEN VYTTD ELSE 0)+
       (IF (VYTMI > 0) THEN VYTMI ELSE 0)+(IF (VYTPR > 0) THEN VYTPR ELSE 0)+
       (IF (VYTPS > 0) THEN VYTPS ELSE 0)+(IF (VYTTC > 0) THEN VYTTC ELSE 0),

VYTNEG = (IF (VYTAG < 0) THEN VYTAG ELSE 0)+(IF (VYTCN < 0) THEN VYTCN ELSE 0)+
       (IF (VYTEW < 0) THEN VYTEW ELSE 0)+(IF (VYTTD < 0) THEN VYTTD ELSE 0)+
       (IF (VYTMI < 0) THEN VYTMI ELSE 0)+(IF (VYTPR < 0) THEN VYTPR ELSE 0)+
       (IF (VYTPS < 0) THEN VYTPS ELSE 0)+(IF (VYTTC < 0) THEN VYTTC ELSE 0)
```

An equation is linking government expenditures (chapter 1 and 2) to the government wage bill. Government consumption was found not to be as good an indicator as wages.

```
ORDINARY LEAST SQUARES

GECH12 = GECH12.1*VYWG

NOB = 25    NOVAR = 1  NCOEF = 1
RANGE: 1971A to 1995A
RSQ =              0.976101        CRSQ =             0.976101
F(1/24) =           NA             PROB>F =           NA
SER =          13620.507693        SSR =       4.45243752e+009
DW(0) =            0.861135        COND =             1
MAX:HAT =          0.119256        RSTUDENT =         4.37736
DFFITS =           1.61075

    COEF     ESTIMATE          STER           TSTAT          PROB>|T|

GECH12.1       1.693272       0.054083       31.308515        0
```

Government expenditures on chapter 3 (less subsidies) are linked to social security expenditures:

```
ORDINARY LEAST SQUARES

LOG(GECH3+VYTNEG) = GECH3.1+GECH3.2*LOG(GESS)

NOB = 25    NOVAR = 2  NCOEF = 2
RANGE: 1971A to 1995A
RSQ =              0.722322        CRSQ =             0.710249
F(1/23) =         59.829682        PROB>F =           0
SER =              0.606741        SSR =              8.467107
DW(0) =            0.247623        COND =            13.069764
MAX:HAT =          0.316007        RSTUDENT =        -1.883809
DFFITS =          -0.576901

   COEF     ESTIMATE          STER           TSTAT          PROB>|T|

GECH3.1        3.806514       0.797639       4.772227 8.21233609e-005
GECH3.2        0.904735       0.116967       7.734965        0
```

Government expenditures on chapter 4 are linked to governmemnt investments:

```
ORDINARY LEAST SQUARES

GECH4 = GECH4.1*VJG
```

```
NOB = 25     NOVAR = 1  NCOEF = 1
RANGE: 1971A to 1995A
RSQ =              0.961338        CRSQ =             0.961338
F(1/24) =            NA            PROB>F =           NA
SER =          15342.414707        SSR =       5.64935254e+009
DW(0) =            0.888497        COND =             1
MAX:HAT =          0.140747        RSTUDENT =        -2.132538
DFFITS =           0.809693

   COEF      ESTIMATE          STER           TSTAT          PROB>|T|
GECH4.1        1.909162        0.078152       24.428724         0
```

Oil revenues are estimates as a function of current and lagged opertaing surplus in the oil sector, indicating that it takes some time for the government to get hold of their part of the oil revenues:

```
ORDINARY LEAST SQUARES

LOG(GROIL) = GROIL.1+
GROIL.2*LOG(VYSO)+
GROIL.3*LOG(VYSO(-1))

NOB = 25     NOVAR = 3  NCOEF = 3
RANGE: 1971A to 1995A
RSQ =              0.961702        CRSQ =             0.95822
F(2/22) =        276.218579        PROB>F =           0
SER =              0.175641        SSR =              0.678698
DW(0) =            0.551857        COND =            97.827088
MAX:HAT =          0.328251        RSTUDENT =         2.674946
DFFITS =          -0.884869

   COEF      ESTIMATE          STER           TSTAT          PROB>|T|

GROIL.1       -1.975805        0.600204       -3.291891         0.003325
GROIL.2        0.788434        0.131179        6.010385 4.75672818e-006
GROIL.3        0.365135        0.112727        3.239108         0.003768
```

Other revenues (less import duties and indirect taxes) are a function of lagged operating surplus in the private sector:

```
ORDINARY LEAST SQUARES

GROTH-VYID-VYTPOS = GROTH.1*VYSP(-1)

NOB = 25     NOVAR = 1  NCOEF = 1
RANGE: 1971A to 1995A
RSQ =              0.919441        CRSQ =             0.919441
F(1/24) =            NA            PROB>F =           NA
SER =           9028.893908        SSR =       1.95650220e+009
DW(0) =            0.575876        COND =             1
MAX:HAT =          0.088806        RSTUDENT =         2.403138
DFFITS =          -0.64993

   COEF      ESTIMATE          STER           TSTAT          PROB>|T|

GROTH.1        0.381238        0.023035       16.550515         0
```

Additional data for the Selection Model

D.1. Methods and main results

The Selection Model describes various variables not included in the National Accounts or any other sources. This is for the most parts variables related to the Cobb-Douglas production functions and the demand functions for labour and capital. In this part we describes and document how the numbers have emerged. The following equations, written here in a general form, represents the equations related to the Cobb-Douglas functions in the Selection Model:

(1) $Y_i = TFP_i \cdot E_i^{\alpha_i} \cdot K_i^{1-\alpha_i}$

(2) $E_i = \alpha_i \frac{PYF_i}{W_i} Y_i$

(3) $K_i = (1-\alpha_i) \frac{PYF_i}{PK_i} Y_i$

(4) $J_i = K_i - (1 - \delta_i) * K_{i-1}$

(5) $PK_i = PJP*(IR_i + \delta_i)$

(6) $IR_i = \rho_i * IR$

(7) $W_i = \gamma_i * WP$

where

Y_i	value added in production sector i
TFP_i	total factor productivity
E_i	employment
K_i	capital stock
PYF_i	factor price indices, exclusive net indirect taxes
W_i	wage rate
WP	private sector wage rate
PK_i	user cost of capital
PJP	price index, private sector investments
IR_i	real rate of return to capital
IR	real rate of return to capital
J_i	gross fixed capital formation

subscript i = sector, -1 = last period

δ	depreciation rate
α_i	marginal elasticity with respect to employment
ρ_i	sectoral share of real rate of return
γ_i	sectoral wage share

We assume a Cobb-Douglas production technology with unit elasticity of substitution as stated in (1), and profit maximizing behaviour. This indicates that we can study the elasticities with respect to labour from the first order condition in (2) by rewriting it as

(8) $\alpha_i = (W_i*E_i)/(PYF_i*Y_i)$. This expression yields time series for α_i, shown, together with some statistics, at the end of this annex. The chosen parameters, based on these time series, are presented in table D.1 below.

Table D.1.1 Elasticities

Sector	*ag*	*mi*	*ma*	*ps*	*pr*	*ew*	*td*	*tc*	*fi*	*re*	*cs*	*og*	*cn*
α	0.4	0.8	0.5	0.5	0.3	0.55	0.2	0.7	0.15	0.15	0.6	0.05	0.5

For many sectors we have simply used the historical average as the chosen parameter. This applies to mining, petrochemicals, manufacturing, trade, transport and construction. For the remaining sectors, with more pronounced trends over (parts of) the history, we have based the estimates on the most recent observations; agriculture, petroleum refining, electricity and water, finance and real estate, community services and finally oil and gas.

Based on estimates for employment by sector (Table 6.2 in the Sixth Development Plan) we can calculate wage rate by sector as $W_{it}= VYW_{it} / E_{it}$.

Table D.1.2 Wage rates

W_{it}	*ag*	*mi*	*ma*	*ps*	*pr*	*ew*	*td*	*tc*	*fi*	*re*	*cs*	*og*	*cn*
1994	31.4	365.9	17.4	245.6	254.2	5	5.5	63.9	10	20.5	3.4	132.3	19.1
1995	32.8	367.6	18.5	266.7	257.3	5.1	5.5	64.8	9.8	20.0	3.5	133.0	19.3

The coefficients γ_i relating wages by sectors to the wage rate in the private sector are calculated as $\gamma_i = W_{it} /WP_t$, the ratio between the wage rate in sector i and the aggregate wage rate.

The depreciation rate, showed later in the annex, is assumed the same in all sectors, and is calculated as $\delta_t = DKP_t /KP_{t-1}$, where DKP_t is defined as $DKP_t = JP_t - KP_t + KP_{t-1}$. DKP_t is the amount of capital depreciated from one year to the next measured in constant prices.

Next we calculate the real rate of return of capital for the private sector as

(9) $$IR_t = \frac{PYFP_t \cdot YP_t - VYWP_t - PJP_t \cdot DKP_t}{PJP_t \cdot KP_t}$$

this formula gave the following results:

Table D.1.3 Real rate of return

	IR
1994	0.0968
1995	0.0887

The user cost of capital is defined as

(10) $PK_t = PJP_t *(IR_t + \delta_t)$, and resulted in:

Table D.1.4 User cost

	PK
1994	0.16
1995	0.17

D.1.1 Investments and capital data

The most serious data limitations for implementing the Cobb-Douglas production functions and demand functions for labour and capital are employment, capital stock and investment by sectors. To establish this information we have made some simplifying assumptions and utilized various sources. Most important are the National Accounts and the Sixth Development Plan from the Ministry of Planning. For investment and employment taken from the Sixth Development Plan, see Table 4.6 and Table 6.2 respectively.

Time series for investment by sector used for plan preparation was provided by MOP. These time series was adjusted to correspond with National Accounts figures for the totals of institutional sectors. The private sectors; agriculture (AG), mining (MI), petrochemicals (PS), manufactering (MA), electricity (EW), construction (CN), trade (TD), transport (TC), real estate (RE), finance (FI) and finally community services (CS) was adjusted to correspond to the total of private sector less private housing (since for this sector we have National Account figures). Adjusted time series for private, oil and government sectors, in current values, resulted from

$$VJ_i^{ADJ} = VJ_i + \frac{VJ_i}{\sum_{i\in\kappa} VJ_i}\left(\sum_{i\in\kappa} VJ_i - VJ_s^{NA}\right)$$

where

κ=(AG, MI, PS, MA, EW, CN, TD, TC, RE, FI, CS) for private non-oil sector

κ=(OG, PR) for oil sector

κ=(G) for government sector.

VJ_s^{NA} Gross fixed capital formation by institutional sector s, according to the National Accounts (s=Private non-oil, Governmant, Oil)

VJ_i is investment in sector i, superscript ADJ indicates adjusted values. VJ_i is investments by institutional sector, and superscript NA indicates National Accounts values. The constant price series is obtained by deflating this current values with the price index for private investments. The adjusted values for government sector and oil sector are derived in a similar way.

1. Mining (MI), Transport and communication (TC), Community services (CS), Manufacturing (MA) and Petrochemicals (PS)

For these secors Capital data are calculated from equation (3) with some adjustments for two of the sectors. Capital stock in Manufacturing in 1993 appears to be reasonable based on the historical series generated from (3), while this is not the case for 1994. Accordingly KMA_{94} is set to 58000. For the capital stock in the Petrochemical sector we accept the 1994 value KPS_{94}, but, based on JPS_{94} taken from the plan, we calculate KPS_{93} from the balance equation (4).

2. Real estate (KRE)

The capital stock in Real estate (KRE) is problematic to fix. According to the input-output table the production sector Real estate has significant deliveries to «consumption of housing» (25 per cent of the demand in this cathegory is delivered by the Real estate production sector). The values implemented is generated from perpetual inventory method based on the assumption that investment in this sector is equal to investment in non-residential building, private non-oil sector, (JPH) which is observed from 1969 to 1994. The assumption of a common depreciation rate is perhaps unjustified for housing, which is likely to depreciate at a slower rate.

3. Crude oil and natural gas (OG) and Petroleum refining (PR)

For the capital stock in Crude oil and natural gas, and Petroleum refining, we have utilized both the National Accounts 1994, Table 7, for information from 1989 to 1994 in current values, as well as

spreadsheets provided by Dr. Heinz Muerdter for information from 1969 to 1992. In these figures the two sectors are aggregated. The calculation of JPR and JOG is carried out as follows:

First we want to estimate the share of Petroleum refining in the total Oil sector. From Table 4.6 in the plan, (also from the old version of the Selection Model) we have taken investment in Petrochemicals in 1989 in current value, estimated to 200 million Saudi Riyals. This amounts to 13 per cent of total investment in the Oil sector, taken from Table 7 in The National Accounts, row 6c, where the value is 1534 million Saudi Riyals (200/1534). We want to calculate the sub-aggregates in non-residential buildings and the sum of Transport and Machinery for the Refined products and the Crude oil and natural gas sectors.

1) VJPRB, investment in non-residential buildings, Petroleum refining, measured in current value, is calculated as 13 per cent from the total (row 3c). For 1989 we have (1248*0.13≈163).

2) VJPRTM, investment in Transport and Machinery (aggregated from rows 4c and 5c), Petroleum refining, in current values, is calculated as 13 per cent from the total. For 1989 we have ((168+118)*0.13≈37).

3) VJOGB, investment in non-residential buildings, Crude oil and natural gas, measured in current value, is calculated as the total subtracted VJPRB in 1), or (1-0.13)*1248.

4) VJOGTM, investment in Transport and Machinery (aggregated from rows 4c and 5c), Crude oil and natural gas, in current values, is calculated as the total subtracted VJPRTM in 2), or (1-0.13)*(168+118).

Now we are able to calculate the constant price series:

5) JPRB=VJPRB/PJOB

6) JPRTM= VJPRTM/PJOTM

7) JOGB= VJOGB/PJOB

8) JOGTM= VJOGTM/PJOTM

Then we aggregate:

9) JPR=JPRB+JPRTM, and

10) JOG=JOGB+JOGTM

The capital stock in Electricity, gas and water (KEW) is determined residually from the total of the private sector.

The final estimates for the capital stock are stated below, while investment figures are shown in the appendix.

Table D.1.5 Estimated capital stock (SR million)

Sector	*kmi*	*ktc*	*kcs*	*kma*	*kps*	*kre*	*kag*	*kew*	*kcn*	*ktd*	*kfi*	*kog*	*kpr*
1993	2413	53160	32444	55064	20219	173447	24691	151544	28067	66563	69507	72243	10795
1994	2580	56032	32779	58000	22237	177000	25926	142574	28888	67143	70000	74653	11155
1995	2910	57612	31686	59386	23774	179536	26316	143166	28688	66070	67459	75367	10688

Employment by sector for 1994 is taken from the Sixth Development Plan Table 6.2. The average annual growth rates quoted are applied providing values for 1995. The figures are then fitted to totals of the institutional sectors by the following adjustment:

$$E_i^{ADJ} = E_i^{6DP} + \frac{E_i^{6DP}}{\sum_{i\in\varphi} E_i^{6DP}} \left(E_s^{ACT} - \sum_{i\in\varphi} E_i^{6DP} \right), \text{ where}$$

φ = (AG, CN, CS, EW, FI, MA, MI, PR PS, RE, TC, TD) for private sector,
φ = (OG) for oil sector
φ = (G) for government sector.
E_s^{ACT} Actual employment by institutional sector s (s=Private non-oil, Government, Oil)

Superscript ADJ refer to adjusted values, ACT to actual values and 6DP refer to values taken from the Sixth Development Plan.

Table D.1.6 Employment (1000 persons)

	1994	*1995*	*% Growth*
EAG	394.7	396.7	0.6
ECN	1109.9	1117.6	0.8
ECS	2322.5	2322.5	0.1
EEW	83.4	84.3	1.2
EFI	292.2	295.5	1.2
EMA	567.2	577.4	1.9
EMI	4.6	4.6	0.9
EPR	17.6	17.6	0.3
EPS	8.4	8.4	0.9
ERE	53.3	53.8	1.2
ETC	334.7	335.1	0.2
ETD	1084.8	1089.1	0.5
EOG	57.2	57.5	0.6
EG	824.7	871.7	5.7
Total	7155.2	7231.9	1.07

Total factor productivity by sector (TFP_i) are calculated from the production functions. These values are of course conditional on the chosen parameters in the functions. The expression for the TFP is:

$$TFP_i = \frac{Y_i}{E_i^{\alpha_i} \cdot K_i^{1-\alpha_i}},$$

where
Y_i is value added in sector i
E_i employment in sector i
K_i capital stock in sector i
α_i is marginal elasticity with respect to employment in production

Table D.1.7 Total factor productivity

	TFPAG	*TFPCN*	*TFPCS*	*TFPEW*	*TFPFI*	*TFPMA*	*TFPMI*	*TFPOG*	*TFPPR*	*TFPPS*	*TFPRE*	*TFPTC*	*TFPTD*
1994	6.40	7.54	1.99	0.31	0.65	3.47	128.97	2.81	9.74	8.97	0.14	19.58	1.12
1995	6.35	7.57	2.02	0.32	0.65	3.46	125.91	2.80	9.89	8.84	0.14	19.44	1.13

D.2 Basis for the parameters

As mentioned above, we assume a Cobb-Douglas production technology with unit elasticity of substitution and a profit maximizing behaviour. This indicates that we can study the elasticities with respect to labour from the first order condition:

$\alpha_i = (W_i*E_i)/(PYF_i*Y_i)$

This expression yields time series for α_i , presented here, together with some statistics. Note that $VYW_i=W_i*E_i$. The parameters are chosen on the basis of these time series.

D.2.1. Factor shares

α_{ag} = VYWAG/(PYFAG*YAG):

1969A :	0.808966	0.781189	0.733568	0.694543
1973A :	0.573362	0.532902	0.503191	0.440062
1977A :	0.419964	0.4642	0.510731	0.410281
1981A :	0.34882	0.39121	0.376801	0.387358
1985A :	0.424021	0.398511	0.398544	0.369056
1989A :	0.369065	0.415	0.469919	0.39855
1993A :	0.39855	0.398529		

NVals:	26	Mean:	0.477573
Min:	0.34882	Max:	0.808966
	Standard Deviation:		0.132965

α_{mi} = VYWMI/(PYFMI*YMI):

1969A :	0.9226	0.913147	0.896387	0.869129
1973A :	0.807954	0.782852	0.800118	0.800504
1977A :	0.801778	0.793728	0.858972	0.826587
1981A :	0.797068	0.804036	0.810189	0.80401
1985A :	0.815568	0.79979	0.799812	0.780119
1989A :	0.779801	0.81012	0.779776	0.800114
1993A :	0.799755	0.799905		

NVals:	26	Mean:	0.817455
Min:	0.779776	Max:	0.9226
	Standard Deviation:		0.040134

α_{ps} = VYWPS/(PYFPS*YPS):

1969A :	0	0	0	0
1973A :	0	0	0	0
1977A :	0	0	0	0
1981A :	0	0	0.488836	0.558551
1985A :	0.653585	0.499958	0.499955	0.450009
1989A :	0.449888	0.496588	0.439898	0.493274
1993A :	0.512197	0.490665		

NVals:	26	Mean:	0.232054
Min:	0	Max:	0.653585
	Standard Deviation:		0.258409

α_{ma} = VYWMA/(PYFMA*YMA):

1969A :	0.659392	0.626167	0.573653	0.531021
1973A :	0.410956	0.37457	0.402278	0.406783
1977A :	0.412115	0.424645	0.451135	0.445045
1981A :	0.4522	0.476067	0.504574	0.512328
1985A :	0.550579	0.500012	0.500009	0.449979
1989A :	0.450047	0.500205	0.45292	0.499787
1993A :	0.496013	0.502238		

NVals:	26	Mean:	0.483258
Min:	0.37457	Max:	0.659392
	Standard Deviation:		0.067515

α_{ew} = VYWEW/(PYFEW*YEW):

1969A :	0.912072	0.880484	0.81356	0.764289
1973A :	0.615596	0.568776	0.639345	0.68509
1977A :	0.682478	0.624677	0.620667	0.901011
1981A :	0.581245	0.688094	1.078808	1.278506
1985A :	1.27852	0.548254	0.548337	0.511487
1989A :	0.511184	0.569447	0.492004	0.548241
1993A :	0.548527	0.547691		

NVals:	26	Mean:	0.709169
Min:	0.492004	Max:	1.27852
	Standard Deviation:		0.223348

α_{cn} = VYWCN/(PYFCN*YCN):

1969A :	0.723747	0.693343	0.644787	0.604021
1973A :	0.485563	0.44681	0.482649	0.477533
1977A :	0.488799	0.503175	0.516016	0.506753
1981A :	0.50556	0.500957	0.501309	0.46201
1985A :	0.434652	0.500004	0.499994	0.480044
1989A :	0.480044	0.526637	0.471975	0.494999
1993A :	0.495014	0.495003		

NVals:	26	Mean:	0.516208
Min:	0.434652	Max:	0.723747
	Standard Deviation:		0.070652

α_{td} = VYWTD/(PYFTD*YTD):

1969A :	0.417987	0.382351	0.332193	0.295571
1973A :	0.205647	0.18137	0.192346	0.197927
1977A :	0.203709	0.205251	0.211024	0.186825
1981A :	0.191251	0.195145	0.199154	0.187926
1985A :	0.195739	0.181583	0.181577	0.179999
1989A :	0.180003	0.20921	0.273007	0.181605
1993A :	0.181586	0.181569		

NVals:	26	Mean:	0.220444
Min:	0.179999	Max:	0.417987
	Standard Deviation:		0.064951

α_{tc} = VYWTC/(PYFTC*YTC):

1969A :	0.8457	0.825581	0.791068	0.76083
1973A :	0.661841	0.626507	0.663491	0.681087
1977A :	0.697463	0.691519	0.659578	0.669397
1981A :	0.68796	0.691057	0.730213	0.729247
1985A :	0.724352	0.702563	0.702564	0.702001
1989A :	0.702004	0.739565	0.811901	0.702556
1993A :	0.702558	0.702572		

NVals:	26	Mean:	0.715584
Min:	0.626507	Max:	0.8457
	Standard Deviation:		0.053137

α_{re} = VYWRE/(PYFRE*YRE):

1969A :	0.190112	0.16873	0.139618	0.120613
1973A :	0.078071	0.067501	0.07023	0.070559
1977A :	0.080072	0.086697	0.09984	0.099501
1981A :	0.108736	0.128838	0.127039	0.116388
1985A :	0.125966	0.129466	0.139431	0.16039
1989A :	0.162287	0.189232	0.240919	0.146371
1993A :	0.146151	0.145414		

NVals:	26	Mean:	0.128391
Min:	0.067501	Max:	0.240919
	Standard Deviation:		0.042162

α_{fi} = VYWFI/(PYFFI*YFI):

1969A :	0.190664	0.169373	0.14148	0.120938
1973A :	0.077517	0.067538	0.070252	0.07059
1977A :	0.080379	0.086718	0.09998	0.099671
1981A :	0.109358	0.129439	0.126836	0.116395
1985A :	0.126087	0.129537	0.139381	0.160398
1989A :	0.16235	0.189294	0.240926	0.146375
1993A :	0.146149	0.145609		

NVals:	26	Mean:	0.128586
Min:	0.067538	Max:	0.240926
	Standard Deviation:		0.042234

α_{cs} = VYWCS/(PYFCS*YCS):

1969A :	0.909979	0.877317	0.825075	0.779045
1973A :	0.641251	0.595918	0.626659	0.662707
1977A :	0.722347	0.75684	0.798149	0.677657
1981A :	0.611109	0.602815	0.611821	0.601204
1985A :	0.624029	0.594309	0.594278	0.570471
1989A :	0.570553	0.625938	0.570534	0.582387
1993A :	0.582432	0.58239		

NVals:	26	Mean:	0.661431
Min:	0.570471	Max:	0.909979
	Standard Deviation:		0.100784

α_{og} = VYWOG/(PYFOG*YOG):

1969A :	0.022104	0.019169	0.01545	0.013041
1973A :	0.008088	0.006942	0.008485	0.009655
1977A :	0.012016	0.015238	0.013644	0.010244
1981A :	0.014778	0.022906	0.037848	0.051764
1985A :	0.079269	0.094741	0.090586	0.092604
1989A :	0.079204	0.094367	0.079001	0.041482
1993A :	0.05046	0.051469		

NVals:	26	Mean:	0.039791
Min:	0.006942	Max:	0.094741
	Standard Deviation:		0.03242

α_{pr} = VYWPR/(PYFPR*YPR):

1969A :	0.074582	0.064793	0.05285	0.044867
1973A :	0.028095	0.02432	0.029382	0.038738
1977A :	0.060763	0.087891	0.083941	0.076849
1981A :	0.091086	0.111301	0.18246	0.215226
1985A :	0.239656	0.580416	0.331743	0.346381
1989A :	0.362998	0.280943	0.362972	0.231454
1993A :	0.27961	0.285163		

NVals:	26	Mean:	0.175711
Min:	0.02432	Max:	0.580416
	Standard Deviation:		0.144238

D.2.2 Depreciation

δ_i = DKP/KP(-1)

1970A :	0.030623	0.030736	0.030922	0.031243
1974A :	0.032087	0.032651	0.031865	0.030444
1978A :	0.029104	0.029193	0.031285	0.033104
1982A :	0.036342	0.038327	0.054141	0.038755
1986A :	0.039497	0.041205	0.043106	0.044928
1990A :	0.044439	0.060559	0.066829	0.067761
1994A :	0.063447			

NVals:	25	Mean:	0.040504
Min:	0.029104	Max:	0.067761
	Standard Deviation:		0.012409

D.2.3 User cost

IR = (PYFP*YP-VYWP-PJP*DKP)/(PJP*KP)

Numeric scalar timeseries --
Time dimension: Periodicity 1, 1970A to 1995A (26 observations)

Time dimension -->

1970A :	0.202917	0.265092	0.31331	0.568317
1974A :	0.508339	0.408146	0.403345	0.395123
1978A :	0.381408	0.341583	0.372056	0.406662
1982A :	0.435621	0.336991	0.259993	0.222819
1986A :	0.206502	0.176012	0.134066	0.133671
1990A :	0.131326	0.111067	0.104543	0.100233
1994A :	0.096841	0.088747		

NVals:	26	Mean:	0.273259
Min:	0.088747	Max:	0.568317
	Standard Deviation:		0.141247

The Selection Model

```
ENDOGENOUS :
CP  CPABR  CPCLO  CPENT  CPFOO  CPFUR  CPMED  CPOTH  CPR  CPRABR  CPRCLO  CPREN  CPRENT
CPRFOO  CPRFUR  CPRMED  CPROTH  CPRREN  CPRTRA  CPTRA  DA  E  EAG  ECN  ECS  EEW  EFI  EG  EMA
EMI  EOG  EP  EPR  EPS  ERE  ES  ETC  ETD  GECH12  GECH3  GECH4  GROIL  GROTH  HR  HW  IRAG
IRCN  IRCS  IRFI  IRMA  IRMI  IROG  IRPR  IRPS  IRRE  IRTC  IRTD  J  JAG  JCN  JCS  JFI  JG
JMA  JMI  JO  JOB  JOG  JOTM  JP  JPB  JPH  JPR  JPTM  JRE  JTC  JTD  KAG  KCN  KCS  KEW  KFI
KMA  KMI  KOG  KP  KPR  KPS  KRE  KTC  KTD  M  MC  MS  MSC  NFA  PCG  PCP  PCPABR  PCPCLO
PCPENT  PCPFOO  PCPFUR  PCPMED  PCPN  PCPOTH  PCPR  PCPREN  PCPTRA  PDS  PJGB  PJGTM  PJOB
PJOTM  PJP  PJPB  PJPH  PJPTM  PKAG  PKCN  PKCS  PKFI  PKMA  PKMI  PKOG  PKPR  PKPS  PKRE
PKTC  PKTD  PMID  PXPS  PXX  PY  PYAG  PYBC  PYCN  PYCS  PYEW  PYFAG  PYFBC  PYFCN  PYFCS
PYFEW  PYFFI  PYFGS  PYFI  PYFMA  PYFMI  PYFOG  PYFPR  PYFPS  PYFRE  PYFTC  PYFTD  PYG  PYGS
PYMA  PYMI  PYOG  PYP  PYPR  PYRE  PYTC  PYTD  QP  SG  SP  TFPOG  VCG  VCP  VCPN  VCPR  VJ
VJG  VJO  VJP  VM  VX  VXOG  VXPR  VXPS  VXX  VY  VYAG  VYBC  VYCN  VYCS  VYEW  VYFI  VYG
VYID  VYMA  VYMI  VYOG  VYP  VYPR  VYPS  VYRE  VYSC  VYSH  VYSO  VYSP  VYT  VYTAG  VYTBC  VYTC
VYTCN  VYTCS  VYTD  VYTEW  VYTFI  VYTMA  VYTMI  VYTNEG  VYTOG  VYTP  VYTPOS  VYTPR  VYTPS
VYTRE  VYTTC  VYTTD  VYW  VYWG  VYWO  VYWP  WAG  WCN  WCS  WEW  WFI  WMA  WMI  WOG  WPR  WPS
WRE  WTC  WTD  X  XOG  XPR  XPS  XX  Y  YAG  YBC  YCN  YCS  YEW  YFI  YG  YGS  YID  YMA  YMI
YO  YP  YPR  YPS  YRE  YTC  YTD  Z  ZG  ZP

EXOGENOUS :
CG  CPN  D90  D94  DS  EN  GESS  ICH  IR  JEW  JGB  JGTM  JOGB  JOGTM  JPRB  JPRTM  JPS  LIABP
LRRATE  M0  M2  MIX  PM  POPSA  PXOG  PXPR  PYID  PYPS  QG  RCPRCLO  RCPRENT  RCPRFOO  RCPRFUR
RCPRMED  RCPROTH  RCPRREN  RCPRTRA  REAG  RECN  RECS  REEW  REFI  REMA  REMI  REOG  REPR  REPS
RERE  RETC  RETD  RGECH12  RGECH3  RGECH4  RGROIL  RGROTH  RJAG  RJCN  RJCS  RJEW  RJFI  RJMA
RJMI  RJOG  RJPB  RJPH  RJPR  RJPS  RJPTM  RJRE  RJTC  RJTD  RKAG  RKCN  RKCS  RKFI  RKMA
RKMI  RKOG  RKPR  RKPS  RKRE  RKTC  RKTD  RMS  RPCG  RPCPABR  RPCPCLO  RPCPENT  RPCPFOO
RPCPFUR  RPCPMED  RPCPN  RPCPOTH  RPCPREN  RPCPTRA  RPJGB  RPJGTM  RPJOB  RPJOTM  RPJPB  RPJPH
RPJPTM  RPMID  RPXOG  RPXPR  RPXPS  RPXX  RPYFBC  RPYFGS  RVCPR  RXX  RYAG  RYBC  RYCN  RYCS
RYEW  RYFI  RYGS  RYID  RYMA  RYMI  RYOG  RYPR  RYPS  RYRE  RYTC  RYTD  TAG  TBC  TCN  TCS
TEW  TFI  TFPAG  TFPCN  TFPCS  TFPEW  TFPFI  TFPMA  TFPMI  TFPPR  TFPPS  TFPRE  TFPTC  TFPTD
TGS  THR  TMA  TMI  TOG  TPR  TPS  TRE  TTC  TTD  VYSSHARE  WG  WP  YOG  ZR

1:   VCPR = PCPFOO*CPRFOO+PCPCLO*CPRCLO+PCPREN*CPRREN+PCPFUR*CPRFUR+
     PCPMED*CPRMED+PCPTRA*CPRTRA+PCPENT*CPRENT+PCPOTH*CPROTH+PCPABR*
     CPRABR+RVCPR
2:   CPRFOO = CPRFOO.1+CPRFOO.2/PCPFOO*(VCPR-(CPRFOO.1*PCPFOO+CPRCLO.1
     *PCPCLO+CPRREN.1*PCPREN+CPRFUR.1*PCPFUR+CPRMED.1*PCPMED+CPRTRA.1
     *PCPTRA+CPRENT.1*PCPENT+CPROTH.1*PCPOTH+CPRABR.1*PCPABR))+
     RCPRFOO
3:   CPRCLO = CPRCLO.1+CPRCLO.2/PCPCLO*(VCPR-(CPRFOO.1*PCPFOO+CPRCLO.1
     *PCPCLO+CPRREN.1*PCPREN+CPRFUR.1*PCPFUR+CPRMED.1*PCPMED+CPRTRA.1
     *PCPTRA+CPRENT.1*PCPENT+CPROTH.1*PCPOTH+CPRABR.1*PCPABR))+
     RCPRCLO
4:   CPRREN = CPRREN.1+CPRREN.2/PCPREN*(VCPR-(CPRFOO.1*PCPFOO+CPRCLO.1
     *PCPCLO+CPRREN.1*PCPREN+CPRFUR.1*PCPFUR+CPRMED.1*PCPMED+CPRTRA.1
     *PCPTRA+CPRENT.1*PCPENT+CPROTH.1*PCPOTH+CPRABR.1*PCPABR))+
     RCPRREN
5:   CPRFUR = CPRFUR.1+CPRFUR.2/PCPFUR*(VCPR-(CPRFOO.1*PCPFOO+CPRCLO.1
     *PCPCLO+CPRREN.1*PCPREN+CPRFUR.1*PCPFUR+CPRMED.1*PCPMED+CPRTRA.1
     *PCPTRA+CPRENT.1*PCPENT+CPROTH.1*PCPOTH+CPRABR.1*PCPABR))+
     RCPRFUR
6:   CPRMED = CPRMED.1+CPRMED.2/PCPMED*(VCPR-(CPRFOO.1*PCPFOO+CPRCLO.1
     *PCPCLO+CPRREN.1*PCPREN+CPRFUR.1*PCPFUR+CPRMED.1*PCPMED+CPRTRA.1
     *PCPTRA+CPRENT.1*PCPENT+CPROTH.1*PCPOTH+CPRABR.1*PCPABR))+
     RCPRMED
7:   CPRTRA = CPRTRA.1+CPRTRA.2/PCPTRA*(VCPR-(CPRFOO.1*PCPFOO+CPRCLO.1
     *PCPCLO+CPRREN.1*PCPREN+CPRFUR.1*PCPFUR+CPRMED.1*PCPMED+CPRTRA.1
     *PCPTRA+CPRENT.1*PCPENT+CPROTH.1*PCPOTH+CPRABR.1*PCPABR))+
     RCPRTRA
8:   CPRENT = CPRENT.1+CPRENT.2/PCPENT*(VCPR-(CPRFOO.1*PCPFOO+CPRCLO.1
     *PCPCLO+CPRREN.1*PCPREN+CPRFUR.1*PCPFUR+CPRMED.1*PCPMED+CPRTRA.1
     *PCPTRA+CPRENT.1*PCPENT+CPROTH.1*PCPOTH+CPRABR.1*PCPABR))+
     RCPRENT
9:   CPROTH = CPROTH.1+CPROTH.2/PCPOTH*(VCPR-(CPRFOO.1*PCPFOO+CPRCLO.1
     *PCPCLO+CPRREN.1*PCPREN+CPRFUR.1*PCPFUR+CPRMED.1*PCPMED+CPRTRA.1
     *PCPTRA+CPRENT.1*PCPENT+CPROTH.1*PCPOTH+CPRABR.1*PCPABR))+
     RCPROTH
10:  CPRABR = CPR-(CPRFOO+CPRCLO+CPRREN+CPRFUR+CPRMED+CPRTRA+CPRENT+
      CPROTH)
11:  CPFOO = CPRFOO+0.07*CPN
12:  CPCLO = CPRCLO+0.06*CPN
13:  CPREN = CPRREN
14:  CPFUR = CPRFUR+0.22*CPN
15:  CPMED = CPRMED
16:  CPTRA = CPRTRA+0.01*CPN
17:  CPENT = CPRENT
```

```
18:  CPOTH = CPROTH+0.64*CPN
19:  CPABR = CPRABR
20:  VCP = VCPR+VCPN
21:  CP = CPR+CPN
22:  PCP = VCP/CP
23:  VCG = CG*PCG
24:  DA = CP+CG+J+DS
25:  X = XOG+XPR+XPS+XX+CPN
26:  VX = VXOG+VXPR+VXPS+VXX+VCPN
27:  VXOG = PXOG*XOG
28:  VXPR = PXPR*XPR
29:  VXPS = PXPS*XPS
30:  VXX = PXX*XX
31:  PMID = (0.95*PM+0.05*PYID)*RPMID
32:  DEL(1: LOG(XX)) = XX.1+XX.2*DEL(1: LOG(PM/PXX))+XX.3*LOG(MIX(-1)/XX(-1))+
     XX.4*LOG(PM(-1)/PXX(-1))+RXX
33:  VCPN = PCPN*CPN
34:  DEL(1: LOG(MS)) = MS.1+MS.2*DEL(1: LOG(PMID/PYP))+MS.3*DEL(1: LOG(PMID(-1)/PYP(-)))+
     MS.4*DEL(1: LOG(M(-1)/MS(-1)))+MS.5*LOG(MS(-1))+MS.6*LOG(PMID(-1)/PYP(-1))+MS.7*D94+RMS
35:  MC = MSC*(0.015*CPFOO+0.014*CG+0.012*(JPH+JPB)+0.009*CPOTH+0.073*CPFUR+0.005*JPTM+
     0.02*CPTRA)
36:  MSC = (PM/PYP)**(-8)
37:  M = MS*(A.M.CPFOO*CPFOO+A.M.CPCLO*CPCLO+A.M.CPREN*CPREN+A.M.CPFUR
      *CPFUR+A.M.CPMED*CPMED+A.M.CPTRA*CPTRA+A.M.CPENT*CPENT+A.M.CPOTH
      *CPOTH+A.M.CPABR*CPABR+A.M.JPH*JPH+A.M.JPB*JPB+A.M.JPTM*JPTM+
      A.M.JGB*JGB+A.M.JGTM*JGTM+A.M.JOB*JOB+A.M.JOTM*JOTM+A.M.CG*CG+
      A.M.DS*DS+A.M.XOG*XOG+A.M.XPR*XPR+A.M.XPS*XPS+A.M.XX*XX)-(RYAG+
      RYBC+RYCN+RYCS+RYEW+RYFI+RYGS+RYID+RYMA+RYMI+RYOG+RYPR+RYPS+RYRE
      +RYTC+RYTD)
38:  VM = PM*M
39:  YAG = A.AG.CPFOO*(1-MS*A.M.CPFOO)/(1-A.M.CPFOO)*CPFOO+A.AG.CPCLO*
      (1-MS*A.M.CPCLO)/(1-A.M.CPCLO)*CPCLO+A.AG.CPREN*(1-MS*A.M.CPREN)
      /(1-A.M.CPREN)*CPREN+A.AG.CPFUR*(1-MS*A.M.CPFUR)/(1-A.M.CPFUR)*
      CPFUR+A.AG.CPMED*(1-MS*A.M.CPMED)/(1-A.M.CPMED)*CPMED+A.AG.CPTRA
      *(1-MS*A.M.CPTRA)/(1-A.M.CPTRA)*CPTRA+A.AG.CPENT*(1-MS*A.M.CPENT
      )/(1-A.M.CPENT)*CPENT+A.AG.CPOTH*(1-MS*A.M.CPOTH)/(1-A.M.CPOTH)*
      CPOTH+A.AG.CPABR*(1-MS*A.M.CPABR)/(1-A.M.CPABR)*CPABR+A.AG.JPH*(
      1-MS*A.M.JPH)/(1-A.M.JPH)*JPH+A.AG.JPB*(1-MS*A.M.JPB)/(1-A.M.JPB
      )*JPB+A.AG.JPTM*(1-MS*A.M.JPTM)/(1-A.M.JPTM)*JPTM+A.AG.JGB*(1-MS
      *A.M.JGB)/(1-A.M.JGB)*JGB+A.AG.JGTM*(1-MS*A.M.JGTM)/(1-A.M.JGTM)
      *JGTM+A.AG.JOB*(1-MS*A.M.JOB)/(1-A.M.JOB)*JOB+A.AG.JOTM*(1-MS*
      A.M.JOTM)/(1-A.M.JOTM)*JOTM+A.AG.CG*(1-MS*A.M.CG)/(1-A.M.CG)*CG+
      A.AG.DS*(1-MS*A.M.DS)/(1-A.M.DS)*DS+A.AG.XOG*(1-MS*A.M.XOG)/(1-
      A.M.XOG)*XOG+A.AG.XPR*(1-MS*A.M.XPR)/(1-A.M.XPR)*XPR+A.AG.XPS*(1
      -MS*A.M.XPS)/(1-A.M.XPS)*XPS+A.AG.XX*(1-MS*A.M.XX)/(1-A.M.XX)*XX
      +RYAG
40:  YMI = A.MI.CPFOO*(1-MS*A.M.CPFOO)/(1-A.M.CPFOO)*CPFOO+A.MI.CPCLO*
      (1-MS*A.M.CPCLO)/(1-A.M.CPCLO)*CPCLO+A.MI.CPREN*(1-MS*A.M.CPREN)
      /(1-A.M.CPREN)*CPREN+A.MI.CPFUR*(1-MS*A.M.CPFUR)/(1-A.M.CPFUR)*
      CPFUR+A.MI.CPMED*(1-MS*A.M.CPMED)/(1-A.M.CPMED)*CPMED+A.MI.CPTRA
      *(1-MS*A.M.CPTRA)/(1-A.M.CPTRA)*CPTRA+A.MI.CPENT*(1-MS*A.M.CPENT
      )/(1-A.M.CPENT)*CPENT+A.MI.CPOTH*(1-MS*A.M.CPOTH)/(1-A.M.CPOTH)*
      CPOTH+A.MI.CPABR*(1-MS*A.M.CPABR)/(1-A.M.CPABR)*CPABR+A.MI.JPH*(
      1-MS*A.M.JPH)/(1-A.M.JPH)*JPH+A.MI.JPB*(1-MS*A.M.JPB)/(1-A.M.JPB
      )*JPB+A.MI.JPTM*(1-MS*A.M.JPTM)/(1-A.M.JPTM)*JPTM+A.MI.JGB*(1-MS
      *A.M.JGB)/(1-A.M.JGB)*JGB+A.MI.JGTM*(1-MS*A.M.JGTM)/(1-A.M.JGTM)
      *JGTM+A.MI.JOB*(1-MS*A.M.JOB)/(1-A.M.JOB)*JOB+A.MI.JOTM*(1-MS*
      A.M.JOTM)/(1-A.M.JOTM)*JOTM+A.MI.CG*(1-MS*A.M.CG)/(1-A.M.CG)*CG+
      A.MI.DS*(1-MS*A.M.DS)/(1-A.M.DS)*DS+A.MI.XOG*(1-MS*A.M.XOG)/(1-
      A.M.XOG)*XOG+A.MI.XPR*(1-MS*A.M.XPR)/(1-A.M.XPR)*XPR+A.MI.XPS*(1
      -MS*A.M.XPS)/(1-A.M.XPS)*XPS+A.MI.XX*(1-MS*A.M.XX)/(1-A.M.XX)*XX
      +RYMI
41:  YPS = A.PS.CPFOO*(1-MS*A.M.CPFOO)/(1-A.M.CPFOO)*CPFOO+A.PS.CPCLO*
      (1-MS*A.M.CPCLO)/(1-A.M.CPCLO)*CPCLO+A.PS.CPREN*(1-MS*A.M.CPREN)
      /(1-A.M.CPREN)*CPREN+A.PS.CPFUR*(1-MS*A.M.CPFUR)/(1-A.M.CPFUR)*
      CPFUR+A.PS.CPMED*(1-MS*A.M.CPMED)/(1-A.M.CPMED)*CPMED+A.PS.CPTRA
      *(1-MS*A.M.CPTRA)/(1-A.M.CPTRA)*CPTRA+A.PS.CPENT*(1-MS*A.M.CPENT
      )/(1-A.M.CPENT)*CPENT+A.PS.CPOTH*(1-MS*A.M.CPOTH)/(1-A.M.CPOTH)*
      CPOTH+A.PS.CPABR*(1-MS*A.M.CPABR)/(1-A.M.CPABR)*CPABR+A.PS.JPH*(
      1-MS*A.M.JPH)/(1-A.M.JPH)*JPH+A.PS.JPB*(1-MS*A.M.JPB)/(1-A.M.JPB
      )*JPB+A.PS.JPTM*(1-MS*A.M.JPTM)/(1-A.M.JPTM)*JPTM+A.PS.JGB*(1-MS
      *A.M.JGB)/(1-A.M.JGB)*JGB+A.PS.JGTM*(1-MS*A.M.JGTM)/(1-A.M.JGTM)
      *JGTM+A.PS.JOB*(1-MS*A.M.JOB)/(1-A.M.JOB)*JOB+A.PS.JOTM*(1-MS*
      A.M.JOTM)/(1-A.M.JOTM)*JOTM+A.PS.CG*(1-MS*A.M.CG)/(1-A.M.CG)*CG+
      A.PS.DS*(1-MS*A.M.DS)/(1-A.M.DS)*DS+A.PS.XOG*(1-MS*A.M.XOG)/(1-
      A.M.XOG)*XOG+A.PS.XPR*(1-MS*A.M.XPR)/(1-A.M.XPR)*XPR+A.PS.XPS*(1
      -MS*A.M.XPS)/(1-A.M.XPS)*XPS+A.PS.XX*(1-MS*A.M.XX)/(1-A.M.XX)*XX
      +RYPS
42:  YMA = A.MA.CPFOO*(1-MS*A.M.CPFOO)/(1-A.M.CPFOO)*CPFOO+A.MA.CPCLO*
      (1-MS*A.M.CPCLO)/(1-A.M.CPCLO)*CPCLO+A.MA.CPREN*(1-MS*A.M.CPREN)
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      /(1-A.M.CPREN)*CPREN+A.MA.CPFUR*(1-MS*A.M.CPFUR)/(1-A.M.CPFUR)*
      CPFUR+A.MA.CPMED*(1-MS*A.M.CPMED)/(1-A.M.CPMED)*CPMED+A.MA.CPTRA
      *(1-MS*A.M.CPTRA)/(1-A.M.CPTRA)*CPTRA+A.MA.CPENT*(1-MS*A.M.CPENT
      )/(1-A.M.CPENT)*CPENT+A.MA.CPOTH*(1-MS*A.M.CPOTH)/(1-A.M.CPOTH)*
      CPOTH+A.MA.CPABR*(1-MS*A.M.CPABR)/(1-A.M.CPABR)*CPABR+A.MA.JPH*(
      1-MS*A.M.JPH)/(1-A.M.JPH)*JPH+A.MA.JPB*(1-MS*A.M.JPB)/(1-A.M.JPB
      )*JPB+A.MA.JPTM*(1-MS*A.M.JPTM)/(1-A.M.JPTM)*JPTM+A.MA.JGB*(1-MS
      *A.M.JGB)/(1-A.M.JGB)*JGB+A.MA.JGTM*(1-MS*A.M.JGTM)/(1-A.M.JGTM)
      *JGTM+A.MA.JOB*(1-MS*A.M.JOB)/(1-A.M.JOB)*JOB+A.MA.JOTM*(1-MS*
      A.M.JOTM)/(1-A.M.JOTM)*JOTM+A.MA.CG*(1-MS*A.M.CG)/(1-A.M.CG)*CG+
      A.MA.DS*(1-MS*A.M.DS)/(1-A.M.DS)*DS+A.MA.XOG*(1-MS*A.M.XOG)/(1-
      A.M.XOG)*XOG+A.MA.XPR*(1-MS*A.M.XPR)/(1-A.M.XPR)*XPR+A.MA.XPS*(1
      -MS*A.M.XPS)/(1-A.M.XPS)*XPS+A.MA.XX*(1-MS*A.M.XX)/(1-A.M.XX)*XX
      +RYMA
43:   YEW = A.EW.CPF00*(1-MS*A.M.CPF00)/(1-A.M.CPF00)*CPF00+A.EW.CPCLO*
      (1-MS*A.M.CPCLO)/(1-A.M.CPCLO)*CPCLO+A.EW.CPREN*(1-MS*A.M.CPREN)
      /(1-A.M.CPREN)*CPREN+A.EW.CPFUR*(1-MS*A.M.CPFUR)/(1-A.M.CPFUR)*
      CPFUR+A.EW.CPMED*(1-MS*A.M.CPMED)/(1-A.M.CPMED)*CPMED+A.EW.CPTRA
      *(1-MS*A.M.CPTRA)/(1-A.M.CPTRA)*CPTRA+A.EW.CPENT*(1-MS*A.M.CPENT
      )/(1-A.M.CPENT)*CPENT+A.EW.CPOTH*(1-MS*A.M.CPOTH)/(1-A.M.CPOTH)*
      CPOTH+A.EW.CPABR*(1-MS*A.M.CPABR)/(1-A.M.CPABR)*CPABR+A.EW.JPH*(
      1-MS*A.M.JPH)/(1-A.M.JPH)*JPH+A.EW.JPB*(1-MS*A.M.JPB)/(1-A.M.JPB
      )*JPB+A.EW.JPTM*(1-MS*A.M.JPTM)/(1-A.M.JPTM)*JPTM+A.EW.JGB*(1-MS
      *A.M.JGB)/(1-A.M.JGB)*JGB+A.EW.JGTM*(1-MS*A.M.JGTM)/(1-A.M.JGTM)
      *JGTM+A.EW.JOB*(1-MS*A.M.JOB)/(1-A.M.JOB)*JOB+A.EW.JOTM*(1-MS*
      A.M.JOTM)/(1-A.M.JOTM)*JOTM+A.EW.CG*(1-MS*A.M.CG)/(1-A.M.CG)*CG+
      A.EW.DS*(1-MS*A.M.DS)/(1-A.M.DS)*DS+A.EW.XOG*(1-MS*A.M.XOG)/(1-
      A.M.XOG)*XOG+A.EW.XPR*(1-MS*A.M.XPR)/(1-A.M.XPR)*XPR+A.EW.XPS*(1
      -MS*A.M.XPS)/(1-A.M.XPS)*XPS+A.EW.XX*(1-MS*A.M.XX)/(1-A.M.XX)*XX
      +RYEW
44:   YCN = A.CN.CPF00*(1-MS*A.M.CPF00)/(1-A.M.CPF00)*CPF00+A.CN.CPCLO*
      (1-MS*A.M.CPCLO)/(1-A.M.CPCLO)*CPCLO+A.CN.CPREN*(1-MS*A.M.CPREN)
      /(1-A.M.CPREN)*CPREN+A.CN.CPFUR*(1-MS*A.M.CPFUR)/(1-A.M.CPFUR)*
      CPFUR+A.CN.CPMED*(1-MS*A.M.CPMED)/(1-A.M.CPMED)*CPMED+A.CN.CPTRA
      *(1-MS*A.M.CPTRA)/(1-A.M.CPTRA)*CPTRA+A.CN.CPENT*(1-MS*A.M.CPENT
      )/(1-A.M.CPENT)*CPENT+A.CN.CPOTH*(1-MS*A.M.CPOTH)/(1-A.M.CPOTH)*
      CPOTH+A.CN.CPABR*(1-MS*A.M.CPABR)/(1-A.M.CPABR)*CPABR+A.CN.JPH*(
      1-MS*A.M.JPH)/(1-A.M.JPH)*JPH+A.CN.JPB*(1-MS*A.M.JPB)/(1-A.M.JPB
      )*JPB+A.CN.JPTM*(1-MS*A.M.JPTM)/(1-A.M.JPTM)*JPTM+A.CN.JGB*(1-MS
      *A.M.JGB)/(1-A.M.JGB)*JGB+A.CN.JGTM*(1-MS*A.M.JGTM)/(1-A.M.JGTM)
      *JGTM+A.CN.JOB*(1-MS*A.M.JOB)/(1-A.M.JOB)*JOB+A.CN.JOTM*(1-MS*
      A.M.JOTM)/(1-A.M.JOTM)*JOTM+A.CN.CG*(1-MS*A.M.CG)/(1-A.M.CG)*CG+
      A.CN.DS*(1-MS*A.M.DS)/(1-A.M.DS)*DS+A.CN.XOG*(1-MS*A.M.XOG)/(1-
      A.M.XOG)*XOG+A.CN.XPR*(1-MS*A.M.XPR)/(1-A.M.XPR)*XPR+A.CN.XPS*(1
      -MS*A.M.XPS)/(1-A.M.XPS)*XPS+A.CN.XX*(1-MS*A.M.XX)/(1-A.M.XX)*XX
      +RYCN
45:   YTD = A.TD.CPF00*(1-MS*A.M.CPF00)/(1-A.M.CPF00)*CPF00+A.TD.CPCLO*
      (1-MS*A.M.CPCLO)/(1-A.M.CPCLO)*CPCLO+A.TD.CPREN*(1-MS*A.M.CPREN)
      /(1-A.M.CPREN)*CPREN+A.TD.CPFUR*(1-MS*A.M.CPFUR)/(1-A.M.CPFUR)*
      CPFUR+A.TD.CPMED*(1-MS*A.M.CPMED)/(1-A.M.CPMED)*CPMED+A.TD.CPTRA
      *(1-MS*A.M.CPTRA)/(1-A.M.CPTRA)*CPTRA+A.TD.CPENT*(1-MS*A.M.CPENT
      )/(1-A.M.CPENT)*CPENT+A.TD.CPOTH*(1-MS*A.M.CPOTH)/(1-A.M.CPOTH)*
      CPOTH+A.TD.CPABR*(1-MS*A.M.CPABR)/(1-A.M.CPABR)*CPABR+A.TD.JPH*(
      1-MS*A.M.JPH)/(1-A.M.JPH)*JPH+A.TD.JPB*(1-MS*A.M.JPB)/(1-A.M.JPB
      )*JPB+A.TD.JPTM*(1-MS*A.M.JPTM)/(1-A.M.JPTM)*JPTM+A.TD.JGB*(1-MS
      *A.M.JGB)/(1-A.M.JGB)*JGB+A.TD.JGTM*(1-MS*A.M.JGTM)/(1-A.M.JGTM)
      *JGTM+A.TD.JOB*(1-MS*A.M.JOB)/(1-A.M.JOB)*JOB+A.TD.JOTM*(1-MS*
      A.M.JOTM)/(1-A.M.JOTM)*JOTM+A.TD.CG*(1-MS*A.M.CG)/(1-A.M.CG)*CG+
      A.TD.DS*(1-MS*A.M.DS)/(1-A.M.DS)*DS+A.TD.XOG*(1-MS*A.M.XOG)/(1-
      A.M.XOG)*XOG+A.TD.XPR*(1-MS*A.M.XPR)/(1-A.M.XPR)*XPR+A.TD.XPS*(1
      -MS*A.M.XPS)/(1-A.M.XPS)*XPS+A.TD.XX*(1-MS*A.M.XX)/(1-A.M.XX)*XX
      +RYTD
46:   YTC = A.TC.CPF00*(1-MS*A.M.CPF00)/(1-A.M.CPF00)*CPF00+A.TC.CPCLO*
      (1-MS*A.M.CPCLO)/(1-A.M.CPCLO)*CPCLO+A.TC.CPREN*(1-MS*A.M.CPREN)
      /(1-A.M.CPREN)*CPREN+A.TC.CPFUR*(1-MS*A.M.CPFUR)/(1-A.M.CPFUR)*
      CPFUR+A.TC.CPMED*(1-MS*A.M.CPMED)/(1-A.M.CPMED)*CPMED+A.TC.CPTRA
      *(1-MS*A.M.CPTRA)/(1-A.M.CPTRA)*CPTRA+A.TC.CPENT*(1-MS*A.M.CPENT
      )/(1-A.M.CPENT)*CPENT+A.TC.CPOTH*(1-MS*A.M.CPOTH)/(1-A.M.CPOTH)*
      CPOTH+A.TC.CPABR*(1-MS*A.M.CPABR)/(1-A.M.CPABR)*CPABR+A.TC.JPH*(
      1-MS*A.M.JPH)/(1-A.M.JPH)*JPH+A.TC.JPB*(1-MS*A.M.JPB)/(1-A.M.JPB
      )*JPB+A.TC.JPTM*(1-MS*A.M.JPTM)/(1-A.M.JPTM)*JPTM+A.TC.JGB*(1-MS
      *A.M.JGB)/(1-A.M.JGB)*JGB+A.TC.JGTM*(1-MS*A.M.JGTM)/(1-A.M.JGTM)
      *JGTM+A.TC.JOB*(1-MS*A.M.JOB)/(1-A.M.JOB)*JOB+A.TC.JOTM*(1-MS*
      A.M.JOTM)/(1-A.M.JOTM)*JOTM+A.TC.CG*(1-MS*A.M.CG)/(1-A.M.CG)*CG+
      A.TC.DS*(1-MS*A.M.DS)/(1-A.M.DS)*DS+A.TC.XOG*(1-MS*A.M.XOG)/(1-
      A.M.XOG)*XOG+A.TC.XPR*(1-MS*A.M.XPR)/(1-A.M.XPR)*XPR+A.TC.XPS*(1
      -MS*A.M.XPS)/(1-A.M.XPS)*XPS+A.TC.XX*(1-MS*A.M.XX)/(1-A.M.XX)*XX
      +RYTC
47:   YRE = A.RE.CPF00*(1-MS*A.M.CPF00)/(1-A.M.CPF00)*CPF00+A.RE.CPCLO*
      (1-MS*A.M.CPCLO)/(1-A.M.CPCLO)*CPCLO+A.RE.CPREN*(1-MS*A.M.CPREN)
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      /(1-A.M.CPREN)*CPREN+A.RE.CPFUR*(1-MS*A.M.CPFUR)/(1-A.M.CPFUR)*
      CPFUR+A.RE.CPMED*(1-MS*A.M.CPMED)/(1-A.M.CPMED)*CPMED+A.RE.CPTRA
      *(1-MS*A.M.CPTRA)/(1-A.M.CPTRA)*CPTRA+A.RE.CPENT*(1-MS*A.M.CPENT
      )/(1-A.M.CPENT)*CPENT+A.RE.CPOTH*(1-MS*A.M.CPOTH)/(1-A.M.CPOTH)*
      CPOTH+A.RE.CPABR*(1-MS*A.M.CPABR)/(1-A.M.CPABR)*CPABR+A.RE.JPH*(
      1-MS*A.M.JPH)/(1-A.M.JPH)*JPH+A.RE.JPB*(1-MS*A.M.JPB)/(1-A.M.JPB
      )*JPB+A.RE.JPTM*(1-MS*A.M.JPTM)/(1-A.M.JPTM)*JPTM+A.RE.JGB*(1-MS
      *A.M.JGB)/(1-A.M.JGB)*JGB+A.RE.JGTM*(1-MS*A.M.JGTM)/(1-A.M.JGTM)
      *JGTM+A.RE.JOB*(1-MS*A.M.JOB)/(1-A.M.JOB)*JOB+A.RE.JOTM*(1-MS*
      A.M.JOTM)/(1-A.M.JOTM)*JOTM+A.RE.CG*(1-MS*A.M.CG)/(1-A.M.CG)*CG+
      A.RE.DS*(1-MS*A.M.DS)/(1-A.M.DS)*DS+A.RE.XOG*(1-MS*A.M.XOG)/(1-
      A.M.XOG)*XOG+A.RE.XPR*(1-MS*A.M.XPR)/(1-A.M.XPR)*XPR+A.RE.XPS*(1
      -MS*A.M.XPS)/(1-A.M.XPS)*XPS+A.RE.XX*(1-MS*A.M.XX)/(1-A.M.XX)*XX
      +RYRE
48:   YFI = A.FI.CPFOO*(1-MS*A.M.CPFOO)/(1-A.M.CPFOO)*CPFOO+A.FI.CPCLO*
      (1-MS*A.M.CPCLO)/(1-A.M.CPCLO)*CPCLO+A.FI.CPREN*(1-MS*A.M.CPREN)
      /(1-A.M.CPREN)*CPREN+A.FI.CPFUR*(1-MS*A.M.CPFUR)/(1-A.M.CPFUR)*
      CPFUR+A.FI.CPMED*(1-MS*A.M.CPMED)/(1-A.M.CPMED)*CPMED+A.FI.CPTRA
      *(1-MS*A.M.CPTRA)/(1-A.M.CPTRA)*CPTRA+A.FI.CPENT*(1-MS*A.M.CPENT
      )/(1-A.M.CPENT)*CPENT+A.FI.CPOTH*(1-MS*A.M.CPOTH)/(1-A.M.CPOTH)*
      CPOTH+A.FI.CPABR*(1-MS*A.M.CPABR)/(1-A.M.CPABR)*CPABR+A.FI.JPH*(
      1-MS*A.M.JPH)/(1-A.M.JPH)*JPH+A.FI.JPB*(1-MS*A.M.JPB)/(1-A.M.JPB
      )*JPB+A.FI.JPTM*(1-MS*A.M.JPTM)/(1-A.M.JPTM)*JPTM+A.FI.JGB*(1-MS
      *A.M.JGB)/(1-A.M.JGB)*JGB+A.FI.JGTM*(1-MS*A.M.JGTM)/(1-A.M.JGTM)
      *JGTM+A.FI.JOB*(1-MS*A.M.JOB)/(1-A.M.JOB)*JOB+A.FI.JOTM*(1-MS*
      A.M.JOTM)/(1-A.M.JOTM)*JOTM+A.FI.CG*(1-MS*A.M.CG)/(1-A.M.CG)*CG+
      A.FI.DS*(1-MS*A.M.DS)/(1-A.M.DS)*DS+A.FI.XOG*(1-MS*A.M.XOG)/(1-
      A.M.XOG)*XOG+A.FI.XPR*(1-MS*A.M.XPR)/(1-A.M.XPR)*XPR+A.FI.XPS*(1
      -MS*A.M.XPS)/(1-A.M.XPS)*XPS+A.FI.XX*(1-MS*A.M.XX)/(1-A.M.XX)*XX
      +RYFI
49:   YCS = A.CS.CPFOO*(1-MS*A.M.CPFOO)/(1-A.M.CPFOO)*CPFOO+A.CS.CPCLO*
      (1-MS*A.M.CPCLO)/(1-A.M.CPCLO)*CPCLO+A.CS.CPREN*(1-MS*A.M.CPREN)
      /(1-A.M.CPREN)*CPREN+A.CS.CPFUR*(1-MS*A.M.CPFUR)/(1-A.M.CPFUR)*
      CPFUR+A.CS.CPMED*(1-MS*A.M.CPMED)/(1-A.M.CPMED)*CPMED+A.CS.CPTRA
      *(1-MS*A.M.CPTRA)/(1-A.M.CPTRA)*CPTRA+A.CS.CPENT*(1-MS*A.M.CPENT
      )/(1-A.M.CPENT)*CPENT+A.CS.CPOTH*(1-MS*A.M.CPOTH)/(1-A.M.CPOTH)*
      CPOTH+A.CS.CPABR*(1-MS*A.M.CPABR)/(1-A.M.CPABR)*CPABR+A.CS.JPH*(
      1-MS*A.M.JPH)/(1-A.M.JPH)*JPH+A.CS.JPB*(1-MS*A.M.JPB)/(1-A.M.JPB
      )*JPB+A.CS.JPTM*(1-MS*A.M.JPTM)/(1-A.M.JPTM)*JPTM+A.CS.JGB*(1-MS
      *A.M.JGB)/(1-A.M.JGB)*JGB+A.CS.JGTM*(1-MS*A.M.JGTM)/(1-A.M.JGTM)
      *JGTM+A.CS.JOB*(1-MS*A.M.JOB)/(1-A.M.JOB)*JOB+A.CS.JOTM*(1-MS*
      A.M.JOTM)/(1-A.M.JOTM)*JOTM+A.CS.CG*(1-MS*A.M.CG)/(1-A.M.CG)*CG+
      A.CS.DS*(1-MS*A.M.DS)/(1-A.M.DS)*DS+A.CS.XOG*(1-MS*A.M.XOG)/(1-
      A.M.XOG)*XOG+A.CS.XPR*(1-MS*A.M.XPR)/(1-A.M.XPR)*XPR+A.CS.XPS*(1
      -MS*A.M.XPS)/(1-A.M.XPS)*XPS+A.CS.XX*(1-MS*A.M.XX)/(1-A.M.XX)*XX
      +RYCS
50:   YGS = A.GS.CPFOO*(1-MS*A.M.CPFOO)/(1-A.M.CPFOO)*CPFOO+A.GS.CPCLO*
      (1-MS*A.M.CPCLO)/(1-A.M.CPCLO)*CPCLO+A.GS.CPREN*(1-MS*A.M.CPREN)
      /(1-A.M.CPREN)*CPREN+A.GS.CPFUR*(1-MS*A.M.CPFUR)/(1-A.M.CPFUR)*
      CPFUR+A.GS.CPMED*(1-MS*A.M.CPMED)/(1-A.M.CPMED)*CPMED+A.GS.CPTRA
      *(1-MS*A.M.CPTRA)/(1-A.M.CPTRA)*CPTRA+A.GS.CPENT*(1-MS*A.M.CPENT
      )/(1-A.M.CPENT)*CPENT+A.GS.CPOTH*(1-MS*A.M.CPOTH)/(1-A.M.CPOTH)*
      CPOTH+A.GS.CPABR*(1-MS*A.M.CPABR)/(1-A.M.CPABR)*CPABR+A.GS.JPH*(
      1-MS*A.M.JPH)/(1-A.M.JPH)*JPH+A.GS.JPB*(1-MS*A.M.JPB)/(1-A.M.JPB
      )*JPB+A.GS.JPTM*(1-MS*A.M.JPTM)/(1-A.M.JPTM)*JPTM+A.GS.JGB*(1-MS
      *A.M.JGB)/(1-A.M.JGB)*JGB+A.GS.JGTM*(1-MS*A.M.JGTM)/(1-A.M.JGTM)
      *JGTM+A.GS.JOB*(1-MS*A.M.JOB)/(1-A.M.JOB)*JOB+A.GS.JOTM*(1-MS*
      A.M.JOTM)/(1-A.M.JOTM)*JOTM+A.GS.CG*(1-MS*A.M.CG)/(1-A.M.CG)*CG+
      A.GS.DS*(1-MS*A.M.DS)/(1-A.M.DS)*DS+A.GS.XOG*(1-MS*A.M.XOG)/(1-
      A.M.XOG)*XOG+A.GS.XPR*(1-MS*A.M.XPR)/(1-A.M.XPR)*XPR+A.GS.XPS*(1
      -MS*A.M.XPS)/(1-A.M.XPS)*XPS+A.GS.XX*(1-MS*A.M.XX)/(1-A.M.XX)*XX
      +RYGS
51:   YBC = A.BC.CPFOO*(1-MS*A.M.CPFOO)/(1-A.M.CPFOO)*CPFOO+A.BC.CPCLO*
      (1-MS*A.M.CPCLO)/(1-A.M.CPCLO)*CPCLO+A.BC.CPREN*(1-MS*A.M.CPREN)
      /(1-A.M.CPREN)*CPREN+A.BC.CPFUR*(1-MS*A.M.CPFUR)/(1-A.M.CPFUR)*
      CPFUR+A.BC.CPMED*(1-MS*A.M.CPMED)/(1-A.M.CPMED)*CPMED+A.BC.CPTRA
      *(1-MS*A.M.CPTRA)/(1-A.M.CPTRA)*CPTRA+A.BC.CPENT*(1-MS*A.M.CPENT
      )/(1-A.M.CPENT)*CPENT+A.BC.CPOTH*(1-MS*A.M.CPOTH)/(1-A.M.CPOTH)*
      CPOTH+A.BC.CPABR*(1-MS*A.M.CPABR)/(1-A.M.CPABR)*CPABR+A.BC.JPH*(
      1-MS*A.M.JPH)/(1-A.M.JPH)*JPH+A.BC.JPB*(1-MS*A.M.JPB)/(1-A.M.JPB
      )*JPB+A.BC.JPTM*(1-MS*A.M.JPTM)/(1-A.M.JPTM)*JPTM+A.BC.JGB*(1-MS
      *A.M.JGB)/(1-A.M.JGB)*JGB+A.BC.JGTM*(1-MS*A.M.JGTM)/(1-A.M.JGTM)
      *JGTM+A.BC.JOB*(1-MS*A.M.JOB)/(1-A.M.JOB)*JOB+A.BC.JOTM*(1-MS*
      A.M.JOTM)/(1-A.M.JOTM)*JOTM+A.BC.CG*(1-MS*A.M.CG)/(1-A.M.CG)*CG+
      A.BC.DS*(1-MS*A.M.DS)/(1-A.M.DS)*DS+A.BC.XOG*(1-MS*A.M.XOG)/(1-
      A.M.XOG)*XOG+A.BC.XPR*(1-MS*A.M.XPR)/(1-A.M.XPR)*XPR+A.BC.XPS*(1
      -MS*A.M.XPS)/(1-A.M.XPS)*XPS+A.BC.XX*(1-MS*A.M.XX)/(1-A.M.XX)*XX
      +RYBC
52:   YOG = A.OG.CPFOO*(1-MS*A.M.CPFOO)/(1-A.M.CPFOO)*CPFOO+A.OG.CPCLO*
      (1-MS*A.M.CPCLO)/(1-A.M.CPCLO)*CPCLO+A.OG.CPREN*(1-MS*A.M.CPREN)
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      /(1-A.M.CPREN)*CPREN+A.OG.CPFUR*(1-MS*A.M.CPFUR)/(1-A.M.CPFUR)*
      CPFUR+A.OG.CPMED*(1-MS*A.M.CPMED)/(1-A.M.CPMED)*CPMED+A.OG.CPTRA
      *(1-MS*A.M.CPTRA)/(1-A.M.CPTRA)*CPTRA+A.OG.CPENT*(1-MS*A.M.CPENT
      )/(1-A.M.CPENT)*CPENT+A.OG.CPOTH*(1-MS*A.M.CPOTH)/(1-A.M.CPOTH)*
      CPOTH+A.OG.CPABR*(1-MS*A.M.CPABR)/(1-A.M.CPABR)*CPABR+A.OG.JPH*(
      1-MS*A.M.JPH)/(1-A.M.JPH)*JPH+A.OG.JPB*(1-MS*A.M.JPB)/(1-A.M.JPB
      )*JPB+A.OG.JPTM*(1-MS*A.M.JPTM)/(1-A.M.JPTM)*JPTM+A.OG.JGB*(1-MS
      *A.M.JGB)/(1-A.M.JGB)*JGB+A.OG.JGTM*(1-MS*A.M.JGTM)/(1-A.M.JGTM)
      *JGTM+A.OG.JOB*(1-MS*A.M.JOB)/(1-A.M.JOB)*JOB+A.OG.JOTM*(1-MS*
      A.M.JOTM)/(1-A.M.JOTM)*JOTM+A.OG.CG*(1-MS*A.M.CG)/(1-A.M.CG)*CG+
      A.OG.DS*(1-MS*A.M.DS)/(1-A.M.DS)*DS+A.OG.XOG*(1-MS*A.M.XOG)/(1-
      A.M.XOG)*XOG+A.OG.XPR*(1-MS*A.M.XPR)/(1-A.M.XPR)*XPR+A.OG.XPS*(1
      -MS*A.M.XPS)/(1-A.M.XPS)*XPS+A.OG.XX*(1-MS*A.M.XX)/(1-A.M.XX)*XX
      +RYOG
53:   YPR = A.PR.CPFOO*(1-MS*A.M.CPFOO)/(1-A.M.CPFOO)*CPFOO+A.PR.CPCLO*
      (1-MS*A.M.CPCLO)/(1-A.M.CPCLO)*CPCLO+A.PR.CPREN*(1-MS*A.M.CPREN)
      /(1-A.M.CPREN)*CPREN+A.PR.CPFUR*(1-MS*A.M.CPFUR)/(1-A.M.CPFUR)*
      CPFUR+A.PR.CPMED*(1-MS*A.M.CPMED)/(1-A.M.CPMED)*CPMED+A.PR.CPTRA
      *(1-MS*A.M.CPTRA)/(1-A.M.CPTRA)*CPTRA+A.PR.CPENT*(1-MS*A.M.CPENT
      )/(1-A.M.CPENT)*CPENT+A.PR.CPOTH*(1-MS*A.M.CPOTH)/(1-A.M.CPOTH)*
      CPOTH+A.PR.CPABR*(1-MS*A.M.CPABR)/(1-A.M.CPABR)*CPABR+A.PR.JPH*(
      1-MS*A.M.JPH)/(1-A.M.JPH)*JPH+A.PR.JPB*(1-MS*A.M.JPB)/(1-A.M.JPB
      )*JPB+A.PR.JPTM*(1-MS*A.M.JPTM)/(1-A.M.JPTM)*JPTM+A.PR.JGB*(1-MS
      *A.M.JGB)/(1-A.M.JGB)*JGB+A.PR.JGTM*(1-MS*A.M.JGTM)/(1-A.M.JGTM)
      *JGTM+A.PR.JOB*(1-MS*A.M.JOB)/(1-A.M.JOB)*JOB+A.PR.JOTM*(1-MS*
      A.M.JOTM)/(1-A.M.JOTM)*JOTM+A.PR.CG*(1-MS*A.M.CG)/(1-A.M.CG)*CG+
      A.PR.DS*(1-MS*A.M.DS)/(1-A.M.DS)*DS+A.PR.XOG*(1-MS*A.M.XOG)/(1-
      A.M.XOG)*XOG+A.PR.XPR*(1-MS*A.M.XPR)/(1-A.M.XPR)*XPR+A.PR.XPS*(1
      -MS*A.M.XPS)/(1-A.M.XPS)*XPS+A.PR.XX*(1-MS*A.M.XX)/(1-A.M.XX)*XX
      +RYPR
54:   YID = A.ID.CPFOO*(1-MS*A.M.CPFOO)/(1-A.M.CPFOO)*CPFOO+A.ID.CPCLO*
      (1-MS*A.M.CPCLO)/(1-A.M.CPCLO)*CPCLO+A.ID.CPREN*(1-MS*A.M.CPREN)
      /(1-A.M.CPREN)*CPREN+A.ID.CPFUR*(1-MS*A.M.CPFUR)/(1-A.M.CPFUR)*
      CPFUR+A.ID.CPMED*(1-MS*A.M.CPMED)/(1-A.M.CPMED)*CPMED+A.ID.CPTRA
      *(1-MS*A.M.CPTRA)/(1-A.M.CPTRA)*CPTRA+A.ID.CPENT*(1-MS*A.M.CPENT
      )/(1-A.M.CPENT)*CPENT+A.ID.CPOTH*(1-MS*A.M.CPOTH)/(1-A.M.CPOTH)*
      CPOTH+A.ID.CPABR*(1-MS*A.M.CPABR)/(1-A.M.CPABR)*CPABR+A.ID.JPH*(
      1-MS*A.M.JPH)/(1-A.M.JPH)*JPH+A.ID.JPB*(1-MS*A.M.JPB)/(1-A.M.JPB
      )*JPB+A.ID.JPTM*(1-MS*A.M.JPTM)/(1-A.M.JPTM)*JPTM+A.ID.JGB*(1-MS
      *A.M.JGB)/(1-A.M.JGB)*JGB+A.ID.JGTM*(1-MS*A.M.JGTM)/(1-A.M.JGTM)
      *JGTM+A.ID.JOB*(1-MS*A.M.JOB)/(1-A.M.JOB)*JOB+A.ID.JOTM*(1-MS*
      A.M.JOTM)/(1-A.M.JOTM)*JOTM+A.ID.CG*(1-MS*A.M.CG)/(1-A.M.CG)*CG+
      A.ID.DS*(1-MS*A.M.DS)/(1-A.M.DS)*DS+A.ID.XOG*(1-MS*A.M.XOG)/(1-
      A.M.XOG)*XOG+A.ID.XPR*(1-MS*A.M.XPR)/(1-A.M.XPR)*XPR+A.ID.XPS*(1
      -MS*A.M.XPS)/(1-A.M.XPS)*XPS+A.ID.XX*(1-MS*A.M.XX)/(1-A.M.XX)*XX
      +RYID
55:   YP = YAG+YMI+YPS+YMA+YEW+YCN+YTD+YTC+YRE+YFI+YCS+YBC
56:   VYP = PYAG*YAG+PYMI*YMI+PYPS*YPS+PYMA*YMA+PYEW*YEW+PYCN*YCN+PYTD*
       YTD+PYTC*YTC+PYRE*YRE+PYFI*YFI+PYCS*YCS+PYBC*YBC
57:   YO = YOG+YPR
58:   YG = YGS
59:   Y = YP+YO+YG+YID
60:   VYG = PYG*YG
61:   PYG = PYGS
62:   VYID = PYID*YID
63:   VY = VYP+VYOG+VYPR+VYG+VYID
64:   PY = VY/Y
65:   VYWP = WP*EP
66:   VYWG = WG*EG
67:   VYWO = EOG*WOG+EPR*WPR
68:   VYW = VYWP+VYWG+VYWO
69:   HR = VYW+VYSH+GESS
70:   HW = M2-M0-LIABP
71:   PYAG = (1-TAG.0)/(1-TAG)*PYFAG
72:   PYMI = (1-TMI.0)/(1-TMI)*PYFMI
73:   PYMA = (1-TMA.0)/(1-TMA)*PYFMA
74:   PYCN = (1-TCN.0)/(1-TCN)*PYFCN
75:   PYTD = (1-TTD.0)/(1-TTD)*PYFTD
76:   PYTC = (1-TTC.0)/(1-TTC)*PYFTC
77:   PYCS = (1-TCS.0)/(1-TCS)*PYFCS
78:   PYGS = (1-TGS.0)/(1-TGS)*PYFGS
79:   PYPS = (1-TPS.0)/(1-TPS)*PYFPS
80:   PYEW = (1-TEW.0)/(1-TEW)*PYFEW
81:   PYRE = (1-TRE.0)/(1-TRE)*PYFRE
82:   PYFI = (1-TFI.0)/(1-TFI)*PYFFI
83:   PYBC = (1-TBC.0)/(1-TBC)*PYFBC
84:   PYPR = (1-TPR.0)/(1-TPR)*PYFPR
85:   PYOG = (1-TOG.0)/(1-TOG)*PYFOG
86:   PYFBC = PYFFI*RPYFBC
87:   PYP = VYP/YP
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88:  PYFGS = WG*RPYFGS
89:  PCPFOO = (MS*A.M.CPFOO*PM+A.AG.CPFOO*(1-MS*A.M.CPFOO)/(1-
      A.M.CPFOO)*PYAG+A.MI.CPFOO*(1-MS*A.M.CPFOO)/(1-A.M.CPFOO)*PYMI+
      A.PS.CPFOO*(1-MS*A.M.CPFOO)/(1-A.M.CPFOO)*PYPS+A.MA.CPFOO*(1-MS*
      A.M.CPFOO)/(1-A.M.CPFOO)*PYMA+A.EW.CPFOO*(1-MS*A.M.CPFOO)/(1-
      A.M.CPFOO)*PYEW+A.CN.CPFOO*(1-MS*A.M.CPFOO)/(1-A.M.CPFOO)*PYCN+
      A.TD.CPFOO*(1-MS*A.M.CPFOO)/(1-A.M.CPFOO)*PYTD+A.TC.CPFOO*(1-MS*
      A.M.CPFOO)/(1-A.M.CPFOO)*PYTC+A.RE.CPFOO*(1-MS*A.M.CPFOO)/(1-
      A.M.CPFOO)*PYRE+A.FI.CPFOO*(1-MS*A.M.CPFOO)/(1-A.M.CPFOO)*PYFI+
      A.CS.CPFOO*(1-MS*A.M.CPFOO)/(1-A.M.CPFOO)*PYCS+A.GS.CPFOO*(1-MS*
      A.M.CPFOO)/(1-A.M.CPFOO)*PYGS+A.BC.CPFOO*(1-MS*A.M.CPFOO)/(1-
      A.M.CPFOO)*PYBC+A.OG.CPFOO*(1-MS*A.M.CPFOO)/(1-A.M.CPFOO)*PYOG+
      A.PR.CPFOO*(1-MS*A.M.CPFOO)/(1-A.M.CPFOO)*PYPR+A.ID.CPFOO*(1-MS*
      A.M.CPFOO)/(1-A.M.CPFOO)*PYID)*RPCPFOO
90:  PCPCLO = (MS*A.M.CPCLO*PM+A.AG.CPCLO*(1-MS*A.M.CPCLO)/(1-
      A.M.CPCLO)*PYAG+A.MI.CPCLO*(1-MS*A.M.CPCLO)/(1-A.M.CPCLO)*PYMI+
      A.PS.CPCLO*(1-MS*A.M.CPCLO)/(1-A.M.CPCLO)*PYPS+A.MA.CPCLO*(1-MS*
      A.M.CPCLO)/(1-A.M.CPCLO)*PYMA+A.EW.CPCLO*(1-MS*A.M.CPCLO)/(1-
      A.M.CPCLO)*PYEW+A.CN.CPCLO*(1-MS*A.M.CPCLO)/(1-A.M.CPCLO)*PYCN+
      A.TD.CPCLO*(1-MS*A.M.CPCLO)/(1-A.M.CPCLO)*PYTD+A.TC.CPCLO*(1-MS*
      A.M.CPCLO)/(1-A.M.CPCLO)*PYTC+A.RE.CPCLO*(1-MS*A.M.CPCLO)/(1-
      A.M.CPCLO)*PYRE+A.FI.CPCLO*(1-MS*A.M.CPCLO)/(1-A.M.CPCLO)*PYFI+
      A.CS.CPCLO*(1-MS*A.M.CPCLO)/(1-A.M.CPCLO)*PYCS+A.GS.CPCLO*(1-MS*
      A.M.CPCLO)/(1-A.M.CPCLO)*PYGS+A.BC.CPCLO*(1-MS*A.M.CPCLO)/(1-
      A.M.CPCLO)*PYBC+A.OG.CPCLO*(1-MS*A.M.CPCLO)/(1-A.M.CPCLO)*PYOG+
      A.PR.CPCLO*(1-MS*A.M.CPCLO)/(1-A.M.CPCLO)*PYPR+A.ID.CPCLO*(1-MS*
      A.M.CPCLO)/(1-A.M.CPCLO)*PYID)*RPCPCLO
91:  PCPREN = (MS*A.M.CPREN*PM+A.AG.CPREN*(1-MS*A.M.CPREN)/(1-
      A.M.CPREN)*PYAG+A.MI.CPREN*(1-MS*A.M.CPREN)/(1-A.M.CPREN)*PYMI+
      A.PS.CPREN*(1-MS*A.M.CPREN)/(1-A.M.CPREN)*PYPS+A.MA.CPREN*(1-MS*
      A.M.CPREN)/(1-A.M.CPREN)*PYMA+A.EW.CPREN*(1-MS*A.M.CPREN)/(1-
      A.M.CPREN)*PYEW+A.CN.CPREN*(1-MS*A.M.CPREN)/(1-A.M.CPREN)*PYCN+
      A.TD.CPREN*(1-MS*A.M.CPREN)/(1-A.M.CPREN)*PYTD+A.TC.CPREN*(1-MS*
      A.M.CPREN)/(1-A.M.CPREN)*PYTC+A.RE.CPREN*(1-MS*A.M.CPREN)/(1-
      A.M.CPREN)*PYRE+A.FI.CPREN*(1-MS*A.M.CPREN)/(1-A.M.CPREN)*PYFI+
      A.CS.CPREN*(1-MS*A.M.CPREN)/(1-A.M.CPREN)*PYCS+A.GS.CPREN*(1-MS*
      A.M.CPREN)/(1-A.M.CPREN)*PYGS+A.BC.CPREN*(1-MS*A.M.CPREN)/(1-
      A.M.CPREN)*PYBC+A.OG.CPREN*(1-MS*A.M.CPREN)/(1-A.M.CPREN)*PYOG+
      A.PR.CPREN*(1-MS*A.M.CPREN)/(1-A.M.CPREN)*PYPR+A.ID.CPREN*(1-MS*
      A.M.CPREN)/(1-A.M.CPREN)*PYID)*RPCPREN
92:  PCPFUR = (MS*A.M.CPFUR*PM+A.AG.CPFUR*(1-MS*A.M.CPFUR)/(1-
      A.M.CPFUR)*PYAG+A.MI.CPFUR*(1-MS*A.M.CPFUR)/(1-A.M.CPFUR)*PYMI+
      A.PS.CPFUR*(1-MS*A.M.CPFUR)/(1-A.M.CPFUR)*PYPS+A.MA.CPFUR*(1-MS*
      A.M.CPFUR)/(1-A.M.CPFUR)*PYMA+A.EW.CPFUR*(1-MS*A.M.CPFUR)/(1-
      A.M.CPFUR)*PYEW+A.CN.CPFUR*(1-MS*A.M.CPFUR)/(1-A.M.CPFUR)*PYCN+
      A.TD.CPFUR*(1-MS*A.M.CPFUR)/(1-A.M.CPFUR)*PYTD+A.TC.CPFUR*(1-MS*
      A.M.CPFUR)/(1-A.M.CPFUR)*PYTC+A.RE.CPFUR*(1-MS*A.M.CPFUR)/(1-
      A.M.CPFUR)*PYRE+A.FI.CPFUR*(1-MS*A.M.CPFUR)/(1-A.M.CPFUR)*PYFI+
      A.CS.CPFUR*(1-MS*A.M.CPFUR)/(1-A.M.CPFUR)*PYCS+A.GS.CPFUR*(1-MS*
      A.M.CPFUR)/(1-A.M.CPFUR)*PYGS+A.BC.CPFUR*(1-MS*A.M.CPFUR)/(1-
      A.M.CPFUR)*PYBC+A.OG.CPFUR*(1-MS*A.M.CPFUR)/(1-A.M.CPFUR)*PYOG+
      A.PR.CPFUR*(1-MS*A.M.CPFUR)/(1-A.M.CPFUR)*PYPR+A.ID.CPFUR*(1-MS*
      A.M.CPFUR)/(1-A.M.CPFUR)*PYID)*RPCPFUR
93:  PCPMED = (MS*A.M.CPMED*PM+A.AG.CPMED*(1-MS*A.M.CPMED)/(1-
      A.M.CPMED)*PYAG+A.MI.CPMED*(1-MS*A.M.CPMED)/(1-A.M.CPMED)*PYMI+
      A.PS.CPMED*(1-MS*A.M.CPMED)/(1-A.M.CPMED)*PYPS+A.MA.CPMED*(1-MS*
      A.M.CPMED)/(1-A.M.CPMED)*PYMA+A.EW.CPMED*(1-MS*A.M.CPMED)/(1-
      A.M.CPMED)*PYEW+A.CN.CPMED*(1-MS*A.M.CPMED)/(1-A.M.CPMED)*PYCN+
      A.TD.CPMED*(1-MS*A.M.CPMED)/(1-A.M.CPMED)*PYTD+A.TC.CPMED*(1-MS*
      A.M.CPMED)/(1-A.M.CPMED)*PYTC+A.RE.CPMED*(1-MS*A.M.CPMED)/(1-
      A.M.CPMED)*PYRE+A.FI.CPMED*(1-MS*A.M.CPMED)/(1-A.M.CPMED)*PYFI+
      A.CS.CPMED*(1-MS*A.M.CPMED)/(1-A.M.CPMED)*PYCS+A.GS.CPMED*(1-MS*
      A.M.CPMED)/(1-A.M.CPMED)*PYGS+A.BC.CPMED*(1-MS*A.M.CPMED)/(1-
      A.M.CPMED)*PYBC+A.OG.CPMED*(1-MS*A.M.CPMED)/(1-A.M.CPMED)*PYOG+
      A.PR.CPMED*(1-MS*A.M.CPMED)/(1-A.M.CPMED)*PYPR+A.ID.CPMED*(1-MS*
      A.M.CPMED)/(1-A.M.CPMED)*PYID)*RPCPMED
94:  PCPTRA = (MS*A.M.CPTRA*PM+A.AG.CPTRA*(1-MS*A.M.CPTRA)/(1-
      A.M.CPTRA)*PYAG+A.MI.CPTRA*(1-MS*A.M.CPTRA)/(1-A.M.CPTRA)*PYMI+
      A.PS.CPTRA*(1-MS*A.M.CPTRA)/(1-A.M.CPTRA)*PYPS+A.MA.CPTRA*(1-MS*
      A.M.CPTRA)/(1-A.M.CPTRA)*PYMA+A.EW.CPTRA*(1-MS*A.M.CPTRA)/(1-
      A.M.CPTRA)*PYEW+A.CN.CPTRA*(1-MS*A.M.CPTRA)/(1-A.M.CPTRA)*PYCN+
      A.TD.CPTRA*(1-MS*A.M.CPTRA)/(1-A.M.CPTRA)*PYTD+A.TC.CPTRA*(1-MS*
      A.M.CPTRA)/(1-A.M.CPTRA)*PYTC+A.RE.CPTRA*(1-MS*A.M.CPTRA)/(1-
      A.M.CPTRA)*PYRE+A.FI.CPTRA*(1-MS*A.M.CPTRA)/(1-A.M.CPTRA)*PYFI+
      A.CS.CPTRA*(1-MS*A.M.CPTRA)/(1-A.M.CPTRA)*PYCS+A.GS.CPTRA*(1-MS*
      A.M.CPTRA)/(1-A.M.CPTRA)*PYGS+A.BC.CPTRA*(1-MS*A.M.CPTRA)/(1-
      A.M.CPTRA)*PYBC+A.OG.CPTRA*(1-MS*A.M.CPTRA)/(1-A.M.CPTRA)*PYOG+
      A.PR.CPTRA*(1-MS*A.M.CPTRA)/(1-A.M.CPTRA)*PYPR+A.ID.CPTRA*(1-MS*
      A.M.CPTRA)/(1-A.M.CPTRA)*PYID)*RPCPTRA
95:  PCPENT = (MS*A.M.CPENT*PM+A.AG.CPENT*(1-MS*A.M.CPENT)/(1-
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      A.M.CPENT)*PYAG+A.MI.CPENT*(1-MS*A.M.CPENT)/(1-A.M.CPENT)*PYMI+
      A.PS.CPENT*(1-MS*A.M.CPENT)/(1-A.M.CPENT)*PYPS+A.MA.CPENT*(1-MS*
      A.M.CPENT)/(1-A.M.CPENT)*PYMA+A.EW.CPENT*(1-MS*A.M.CPENT)/(1-
      A.M.CPENT)*PYEW+A.CN.CPENT*(1-MS*A.M.CPENT)/(1-A.M.CPENT)*PYCN+
      A.TD.CPENT*(1-MS*A.M.CPENT)/(1-A.M.CPENT)*PYTD+A.TC.CPENT*(1-MS*
      A.M.CPENT)/(1-A.M.CPENT)*PYTC+A.RE.CPENT*(1-MS*A.M.CPENT)/(1-
      A.M.CPENT)*PYRE+A.FI.CPENT*(1-MS*A.M.CPENT)/(1-A.M.CPENT)*PYFI+
      A.CS.CPENT*(1-MS*A.M.CPENT)/(1-A.M.CPENT)*PYCS+A.GS.CPENT*(1-MS*
      A.M.CPENT)/(1-A.M.CPENT)*PYGS+A.BC.CPENT*(1-MS*A.M.CPENT)/(1-
      A.M.CPENT)*PYBC+A.OG.CPENT*(1-MS*A.M.CPENT)/(1-A.M.CPENT)*PYOG+
      A.PR.CPENT*(1-MS*A.M.CPENT)/(1-A.M.CPENT)*PYPR+A.ID.CPENT*(1-MS*
      A.M.CPENT)/(1-A.M.CPENT)*PYID)*RPCPENT
96:   PCPOTH = (MS*A.M.CPOTH*PM+A.AG.CPOTH*(1-MS*A.M.CPOTH)/(1-
      A.M.CPOTH)*PYAG+A.MI.CPOTH*(1-MS*A.M.CPOTH)/(1-A.M.CPOTH)*PYMI+
      A.PS.CPOTH*(1-MS*A.M.CPOTH)/(1-A.M.CPOTH)*PYPS+A.MA.CPOTH*(1-MS*
      A.M.CPOTH)/(1-A.M.CPOTH)*PYMA+A.EW.CPOTH*(1-MS*A.M.CPOTH)/(1-
      A.M.CPOTH)*PYEW+A.CN.CPOTH*(1-MS*A.M.CPOTH)/(1-A.M.CPOTH)*PYCN+
      A.TD.CPOTH*(1-MS*A.M.CPOTH)/(1-A.M.CPOTH)*PYTD+A.TC.CPOTH*(1-MS*
      A.M.CPOTH)/(1-A.M.CPOTH)*PYTC+A.RE.CPOTH*(1-MS*A.M.CPOTH)/(1-
      A.M.CPOTH)*PYRE+A.FI.CPOTH*(1-MS*A.M.CPOTH)/(1-A.M.CPOTH)*PYFI+
      A.CS.CPOTH*(1-MS*A.M.CPOTH)/(1-A.M.CPOTH)*PYCS+A.GS.CPOTH*(1-MS*
      A.M.CPOTH)/(1-A.M.CPOTH)*PYGS+A.BC.CPOTH*(1-MS*A.M.CPOTH)/(1-
      A.M.CPOTH)*PYBC+A.OG.CPOTH*(1-MS*A.M.CPOTH)/(1-A.M.CPOTH)*PYOG+
      A.PR.CPOTH*(1-MS*A.M.CPOTH)/(1-A.M.CPOTH)*PYPR+A.ID.CPOTH*(1-MS*
      A.M.CPOTH)/(1-A.M.CPOTH)*PYID)*RPCPOTH
97:   PCPABR = (MS*A.M.CPABR*PM+A.AG.CPABR*(1-MS*A.M.CPABR)/(1-
      A.M.CPABR)*PYAG+A.MI.CPABR*(1-MS*A.M.CPABR)/(1-A.M.CPABR)*PYMI+
      A.PS.CPABR*(1-MS*A.M.CPABR)/(1-A.M.CPABR)*PYPS+A.MA.CPABR*(1-MS*
      A.M.CPABR)/(1-A.M.CPABR)*PYMA+A.EW.CPABR*(1-MS*A.M.CPABR)/(1-
      A.M.CPABR)*PYEW+A.CN.CPABR*(1-MS*A.M.CPABR)/(1-A.M.CPABR)*PYCN+
      A.TD.CPABR*(1-MS*A.M.CPABR)/(1-A.M.CPABR)*PYTD+A.TC.CPABR*(1-MS*
      A.M.CPABR)/(1-A.M.CPABR)*PYTC+A.RE.CPABR*(1-MS*A.M.CPABR)/(1-
      A.M.CPABR)*PYRE+A.FI.CPABR*(1-MS*A.M.CPABR)/(1-A.M.CPABR)*PYFI+
      A.CS.CPABR*(1-MS*A.M.CPABR)/(1-A.M.CPABR)*PYCS+A.GS.CPABR*(1-MS*
      A.M.CPABR)/(1-A.M.CPABR)*PYGS+A.BC.CPABR*(1-MS*A.M.CPABR)/(1-
      A.M.CPABR)*PYBC+A.OG.CPABR*(1-MS*A.M.CPABR)/(1-A.M.CPABR)*PYOG+
      A.PR.CPABR*(1-MS*A.M.CPABR)/(1-A.M.CPABR)*PYPR+A.ID.CPABR*(1-MS*
      A.M.CPABR)/(1-A.M.CPABR)*PYID)*RPCPABR
98:   PCPR = VCPR/CPR
99:   PJPH = (MS*A.M.JPH*PM+A.AG.JPH*(1-MS*A.M.JPH)/(1-A.M.JPH)*PYAG+
      A.MI.JPH*(1-MS*A.M.JPH)/(1-A.M.JPH)*PYMI+A.PS.JPH*(1-MS*A.M.JPH)
      /(1-A.M.JPH)*PYPS+A.MA.JPH*(1-MS*A.M.JPH)/(1-A.M.JPH)*PYMA+
      A.EW.JPH*(1-MS*A.M.JPH)/(1-A.M.JPH)*PYEW+A.CN.JPH*(1-MS*A.M.JPH)
      /(1-A.M.JPH)*PYCN+A.TD.JPH*(1-MS*A.M.JPH)/(1-A.M.JPH)*PYTD+
      A.TC.JPH*(1-MS*A.M.JPH)/(1-A.M.JPH)*PYTC+A.RE.JPH*(1-MS*A.M.JPH)
      /(1-A.M.JPH)*PYRE+A.FI.JPH*(1-MS*A.M.JPH)/(1-A.M.JPH)*PYFI+
      A.CS.JPH*(1-MS*A.M.JPH)/(1-A.M.JPH)*PYCS+A.GS.JPH*(1-MS*A.M.JPH)
      /(1-A.M.JPH)*PYGS+A.BC.JPH*(1-MS*A.M.JPH)/(1-A.M.JPH)*PYBC+
      A.OG.JPH*(1-MS*A.M.JPH)/(1-A.M.JPH)*PYOG+A.PR.JPH*(1-MS*A.M.JPH)
      /(1-A.M.JPH)*PYPR+A.ID.JPH*(1-MS*A.M.JPH)/(1-A.M.JPH)*PYID)*
      RPJPH
100:  PJPB = (MS*A.M.JPB*PM+A.AG.JPB*(1-MS*A.M.JPB)/(1-A.M.JPB)*PYAG+
       A.MI.JPB*(1-MS*A.M.JPB)/(1-A.M.JPB)*PYMI+A.PS.JPB*(1-MS*A.M.JPB)
       /(1-A.M.JPB)*PYPS+A.MA.JPB*(1-MS*A.M.JPB)/(1-A.M.JPB)*PYMA+
       A.EW.JPB*(1-MS*A.M.JPB)/(1-A.M.JPB)*PYEW+A.CN.JPB*(1-MS*A.M.JPB)
       /(1-A.M.JPB)*PYCN+A.TD.JPB*(1-MS*A.M.JPB)/(1-A.M.JPB)*PYTD+
       A.TC.JPB*(1-MS*A.M.JPB)/(1-A.M.JPB)*PYTC+A.RE.JPB*(1-MS*A.M.JPB)
       /(1-A.M.JPB)*PYRE+A.FI.JPB*(1-MS*A.M.JPB)/(1-A.M.JPB)*PYFI+
       A.CS.JPB*(1-MS*A.M.JPB)/(1-A.M.JPB)*PYCS+A.GS.JPB*(1-MS*A.M.JPB)
       /(1-A.M.JPB)*PYGS+A.BC.JPB*(1-MS*A.M.JPB)/(1-A.M.JPB)*PYBC+
       A.OG.JPB*(1-MS*A.M.JPB)/(1-A.M.JPB)*PYOG+A.PR.JPB*(1-MS*A.M.JPB)
       /(1-A.M.JPB)*PYPR+A.ID.JPB*(1-MS*A.M.JPB)/(1-A.M.JPB)*PYID)*
       RPJPB
101:  PJPTM = (MS*A.M.JPTM*PM+A.AG.JPTM*(1-MS*A.M.JPTM)/(1-A.M.JPTM)*
       PYAG+A.MI.JPTM*(1-MS*A.M.JPTM)/(1-A.M.JPTM)*PYMI+A.PS.JPTM*(1-MS
       *A.M.JPTM)/(1-A.M.JPTM)*PYPS+A.MA.JPTM*(1-MS*A.M.JPTM)/(1-
       A.M.JPTM)*PYMA+A.EW.JPTM*(1-MS*A.M.JPTM)/(1-A.M.JPTM)*PYEW+
       A.CN.JPTM*(1-MS*A.M.JPTM)/(1-A.M.JPTM)*PYCN+A.TD.JPTM*(1-MS*
       A.M.JPTM)/(1-A.M.JPTM)*PYTD+A.TC.JPTM*(1-MS*A.M.JPTM)/(1-
       A.M.JPTM)*PYTC+A.RE.JPTM*(1-MS*A.M.JPTM)/(1-A.M.JPTM)*PYRE+
       A.FI.JPTM*(1-MS*A.M.JPTM)/(1-A.M.JPTM)*PYFI+A.CS.JPTM*(1-MS*
       A.M.JPTM)/(1-A.M.JPTM)*PYCS+A.GS.JPTM*(1-MS*A.M.JPTM)/(1-
       A.M.JPTM)*PYGS+A.BC.JPTM*(1-MS*A.M.JPTM)/(1-A.M.JPTM)*PYBC+
       A.OG.JPTM*(1-MS*A.M.JPTM)/(1-A.M.JPTM)*PYOG+A.PR.JPTM*(1-MS*
       A.M.JPTM)/(1-A.M.JPTM)*PYPR+A.ID.JPTM*(1-MS*A.M.JPTM)/(1-
       A.M.JPTM)*PYID)*RPJPTM
102:  PJGB = (MS*A.M.JGB*PM+A.AG.JGB*(1-MS*A.M.JGB)/(1-A.M.JGB)*PYAG+
       A.MI.JGB*(1-MS*A.M.JGB)/(1-A.M.JGB)*PYMI+A.PS.JGB*(1-MS*A.M.JGB)
       /(1-A.M.JGB)*PYPS+A.MA.JGB*(1-MS*A.M.JGB)/(1-A.M.JGB)*PYMA+
       A.EW.JGB*(1-MS*A.M.JGB)/(1-A.M.JGB)*PYEW+A.CN.JGB*(1-MS*A.M.JGB)
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        /(1-A.M.JGB)*PYCN+A.TD.JGB*(1-MS*A.M.JGB)/(1-A.M.JGB)*PYTD+
        A.TC.JGB*(1-MS*A.M.JGB)/(1-A.M.JGB)*PYTC+A.RE.JGB*(1-MS*A.M.JGB)
        /(1-A.M.JGB)*PYRE+A.FI.JGB*(1-MS*A.M.JGB)/(1-A.M.JGB)*PYFI+
        A.CS.JGB*(1-MS*A.M.JGB)/(1-A.M.JGB)*PYCS+A.GS.JGB*(1-MS*A.M.JGB)
        /(1-A.M.JGB)*PYGS+A.BC.JGB*(1-MS*A.M.JGB)/(1-A.M.JGB)*PYBC+
        A.OG.JGB*(1-MS*A.M.JGB)/(1-A.M.JGB)*PYOG+A.PR.JGB*(1-MS*A.M.JGB)
        /(1-A.M.JGB)*PYPR+A.ID.JGB*(1-MS*A.M.JGB)/(1-A.M.JGB)*PYID)*
        RPJGB
103:    PJGTM = (MS*A.M.JGTM*PM+A.AG.JGTM*(1-MS*A.M.JGTM)/(1-A.M.JGTM)*
        PYAG+A.MI.JGTM*(1-MS*A.M.JGTM)/(1-A.M.JGTM)*PYMI+A.PS.JGTM*(1-MS
        *A.M.JGTM)/(1-A.M.JGTM)*PYPS+A.MA.JGTM*(1-MS*A.M.JGTM)/(1-
        A.M.JGTM)*PYMA+A.EW.JGTM*(1-MS*A.M.JGTM)/(1-A.M.JGTM)*PYEW+
        A.CN.JGTM*(1-MS*A.M.JGTM)/(1-A.M.JGTM)*PYCN+A.TD.JGTM*(1-MS*
        A.M.JGTM)/(1-A.M.JGTM)*PYTD+A.TC.JGTM*(1-MS*A.M.JGTM)/(1-
        A.M.JGTM)*PYTC+A.RE.JGTM*(1-MS*A.M.JGTM)/(1-A.M.JGTM)*PYRE+
        A.FI.JGTM*(1-MS*A.M.JGTM)/(1-A.M.JGTM)*PYFI+A.CS.JGTM*(1-MS*
        A.M.JGTM)/(1-A.M.JGTM)*PYCS+A.GS.JGTM*(1-MS*A.M.JGTM)/(1-
        A.M.JGTM)*PYGS+A.BC.JGTM*(1-MS*A.M.JGTM)/(1-A.M.JGTM)*PYBC+
        A.OG.JGTM*(1-MS*A.M.JGTM)/(1-A.M.JGTM)*PYOG+A.PR.JGTM*(1-MS*
        A.M.JGTM)/(1-A.M.JGTM)*PYPR+A.ID.JGTM*(1-MS*A.M.JGTM)/(1-
        A.M.JGTM)*PYID)*RPJGTM
104:    PJOB = (MS*A.M.JOB*PM+A.AG.JOB*(1-MS*A.M.JOB)/(1-A.M.JOB)*PYAG+
        A.MI.JOB*(1-MS*A.M.JOB)/(1-A.M.JOB)*PYMI+A.PS.JOB*(1-MS*A.M.JOB)
        /(1-A.M.JOB)*PYPS+A.MA.JOB*(1-MS*A.M.JOB)/(1-A.M.JOB)*PYMA+
        A.EW.JOB*(1-MS*A.M.JOB)/(1-A.M.JOB)*PYEW+A.CN.JOB*(1-MS*A.M.JOB)
        /(1-A.M.JOB)*PYCN+A.TD.JOB*(1-MS*A.M.JOB)/(1-A.M.JOB)*PYTD+
        A.TC.JOB*(1-MS*A.M.JOB)/(1-A.M.JOB)*PYTC+A.RE.JOB*(1-MS*A.M.JOB)
        /(1-A.M.JOB)*PYRE+A.FI.JOB*(1-MS*A.M.JOB)/(1-A.M.JOB)*PYFI+
        A.CS.JOB*(1-MS*A.M.JOB)/(1-A.M.JOB)*PYCS+A.GS.JOB*(1-MS*A.M.JOB)
        /(1-A.M.JOB)*PYGS+A.BC.JOB*(1-MS*A.M.JOB)/(1-A.M.JOB)*PYBC+
        A.OG.JOB*(1-MS*A.M.JOB)/(1-A.M.JOB)*PYOG+A.PR.JOB*(1-MS*A.M.JOB)
        /(1-A.M.JOB)*PYPR+A.ID.JOB*(1-MS*A.M.JOB)/(1-A.M.JOB)*PYID)*
        RPJOB
105:    PJOTM = (MS*A.M.JOTM*PM+A.AG.JOTM*(1-MS*A.M.JOTM)/(1-A.M.JOTM)*
        PYAG+A.MI.JOTM*(1-MS*A.M.JOTM)/(1-A.M.JOTM)*PYMI+A.PS.JOTM*(1-MS
        *A.M.JOTM)/(1-A.M.JOTM)*PYPS+A.MA.JOTM*(1-MS*A.M.JOTM)/(1-
        A.M.JOTM)*PYMA+A.EW.JOTM*(1-MS*A.M.JOTM)/(1-A.M.JOTM)*PYEW+
        A.CN.JOTM*(1-MS*A.M.JOTM)/(1-A.M.JOTM)*PYCN+A.TD.JOTM*(1-MS*
        A.M.JOTM)/(1-A.M.JOTM)*PYTD+A.TC.JOTM*(1-MS*A.M.JOTM)/(1-
        A.M.JOTM)*PYTC+A.RE.JOTM*(1-MS*A.M.JOTM)/(1-A.M.JOTM)*PYRE+
        A.FI.JOTM*(1-MS*A.M.JOTM)/(1-A.M.JOTM)*PYFI+A.CS.JOTM*(1-MS*
        A.M.JOTM)/(1-A.M.JOTM)*PYCS+A.GS.JOTM*(1-MS*A.M.JOTM)/(1-
        A.M.JOTM)*PYGS+A.BC.JOTM*(1-MS*A.M.JOTM)/(1-A.M.JOTM)*PYBC+
        A.OG.JOTM*(1-MS*A.M.JOTM)/(1-A.M.JOTM)*PYOG+A.PR.JOTM*(1-MS*
        A.M.JOTM)/(1-A.M.JOTM)*PYPR+A.ID.JOTM*(1-MS*A.M.JOTM)/(1-
        A.M.JOTM)*PYID)*RPJOTM
106:    PJP = VJP/JP
107:    PCG = (MS*A.M.CG*PM+A.AG.CG*(1-MS*A.M.CG)/(1-A.M.CG)*PYAG+A.MI.CG
        *(1-MS*A.M.CG)/(1-A.M.CG)*PYMI+A.PS.CG*(1-MS*A.M.CG)/(1-A.M.CG)*
        PYPS+A.MA.CG*(1-MS*A.M.CG)/(1-A.M.CG)*PYMA+A.EW.CG*(1-MS*A.M.CG)
        /(1-A.M.CG)*PYEW+A.CN.CG*(1-MS*A.M.CG)/(1-A.M.CG)*PYCN+A.TD.CG*(
        1-MS*A.M.CG)/(1-A.M.CG)*PYTD+A.TC.CG*(1-MS*A.M.CG)/(1-A.M.CG)*
        PYTC+A.RE.CG*(1-MS*A.M.CG)/(1-A.M.CG)*PYRE+A.FI.CG*(1-MS*A.M.CG)
        /(1-A.M.CG)*PYFI+A.CS.CG*(1-MS*A.M.CG)/(1-A.M.CG)*PYCS+A.GS.CG*(
        1-MS*A.M.CG)/(1-A.M.CG)*PYGS+A.BC.CG*(1-MS*A.M.CG)/(1-A.M.CG)*
        PYBC+A.OG.CG*(1-MS*A.M.CG)/(1-A.M.CG)*PYOG+A.PR.CG*(1-MS*A.M.CG)
        /(1-A.M.CG)*PYPR+A.ID.CG*(1-MS*A.M.CG)/(1-A.M.CG)*PYID)*RPCG
108:    PDS = (VY+VM-VCPR-VCG-VJ-VX)/DS
109:    PXOG = (MS*A.M.XOG*PM+A.AG.XOG*(1-MS*A.M.XOG)/(1-A.M.XOG)*PYAG+
        A.MI.XOG*(1-MS*A.M.XOG)/(1-A.M.XOG)*PYMI+A.PS.XOG*(1-MS*A.M.XOG)
        /(1-A.M.XOG)*PYPS+A.MA.XOG*(1-MS*A.M.XOG)/(1-A.M.XOG)*PYMA+
        A.EW.XOG*(1-MS*A.M.XOG)/(1-A.M.XOG)*PYEW+A.CN.XOG*(1-MS*A.M.XOG)
        /(1-A.M.XOG)*PYCN+A.TD.XOG*(1-MS*A.M.XOG)/(1-A.M.XOG)*PYTD+
        A.TC.XOG*(1-MS*A.M.XOG)/(1-A.M.XOG)*PYTC+A.RE.XOG*(1-MS*A.M.XOG)
        /(1-A.M.XOG)*PYRE+A.FI.XOG*(1-MS*A.M.XOG)/(1-A.M.XOG)*PYFI+
        A.CS.XOG*(1-MS*A.M.XOG)/(1-A.M.XOG)*PYCS+A.GS.XOG*(1-MS*A.M.XOG)
        /(1-A.M.XOG)*PYGS+A.BC.XOG*(1-MS*A.M.XOG)/(1-A.M.XOG)*PYBC+
        A.OG.XOG*(1-MS*A.M.XOG)/(1-A.M.XOG)*PYOG+A.PR.XOG*(1-MS*A.M.XOG)
        /(1-A.M.XOG)*PYPR+A.ID.XOG*(1-MS*A.M.XOG)/(1-A.M.XOG)*PYID)*
        RPXOG
110:    PXPR = (MS*A.M.XPR*PM+A.AG.XPR*(1-MS*A.M.XPR)/(1-A.M.XPR)*PYAG+
        A.MI.XPR*(1-MS*A.M.XPR)/(1-A.M.XPR)*PYMI+A.PS.XPR*(1-MS*A.M.XPR)
        /(1-A.M.XPR)*PYPS+A.MA.XPR*(1-MS*A.M.XPR)/(1-A.M.XPR)*PYMA+
        A.EW.XPR*(1-MS*A.M.XPR)/(1-A.M.XPR)*PYEW+A.CN.XPR*(1-MS*A.M.XPR)
        /(1-A.M.XPR)*PYCN+A.TD.XPR*(1-MS*A.M.XPR)/(1-A.M.XPR)*PYTD+
        A.TC.XPR*(1-MS*A.M.XPR)/(1-A.M.XPR)*PYTC+A.RE.XPR*(1-MS*A.M.XPR)
        /(1-A.M.XPR)*PYRE+A.FI.XPR*(1-MS*A.M.XPR)/(1-A.M.XPR)*PYFI+
        A.CS.XPR*(1-MS*A.M.XPR)/(1-A.M.XPR)*PYCS+A.GS.XPR*(1-MS*A.M.XPR)
        /(1-A.M.XPR)*PYGS+A.BC.XPR*(1-MS*A.M.XPR)/(1-A.M.XPR)*PYBC+
        A.OG.XPR*(1-MS*A.M.XPR)/(1-A.M.XPR)*PYOG+A.PR.XPR*(1-MS*A.M.XPR)
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       /(1-A.M.XPR)*PYPR+A.ID.XPR*(1-MS*A.M.XPR)/(1-A.M.XPR)*PYID)*
       RPXPR
111:  PXPS = (MS*A.M.XPS*PM+A.AG.XPS*(1-MS*A.M.XPS)/(1-A.M.XPS)*PYAG+
       A.MI.XPS*(1-MS*A.M.XPS)/(1-A.M.XPS)*PYMI+A.PS.XPS*(1-MS*A.M.XPS)
       /(1-A.M.XPS)*PYPS+A.MA.XPS*(1-MS*A.M.XPS)/(1-A.M.XPS)*PYMA+
       A.EW.XPS*(1-MS*A.M.XPS)/(1-A.M.XPS)*PYEW+A.CN.XPS*(1-MS*A.M.XPS)
       /(1-A.M.XPS)*PYCN+A.TD.XPS*(1-MS*A.M.XPS)/(1-A.M.XPS)*PYTD+
       A.TC.XPS*(1-MS*A.M.XPS)/(1-A.M.XPS)*PYTC+A.RE.XPS*(1-MS*A.M.XPS)
       /(1-A.M.XPS)*PYRE+A.FI.XPS*(1-MS*A.M.XPS)/(1-A.M.XPS)*PYFI+
       A.CS.XPS*(1-MS*A.M.XPS)/(1-A.M.XPS)*PYCS+A.GS.XPS*(1-MS*A.M.XPS)
       /(1-A.M.XPS)*PYGS+A.BC.XPS*(1-MS*A.M.XPS)/(1-A.M.XPS)*PYBC+
       A.OG.XPS*(1-MS*A.M.XPS)/(1-A.M.XPS)*PYOG+A.PR.XPS*(1-MS*A.M.XPS)
       /(1-A.M.XPS)*PYPR+A.ID.XPS*(1-MS*A.M.XPS)/(1-A.M.XPS)*PYID)*
       RPXPS
112:  PXX = (MS*A.M.XX*PM+A.AG.XX*(1-MS*A.M.XX)/(1-A.M.XX)*PYAG+A.MI.XX
       *(1-MS*A.M.XX)/(1-A.M.XX)*PYMI+A.PS.XX*(1-MS*A.M.XX)/(1-A.M.XX)*
       PYPS+A.MA.XX*(1-MS*A.M.XX)/(1-A.M.XX)*PYMA+A.EW.XX*(1-MS*A.M.XX)
       /(1-A.M.XX)*PYEW+A.CN.XX*(1-MS*A.M.XX)/(1-A.M.XX)*PYCN+A.TD.XX*(
       1-MS*A.M.XX)/(1-A.M.XX)*PYTD+A.TC.XX*(1-MS*A.M.XX)/(1-A.M.XX)*
       PYTC+A.RE.XX*(1-MS*A.M.XX)/(1-A.M.XX)*PYRE+A.FI.XX*(1-MS*A.M.XX)
       /(1-A.M.XX)*PYFI+A.CS.XX*(1-MS*A.M.XX)/(1-A.M.XX)*PYCS+A.GS.XX*(
       1-MS*A.M.XX)/(1-A.M.XX)*PYGS+A.BC.XX*(1-MS*A.M.XX)/(1-A.M.XX)*
       PYBC+A.OG.XX*(1-MS*A.M.XX)/(1-A.M.XX)*PYOG+A.PR.XX*(1-MS*A.M.XX)
       /(1-A.M.XX)*PYPR+A.ID.XX*(1-MS*A.M.XX)/(1-A.M.XX)*PYID)*RPXX
113:  PCPN = 0.07*PCPFOO+0.06*PCPCLO+0.22*PCPFUR+0.01*PCPTRA+0.64*
       PCPOTH+RPCPN
114:  VYAG = PYAG*YAG
115:  VYMI = PYMI*YMI
116:  VYPS = PYPS*YPS
117:  VYMA = PYMA*YMA
118:  VYEW = PYEW*YEW
119:  VYCN = PYCN*YCN
120:  VYTD = PYTD*YTD
121:  VYTC = PYTC*YTC
122:  VYRE = PYRE*YRE
123:  VYFI = PYFI*YFI
124:  VYCS = PYCS*YCS
125:  VYBC = PYBC*YBC
126:  VYPR = PYPR*YPR
127:  VYOG = PYOG*YOG
128:  VYTAG = VYAG-PYFAG*(1-TAG.0)*YAG
129:  VYTMI = VYMI-PYFMI*(1-TMI.0)*YMI
130:  VYTPS = VYPS-PYFPS*(1-TPS.0)*YPS
131:  VYTMA = VYMA-PYFMA*(1-TMA.0)*YMA
132:  VYTEW = VYEW-PYFEW*(1-TEW.0)*YEW
133:  VYTCN = VYCN-PYFCN*(1-TCN.0)*YCN
134:  VYTTD = VYTD-PYFTD*(1-TTD.0)*YTD
135:  VYTTC = VYTC-PYFTC*(1-TTC.0)*YTC
136:  VYTRE = VYRE-PYFRE*(1-TRE.0)*YRE
137:  VYTFI = VYFI-PYFFI*(1-TFI.0)*YFI
138:  VYTCS = VYCS-PYFCS*(1-TCS.0)*YCS
139:  VYTBC = VYBC-PYFBC*(1-TBC.0)*YBC
140:  VYTPR = VYPR-PYFPR*(1-TPR.0)*YPR
141:  VYTOG = VYOG-PYFOG*(1-TOG.0)*YOG
142:  VYTP = VYTAG+VYTMI+VYTPS+VYTMA+VYTEW+VYTCN+VYTTD+VYTTC+VYTRE+VYTFI+VYTCS+VYTBC
143:  VYT = VYTP+VYTOG+VYTPR
144:  VYSP = VYP-VYTP-WP*EP
145:  VYSH = VYSSHARE*VYSP
146:  VYSC = (1-VYSSHARE)*VYSP
147:  VYSO = VYOG+VYPR-VYTOG-VYTPR-VYWO
148:  Z = VX-VM+ZR
149:  NFA = Z+NFA(-1)
150:  VYTPOS = (IF (VYTAG > 0) THEN VYTAG ELSE 0)+(IF (VYTCN > 0) THEN VYTCN ELSE 0)+
      (IF (VYTEW > 0) THEN VYTEW ELSE 0)+(IF (VYTTD > 0) THEN VYTTD ELSE 0)+
      (IF (VYTMI > 0) THEN VYTMI ELSE 0)+(IF (VYTPR > 0) THEN VYTPR ELSE 0)+
      (IF (VYTPS > 0) THEN VYTPS ELSE 0)+(IF (VYTTC > 0) THEN VYTTC ELSE 0)
151:  VYTNEG = (IF (VYTAG < 0) THEN VYTAG ELSE 0)+(IF (VYTCN < 0) THEN VYTCN ELSE 0)+
      (IF (VYTEW < 0) THEN VYTEW ELSE 0)+(IF (VYTTD < 0) THEN VYTTD ELSE 0)+
      (IF (VYTMI < 0) THEN VYTMI ELSE 0)+(IF (VYTPR < 0) THEN VYTPR ELSE 0)+
      (IF (VYTPS < 0) THEN VYTPS ELSE 0)+(IF (VYTTC < 0) THEN VYTTC ELSE 0)
152:  GECH12 = GECH12.1*VYWG+RGECH12
153:  LOG(GECH3+VYTNEG) = GECH3.1+GECH3.2*LOG(GESS)+RGECH3
154:  GECH4 = GECH4.1*VJG+RGECH4
155:  GROTH-VYID-VYTPOS = GROTH.1*VYSP(-1)+RGROTH
156:  LOG(GROIL) = GROIL.1+GROIL.2*LOG(VYSO)+GROIL.3*LOG(VYSO(-1))+RGROIL
157:  ZG = GROIL+GROTH+THR*HR-GECH12-GECH3-GECH4
158:  ZP = Z-ZG
159:  SP = ZP+VJP+PDS*DS
160:  SG = ZG+VJG+VJO
161:  YAG = TFPAG*EAG**A.AG*KAG**(1-A.AG)
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162:  YMI = TFPMI*EMI**A.MI*KMI**(1-A.MI)
163:  YPS = TFPPS*EPS**A.PS*KPS**(1-A.PS)
164:  YMA = TFPMA*EMA**A.MA*KMA**(1-A.MA)
165:  YEW = TFPEW*EEW**A.EW*KEW**(1-A.EW)
166:  YCN = TFPCN*ECN**A.CN*KCN**(1-A.CN)
167:  YTD = TFPTD*ETD**A.TD*KTD**(1-A.TD)
168:  YTC = TFPTC*ETC**A.TC*KTC**(1-A.TC)
169:  YRE = TFPRE*ERE**A.RE*KRE**(1-A.RE)
170:  YFI = TFPFI*EFI**A.FI*KFI**(1-A.FI)
171:  YCS = TFPCS*ECS**A.CS*KCS**(1-A.CS)
172:  YOG = TFPOG*EOG**A.OG*KOG**(1-A.OG)
173:  YPR = TFPPR*EPR**A.PR*KPR**(1-A.PR)
174:  EAG = A.AG*PYFAG/WAG*YAG+REAG
175:  EMI = A.MI*PYFMI/WMI*YMI+REMI
176:  EPS = A.PS*PYFPS/WPS*YPS+REPS
177:  EMA = A.MA*PYFMA/WMA*YMA+REMA
178:  EEW = A.EW*PYFEW/WEW*YEW+REEW
179:  ECN = A.CN*PYFCN/WCN*YCN+RECN
180:  ETD = A.TD*PYFTD/WTD*YTD+RETD
181:  ETC = A.TC*PYFTC/WTC*YTC+RETC
182:  ERE = A.RE*PYFRE/WRE*YRE+RERE
183:  EFI = A.FI*PYFFI/WFI*YFI+REFI
184:  ECS = A.CS*PYFCS/WCS*YCS+RECS
185:  EOG = A.OG*PYFOG/WOG*YOG+REOG
186:  EPR = A.PR*PYFPR/WPR*YPR+REPR
187:  EP = EAG+EMI+EPS+EMA+EEW+ECN+ETD+ETC+ERE+EFI+ECS
188:  EG = YG/QG
189:  E = EP+EG+EOG+EPR
190:  ES = LRRATE*POPSA
191:  EN+ES = E
192:  QP = YP/EP
193:  KAG = (1-A.AG)*PYFAG/PKAG*YAG*RKAG
194:  KMI = (1-A.MI)*PYFMI/PKMI*YMI*RKMI
195:  KPS = (1-A.PS)*PYFPS/PKPS*YPS*RKPS
196:  KMA = (1-A.MA)*PYFMA/PKMA*YMA*RKMA
197:  KCN = (1-A.CN)*PYFCN/PKCN*YCN*RKCN
198:  KTD = (1-A.TD)*PYFTD/PKTD*YTD*RKTD
199:  KTC = (1-A.TC)*PYFTC/PKTC*YTC*RKTC
200:  KRE = (1-A.RE)*PYFRE/PKRE*YRE*RKRE
201:  KFI = (1-A.FI)*PYFFI/PKFI*YFI*RKFI
202:  KCS = (1-A.CS)*PYFCS/PKCS*YCS*RKCS
203:  KOG = (1-A.OG)*PYFOG/PKOG*YOG*RKOG
204:  KPR = (1-A.PR)*PYFPR/PKPR*YPR*RKPR
205:  KP = KAG+KMI+KPS+KMA+KEW+KCN+KTD+KTC+KRE+KFI+KCS
206:  JAG = KAG-(1-DELTA.AG)*KAG(-1)+RJAG
207:  JMI = KMI-(1-DELTA.MI)*KMI(-1)+RJMI
208:  JPS = KPS-(1-DELTA.PS)*KPS(-1)+RJPS
209:  JMA = KMA-(1-DELTA.MA)*KMA(-1)+RJMA
210:  JEW = KEW-(1-DELTA.EW)*KEW(-1)+RJEW
211:  JCN = KCN-(1-DELTA.CN)*KCN(-1)+RJCN
212:  JTD = KTD-(1-DELTA.TD)*KTD(-1)+RJTD
213:  JTC = KTC-(1-DELTA.TC)*KTC(-1)+RJTC
214:  JRE = KRE-(1-DELTA.RE)*KRE(-1)+RJRE
215:  JFI = KFI-(1-DELTA.FI)*KFI(-1)+RJFI
216:  JCS = KCS-(1-DELTA.CS)*KCS(-1)+RJCS
217:  JOG = KOG-(1-DELTA.OG)*KOG(-1)+RJOG
218:  JPR = KPR-(1-DELTA.PR)*KPR(-1)+RJPR
219:  JOB = JOGB+JPRB
220:  JOTM = JOGTM+JPRTM
221:  JOG = JOGB+JOGTM
222:  JPR = JPRB+JPRTM
223:  LOG(JPH)-LOG(JPH(-1)) = JPH.1+JPH.2*(LOG(ICH/PJPH)-LOG(ICH(-1)/PJPH(-1)))+
      JPH.3*(LOG(HR/PJPH)-LOG(HR(-1)/PJPH(-1)))+JPH.4*(LOG(JPH(-1))-LOG(HR(-1)/PJPH(-1)))+
      JPH.5*D90+RJPH
224:  JPB = 0.544996948063*(JAG+JMI+JPS+JMA+JEW+JCN+JTD+JTC+JFI+JCS+JRE)+RJPB
225:  JPTM = (1-0.544996948063)*(JAG+JMI+JPS+JMA+JEW+JCN+JTD+JTC+JFI+JCS+JRE)+RJPTM
226:  JP = JPH+JPB+JPTM
227:  JG = JGB+JGTM
228:  JO = JOB+JOTM
229:  J = JP+JG+JO
230:  VJP = PJPH*JPH+PJPB*JPB+PJPTM*JPTM
231:  VJG = PJGB*JGB+PJGTM*JGTM
232:  VJO = PJOB*JOB+PJOTM*JOTM
233:  VJ = VJP+VJG+VJO
234:  PKAG = PJP*(IRAG+DELTA.AG)
235:  PKMI = PJP*(IRMI+DELTA.MI)
236:  PKPS = PJP*(IRPS+DELTA.PS)
237:  PKMA = PJP*(IRMA+DELTA.MA)
238:  PKCN = PJP*(IRCN+DELTA.CN)
239:  PKTD = PJP*(IRTD+DELTA.TD)
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240:  PKTC = PJP*(IRTC+DELTA.TC)
241:  PKRE = PJP*(IRRE+DELTA.RE)
242:  PKFI = PJP*(IRFI+DELTA.FI)
243:  PKCS = PJP*(IRCS+DELTA.CS)
244:  PKOG = PJP*(IROG+DELTA.OG)
245:  PKPR = PJP*(IRPR+DELTA.PR)
246:  IRAG = RHO.AG*IR
247:  IRMI = RHO.MI*IR
248:  IRMA = RHO.MA*IR
249:  IRCN = RHO.CN*IR
250:  IRTD = RHO.TD*IR
251:  IRTC = RHO.TC*IR
252:  IRRE = RHO.RE*IR
253:  IRFI = RHO.FI*IR
254:  IRCS = RHO.CS*IR
255:  WAG = W.AG*WP
256:  WMI = W.MI*WP
257:  WPS = W.PS*WP
258:  WMA = W.MA*WP
259:  WEW = W.EW*WP
260:  WCN = W.CN*WP
261:  WTD = W.TD*WP
262:  WTC = W.TC*WP
263:  WRE = W.RE*WP
264:  WFI = W.FI*WP
265:  WCS = W.CS*WP
266:  WOG = W.OG*WP
267:  WPR = W.PR*WP
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