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The Selection Model
A General Equilibrium Model for
Saudi Arabia

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Abstract:
This report gives a documentation of the Selection Model, developed by the Research Department of Statistics Norway as part of the construction of a system of macroeconomic models for the use of the Ministry of Planning in Saudi Arabia. The model is designed to be a model tool in the preparation of the five-year development plans, in particular for analysing consequences of investment programs, undertaken by the government and the private sector. The model is based on the structure of the Implementation Model (see Johansen and Magnussen, 1996) including an input-output core, but extended with sectoral production functions, labour demand and capital stock relations. The structure of industry models is designed in accordance with the special features of the Saudi Arabian economy, with most of export activities based on petroleum products. The report contains a general discussion of CGE-models, a presentation of the chosen model structure for the Selection Model and a description of its main properties by simulation exercises. In addition, the estimation of production functions is documented.

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1. Introduction

The general background for the development and use of macroeconomic models in the Ministry of Planning is given in UNDP Project Document <u>Support for Economic Planning, Modelling and Management Information Systems</u> (SAU/94/001/A701/01, pp. 1-4). The current macroeconomic model tool and the data system built around it has been intensively utilised and played an important role in the preparation of the macroeconomic parts of 5th and 6th Development Plans and in the monitoring of the economy in the corresponding period. It has been recognised to have serious limitations with regard to a more policy oriented use of models (p.4). In Bjerkholt (1993), a system of three models was proposed, among those an applied general equilibrium model; The Selection Model.

The model is designed to be a model tool in the preparation of development plans, in particular to analyse consequences of investment programs, whether undertaken by the government or private sector. Accordingly the available resources are taken as given in the model, so that e.g. a reduction of government expenditures will leave more resources for an expansion of the private sector. Although based on weak data foundations and strong assumptions about the production side of the industries, the modelling of different production sectors also makes the model able to analyse composition of investment programs.

The specification of the Selection Model is based on the input-output core developed for the Implementation Model, along with other equations from that model. In this way a close connection between the twoi models is forged, and we regard this 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 attached labour demand and capital stock relations put the emphasis in the Selection Model on the <u>supply side</u> of the economy. The overall mode of operation of the Selection Model is accordingly very different from that of the Implementation model. The specification and content of the Selection Model are spelled out in more detail in chapter 4 and 5.

A brief overview of the role of computable general equilibrium models is given in chapter 2, while chapter 3 offers a more detailed discussion of various aspects of such models. In chapter 4 the Selection Model is presented and chapter 5 demonstrates two multiplier analyses of the model. The concluding chapter 6 offers some thoughts on the further work on the model. The annexes comprise a complete list of the variables, a documentation of the establishment of coefficients to be used in production functions and equations of the model.

2. The role of a computable general equilibrium model

A general equilibrium model will normally focus 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, income and price effects that link different markets by consumer and producer behaviour.

The role of a computable general equilibrium model (CGE) is twofold. It can be used as a tool for analysing the potential growth of an economy and for studying the effects of changes in policy variables that affects the efficiency of a market economy. In the latter capacity, the literature is full of CGE studies of tax reforms, import tariffs and trade policy, subsidies and so on. These studies focus on what kind of distortions and market inefficiencies that may arise as a consequence of policy interventions or other institutional aspects that may interfere with the working of a market economy.

The CGE models do 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 which may be regarded as superior to economic calculations. On the other hand, a CGE model may help a government to evaluate the costs of pursuing these other objectives.

It is often argued that CGE models are based on firm microeconomic theory while macroeconometric models with their emphasis on fitting equations to 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 offers a number of different ways of analysing market behaviour and which one to choose ought to be influenced not least by an empirical evaluation. Often, CGE models are not firmly based on econometric studies but rely instead on parameters calibrated from benchmark data or as «guesstimates» guided by theoretical considerations. In view of the data deficiencies this is also to a considerable extent how we have chosen to determine the parameters of the Selection Model.

There are different ways of «closing» a CGE model. The choice of how to close the model may be based on ad hoc arguments or by an «arm chair» approach as to how the particular economy operates in the long run. The choice will also usually be influenced by the intended use of the model. To close the model involves choosing e.g. whether to impose a balanced budget in the simulations or let the budget balance be endogenous. Another example is whether or not to impose that the exchange rate should secure a balance on the current account. A third example is how to determine the volume of investments. In the model versions below, we have chosen to have the rate of return on capital exogenous and determining the capital stock and investment endogenously. Alternatively, the amount of investment and savings could be taken as given from the Development Plan and, hence the rate of return would become endogenous.

The best way of closing a CGE model for the Saudi economy and in a planning context is something that should be open to discussion as one gains experience with using the models. It should be noted that the various options for closing the model influence the set of possible solutions, but not the actual interrelations of the variables of the model. It may even be well worth having models with varying ways of closure and experimenting with these in a practical planning situation.

An attempt at constructing an applied general equilibrium model for Saudi Arabia was undertaken about 15 years ago, see Coopers & Lybrand (1981). This model was apparently never used for planning purposes since the model structure and planning system proposed never materialized. Also the data requirements of that model were very ambitious and the first benchmark set of data were never updated. The detailed specifications, level of disaggregation and dynamic structure went beyond the current effort of the Selection Model.

With this experience in mind, we have chosen to specify a number of aggregated CGE models in the following chapter in order to illustrate different possibilities as of how to develop a more elaborate model. In chapter 4, we then specify and simulate the Selection Model as a specific CGE model with the same level of aggregation as the Implementation Model. A number of equations and the whole input-output structure have been transferred from the Implementation Model. The notation of the two models is generally the same. In order to construct the Selection Model, in particular the disaggregated production functions, a number of ad hoc data had to be «constructed». This is described in more detail in Annex B. The variable list is given in Annex A and a full listing of all the equations of the Selection Model is shown in Annex C.

3. Some aggregated CGE-models

The purpose of this chapter is to illustrate some features of aggregated CGE-models. These models have been programmed in TROLL and are simulated to show the response in our «model economy» of changes in various exogenous variables. One of these aggregated models is quite similar in structure to the Selection Model specified in chapter 4.

3.1. The basic model

The economy is aggregated into three production sectors; the government sector, the oil sector which includes refineries, and the private non-oil sector. In addition households and the government sector is treated as institutional sectors. In the programmed models, a number of bridge equations and identities determine variables related to the government and the oil sector. As these equations are fairly simple and are included only to make the models complete in a national accounting sense, they are not described in detail here. We focus instead on the modelling of the private non-oil sector.

The private non-oil sector is divided in two main parts, households and firms. Value added in volume terms is determined by a Cobb-Douglas production function:

(1) $YP = TFP*EP^a*KP^b$

where TFP is total factor productivity and exogenous, EP is employment and KP the capital stock. a and b are coefficients that are assumed to sum to one, i.e. we assume constant returns to scale. a is simply calibrated by using the share of wages in factor income.

The first order conditions for profit maximization are:

(2) $EP*WP = a*PYFP*YP$

(3) $KP*PKP = b*PYFP*YP$

where WP is the wage rate and PYFP the (factor) output price. The user cost of capital (PKP) is given by:

(4) $PKP = PJP*(IKRATE + DKPRATE)$

PJP is the price of new capital goods. IKRATE is the real rate of return on capital that is demanded for investment projects and could be interpreted as a risk adjusted real interest rate given on world capital markets. It is assumed to be exogenous in the model. DKPRATE is the depreciation rate:

(5) $DKP = DKPRATE*KP(-1)$

Equations 1-5 now determine value added and factor demand in the private non-oil sector as a function of relative prices, the real rate of return and total factor productivity.

The volume of gross investment in the private non-oil sector (JP) is given implicitly by:

(6) $KP = KP(-1) - DKP + JP$

In one version of the aggregated models, which we shall call SOE (short for Small Open Economy), we assume that the non-oil private sector produces a homogeneous good that can be traded in international markets at a given price. This price is the import price to Saudi Arabia (PM) corrected for import duties:

(7) PMID = [(1+ IDRATE)/(1+IDRATE89)]*PM

In general, however, the price of domestic absorption (PHP) is a weighted average of the domestic production price and the import price using the import share (IMP) as a weight:

(8) PHP = [(1+TRP)/(1+TRP1989)]*[(IMP*PMID+(1-IMP)*PYFP)]

where TRP is the rate of indirect taxation.

Imports are given by:

(9) M = IMP*DA

where DA is domestic absorption in constant prices and IMP is simply an aggregated importshare which generally is assumed to be exogenous. Domestic absorption is defined by:

(10) DA = CPR + GSGN + J + DS + DAREST

CPR is consumption by residents, GSGN is government net purchase of goods and services other than labour, J is total gross investment, DS is stockbuilding and DAREST is a residual. J is given as:

(11) J = JG + JO + JP

where JG and JO is gross investment by the government and the oil sector. The balance equation for private non-oil goods and services is:

(12) YP = DA + XX + XPS - M + YPRES

YPRES is a residual and XX + XPS is exports of goods and services from the private non-oil sector. By separating exports of petrochemicals (XPS) from other non-oil exports (XX) we keep the variable list of the Selection Model as close to the Implementation Model as possible. We treat XX + XPS as exogenous.

The export price PXX is given by:

(13) PXX = PYFP*PXXR

where PXXR is a residual equal to one in the base year.

Private consumption is divided between residents (Saudis and expatriates) and non-residents:

(14) CP = CPR + CPN

The modelling of CPR will be discussed in the section on household behaviour while CPN is exogenous and part of total exports, cf. eq. (22), (25) and (26) of the Selection Model described in Annex 3 below.

The consumer price (for both groups) is simply postulated as:

(15) PCP = PHP*PCPR

where PCPR is an exogenous error term. Similarly the investment price is given by:

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(16) PJP = PHP*PJPR

The value added price index depends on the factor price index and the net indirect tax rate (TRP):

(17) PYP = [(1+TRP)/(1+TRP1989)]*PYPF

Value added in current prices in the private non-oil sector is given as:

(18) VYP = PYP*YP

and gross operating surplus as:

(19) VYSP = VYP - VYTP - WP*EP

where net indirect taxes is given by:

(20) VYTP = TRP*PYFP*YP

The household sector consists of two types of households: Saudis and expatriates. Expatriates supply labour EN which is considered exogenous in and equal to their employment. The Saudi labour supply (LR) is assumed to be a fixed share of the population:

(21) LR = LRRATE*POPSA

where POPSA is the exogenous total population of residents. Thus LR is effectively exogenous in the model or predetermined to be more precise.

A share of gross operating surplus in the private non-oil sector is regarded as income by households:

(22) VYSH = VYSSHARE*VYSP

Total household income is then:

(23) HR = WO*EO + WG*EG + WP*EP + GESS + VYSH

where WO and WG is the wage rate in the oil and government sectors, EO and EG are employment in the two sectors. The former are linked to wages in the private non-oil sector while EO and EG can be considered as exogenous. GESS is nominal government transfers to households and is exogenous.

Consumption (for Saudis and expatriates) is assumed to be a fixed share of household real income:

(24) CPR = CPRRATE*HR/PCP

as direct taxes are zero.

The labour market in the aggregated models is very simple. We assume that labour is homogeneous so that the labour market clears:

(25) EN + LR = EG + EO + EP

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Since labour supply (EN + LR) is exogenous and EO and EG are exogenous either directly or via exogenous oil production, EP is determined by eq. 25. The implication is that the product real wage WP/PYFP is determined by eq. 2.

The value of total imports is given by:

(26) VM = PM*M

while the value of total exports is determined by:

(27) VX = PXX*(XX + XPS) + PXOG*XO + PCP*CPN

where PXOG is the export oil price. The current account is given by:

(28) Z = VX - VM + ZR

where ZR is an exogenous residual covering all items on the current account other than the trade balance (VX - VM). In later versions of the models it is important to link components of ZR to foreign assets and liabilities and interest rates. These data are not available at the moment.

3.2. The structure of a Small-Open-Economy model

As mentioned above the basic framework can be used to establish a number of small CGE models. The simplest version of all is one we shall label the Small-Open-Economy version. In this version an equation is added which sets the price of domestic output equal to the import price:

(29) PYFP = PMID

In this case it does not really make sense to distinguish between exports and imports as imported and exported goods are homogeneous. All imports are now treated as competitive imports. Although this is not realistic in the case of the Saudi economy, the purpose here is to explain certain model characteristics that may be relevant for some sectors of the Saudi economy but not necessarily for the economy as a whole. As we observe both exports and imports, we shall assume that exports are exogenous and that the import share is endogenous. The same results could have been achieved by assuming an exogenous import share and endogenous exports (XX+XPS).

In this model version there is only one simultaneous block which consists of equation (1) and (3) and determines YP and KP. To see this one only has to look at equation (25) which determines EP since the other variables in that equation are exogenous or linked to variables that are exogenous. Thus in (1) only YP and KP are really endogenous as is also the case in (3). However, in (3) PKP and PYFP enter also, but using equation (4), (7), (8) and (16), it becomes clear that PYFP/PKP only depends on exogenous factors. Thus (3) can be rewritten so that only YP and KP enter. Consequently these two equations determine YP and KP. The rest of the equations can be solved recursively. The reduced form expression for YP is:

(30) YP = c*(EN+LR-EG-EORATE*OO)*TFP1/a*((1+TRP)*(IKRATE + DKPRATE))(1-1/a)

where the constant term (c) only includes non-essential exogenous variables or coefficients. From equation (30) we see that YP is positively related to total factor productivity (TFP) and negatively related to the net indirect tax rate (TRP) and the two components of the real user cost of capital. The reason why net indirect taxes affect output is that these taxes are assumed to be levied on investment as well as on consumption. This drives a wedge between the producer price (PYPF) and the prices that all buyers pay (in this case PJP). The term in the first parenthesis is simply the amount of labour

left to the private non-oil sector given total labour supply (EN+LR) minus government and oil sector demand.

Note that YP does not depend on any variables in the model other than those in (30). This follows from the small open economy assumption. Thus changes in domestic demand will only affect imports, not private sector output. On the other hand, changes in private non-oil supply will change domestic demand by increasing demand for capital and household consumption. The latter can occur both because of changes in household income by a reallocation of labour between sectors (as wage rates differ substantially between sectors) and because real wages will increase. A change in YP will tend to increase WP similarly as PYFP is linked to PM (which is exogenous) and EP is derived from equation (25) and consequently «independent» of YP. Thus the wage rate adjusts so as to secure that a potential increase in labour demand due to higher output, is «choked» by higher wages.

The model as it now stands is not very dynamic. However due to equation (6), a positive permanent shift in KP will lead to a jump in investment (JP) which will normally increase imports (and also reduce exports if the import share is exogenous). The following year only replacement of depreciations will lead to higher gross investment, but now at a much lower level. Consequently also imports will be lower the following year after the initial jump.

We have carried out three different simulations on the SOE-version of the model. An increase in total factor productivity (TFP) by one percent; a reduction in the rate of return on capital (IKRATE) by one percentage point; and an increase in government employment (EG) by one percent. All changes are permanent and the results are presented in tables 3.1, 3.2., and 3.3. Let us first look at higher total factor productivity.

Table 3.1. Effects (in %) of a permanent increase in total factor productivity by one percent

Variable	1. year	2. year	3. year	Long run
Household consumption	2.3	2.3	2.3	2.3
Government consumption	0.0	0.0	0.0	0.0
Non-oil investment	23.4	2.3	2.3	2.3
Domestic absorption	4.7	1.3	1.4	1.6
Imports	8.6	0.6	0.6	0.7
Non-oil value added	2.3	2.3	2.3	2.3
Non-oil capital stock	2.3	2.3	2.3	2.3
Wage rates	2.3	2.3	2.3	2.3
Non-oil price	0.0	0.0	0.0	0.0

As explained above, value added and capital stock in the private non-oil sector increase by the same percent. Due to inelastic labour supply, so do wage rates in all sectors. Since output prices stay the same as they are linked to exogenous import prices, operating surplus in the non-oil sector increases by the same percent. Consequently household income and thereby consumption increase by the same amount. (However, due to the definition of household income, cf. (22) where government transfers to households are exogenous, the increase in consumption is in fact slightly less than in wage income.) Notice the large increase in non-oil investment the first year and the smaller impact the following years. The change in domestic absorption is, however, covered by higher imports the first year. There is also a permanent increase in imports in spite of the large increase in non-oil output. In table 3.2. we show the effects of a sustained increase in government employment by one percent.

Table 3.2. Effects (in %) of a sustained increase in government employment by one percent

Variable	1. year	2. year	3. year	Long run
Household consumption	0.2	0.2	0.2	0.2
Government consumption	0.5	0.5	0.5	0.5
Non-oil investment	-1.7	-0.1	-0.1	-0.1
Domestic absorption	-0.1	-0.1	-0.1	-0.1
Imports	-0.1	0.4	0.4	0.4
Non-oil value added	-0.1	-0.1	-0.1	-0.1
Non-oil capital stock	-0.1	-0.1	-0.1	-0.1
Wage rates	0.0	0.0	0.0	0.0
Non-oil price	0.0	0.0	0.0	0.0

More government employment increases government consumption and government value added. As the wage rate is higher in the government sector than in the private non-oil sector, this reallocation of labour total output or GDP. It also increases households income and thereby increases consumption. As there is less labour disposable for the private non-oil sector, output is reduced and, as a consequence, there is no need for any real wage adjustment. As a consequence of lower output, the optimal capital stock is reduced and this leads to a reduction in gross investment, domestic absorption and imports. From the second year onwards higher household consumption and lower non-oil output imply permanently higher imports and deficits on the current account.

Finally, let us look at the results of reducing the user cost of capital by permanently reducing the IKRATE by one percentage point. The results are shown in table 3.3.

Table 3.3. Effects (in %) of a permanent reduction in the user cost of capital by 1%

Variable	1. year	2. year	3. year	Long run
Household consumption	9.7	9.7	9.7	9.7
Government consumption	0.0	0.0	0.0	0.0
Non-oil investment	224.1	17.5	17.5	17.5
Domestic absorption	32.7	6.6	6.7	8.1
Imports	69.8	4.8	4.9	7.2
Non-oil value added	9.8	9.8	9.8	9.8
Non-oil capital stock	17.5	17.5	17.5	17.5
Wage rates	9.8	9.8	9.8	9.8
Non-oil price	0.0	0.0	0.0	0.0

The reduction in the user cost increases the demand for capital by 17.5 % leading to a large increase in gross investment in the first year. The second year gross investment reaches its equilibrium level which is also higher due to larger depreciation as the capital stock is higher. The effect on non-oil value added (in percent) is simply the increase in the capital stock (in percent) times the share of capital in value added (0.56). This increase in output is however not sufficient to cover all the increase in domestic absorption so that imports increase as well and particularly the first year.

Higher output increases labour demand, but due to the assumption of inelastic labour supply, the wage rates increase so that labour demand is reduced and is just equal to supply. This leads to an increase in the real wage rate which is equal to the increase in value added. Thus household income is increased as well and therefore consumption also grows. The reason why consumption increases somewhat less than value added and real wages is simply that government transfers are fixed so that household income increases slightly less than output.

Other policy simulations can also be carried out. For example we can study what kind of changes that will occur when different fiscal policy instruments are used in order to reduce imbalances on the government budget or on the current account.

3.3. A model with heterogeneous products

The small open economy assumption used in section 3.2 is indeed extreme as a description of the non-oil sector as a whole. It may be more realistic when applied only to that part of the sector producing tradables while prices on non-tradables are adjusted to clear the market for these goods and services.

To illustrate how the model characteristics change when assuming an endogenous price on domestic output, we have changed the model presented in section 3.2. First we delete equation (29) which relates the output price to the import price. Instead we introduce an equation where non-oil exports is made a function of relative prices between export and import prices (as a proxy for world market prices) as well as an indicator of world market demand (DW). This is the so called Armington-approach:

(31) XX+XPS = const*DW*(PXX/PM)e

where e is a price elasticity assumed to be -1. Implicitly we assume an income elasticity of one. Equation (31) determines only XX or XPS, not both and XPS is assumed to be exogenous. For non-oil exports we retain the assumption of exogenous price and volume for simplicity.

The determination of imports is also changed in that we now assume the import share to be exogenous so that a fixed share of changes in domestic use of goods and services is supplied by foreign producers. We could have assumed that this import share also was dependent on relative prices, but due to the specialized structure of the Saudi economy, it is believed to be more realistic to let all imports be of the non-competitive kind.

This model version is quite different in structure compared to the SOE-version in that prices (PYFP) is now determined by «supply and demand» in a way quite similar to a textbook version of a market. The simple recursive structure of the SOE-model is no longer valid and a larger simultaneous block emerges consisting of most of the equations that enters the non-oil sector and the household block described in section 3.1 (23 equations to be precise). The reason for this difference in model structure can easily be seen. The relative price of output (PYFP) and any price for domestic demand say PJP, can no longer be reduced to a factor depending only on exogenous variables. Similarly in the equation linking labour demand to output and real wages, the output price is now endogenous and thus the nominal wage cannot be solved by equation (2) as in the SOE-version. The simulation results below illustrate these features of the model in more detail in the tables 3.4, 3.5, and 3.6.

Table 3.4. Effects (in %) of a permanent increase in total factor productivity by one percent

Variable	1. year	2. year	3. year	10. year	20. year
Household consumption	0.4	0.8	1.1	3.4	5.2
Non-oil investment	6.2	6.5	6.8	7.8	7.3
Domestic absorption	0.8	1.0	1.2	2.4	3.3
Non-oil value added	1.2	1.4	1.7	3.0	4.9
Non-oil capital stock	0.4	0.8	1.1	3.4	5.3
Wage rates	-0.9	-0.3	0.3	4.2	7.9
Non-oil price	-2.0	-1.7	-1.3	1.2	3.7

An increase in total factor productivity reduces production costs at given factor prices, thus the output price goes down initially. The reason why the price goes down more than the shift in productivity is that the user cost of capital is reduced because part of the capital equipment is produced domestically.

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Given the initial level of factors of production, output is higher and this also stimulates demand for capital and investment increases. With higher output and capital stock, real wages increase even if the nominal wage rates decline initially. Since imports are linked to domestic absorption, imports increase pari passu with absorption.

In the longer run the increase in productivity pushes labour demand up and wage rates have to increase since labour supply is given. This also pushes prices up in the longer run. Notice, however, that even after 20 years a new stable situation has not been reached. The reason is that the adjustment of the capital stock now depends on the domestic production capacity given by the production function and the level of labour supply. A sudden and large increase in imports (as in the SOE-version) is no longer the «quick fix» in order to adjust the capital stock as large parts of the capital equipment have to be produced domestically in this model version. The importance of this feature is also illustrated in the simulation of an increase in government employment shown in table 3.5.

Table 3.5. Effects (in %) of a sustained increase in government employment by one percent

Variable	1. year	2. year	3. year	10. year	20. year
Household consumption	0.2	0.1	0.0	-0.8	-1.5
Non-oil investment	-2.1	-2.3	-2.4	-2.9	-3.0
Domestic absorption	-0.1	-0.2	-0.2	-0.7	-1.0
Non-oil value added	-0.1	-0.2	-0.3	-0.7	-1.1
Non-oil capital stock	-0.1	-0.3	-0.4	-1.2	-1.9
Wage rates	0.0	-0.2	-0.4	-1.8	-3.2
Non-oil price	0.0	-0.1	-0.3	-1.2	-2.2

Higher government employment reduces the labour available for the private non-oil sector. As wages are higher in the government sector, household income increases and thus consumption. Lower supply of labour to the private sector leads to lower output, demand for capital and investment. Thus there is lower demand as well as investment is a major component of domestic demand. This reduction in demand is followed by lower output prices and this also leads to lower nominal and real wages. The reason why real wages decline is that the capital stock is reduced more than employment so that labour productivity declines. When the output price declines while import prices are unchanged (by assumption), the capital output ratio also declines. This is the main reason why the real wage goes down.

Table 3.6. Effects (in %) of a permanent reduction in the user cost of capital

Variable	1. year	2. year	3. year	10. year	20. year
Household consumption	-0.6	-0.5	-0.4	0.4	1.1
Non-oil investment	1.8	2.0	2.1	2.7	2.9
Domestic absorption	-0.1	0.0	0.0	0.5	0.9
Non-oil value added	0.1	0.1	0.2	0.6	1.1
Non-oil capital stock	0.1	0.2	0.3	1.1	1.9
Wage rates	-1.6	-1.5	-1.3	-0.1	1.3
Non-oil price	-1.7	-1.6	-1.5	-0.7	-0.2

A reduction in the user cost of capital increases investment and the capital stock. Thus output increases. In addition the output price is reduced due to lower production costs. However, due to the importance of imports, consumer prices are not reduced as much as the output price and consumer real wages are therefore reduced. This explains why consumer demand is lower in the first years. Gradually real wages increases as the capital output ratio and labour productivity increase. Higher demand in the longer run increase the nominal wage rate and thus the output price.

3.4. An aggregated version of the Selection Model

Compared to the model in the previous section we now assume wage rates to be exogenous. Thus we must drop one equation and the consumption function is chosen. What is the interpretation of this model? One possible interpretation is that the wage rate in the private sector is basically given on the world market as most employment is carried out by foreign workers. One might object to this interpretation by claiming that in this case employment by foreigners should have been endogenous, not exogenous as is the case. One reply to this objection is that the number of foreign workers are regulated by the authorities.

An alternative way of «closing» this model would have been to let the number of foreign workers be endogenous and retain the consumption function. Such a model would however, be quite similar to the Implementation Model in model characteristics in that wages were nominally rigid and employment demand determined. This does not seem to be a worthwhile solution. The problem really comes down to how to model the labour market. As long as labour is treated as a homogeneous factor of production - which is not a very good solution, although very common - we are left with few options. Thus in the further development of the Selection Model much emphasis should be put on how to model the labour market.

We have carried out simulations also on this aggregated CGE-version but the results will not be shown in detail as that is done for the disaggregated model in chapter 5. The results of higher total factor productivity is in many ways quite similar to the results in the SOE-model. The main difference is really that because the wage rate is exogenous (as opposed to the output price in the SOE-model), prices will now decline in order to bring about an increase in real wages. In addition, it is now household consumption that takes the burden of adjusting initially when investment increases and not imports. But from the second year and onwards, this difference disappears. Also the results of higher government employment are quite similar between the two model versions.

4. The Structure of the Selection Model

4.1 Main features

The Selection Model is a general equilibrium model intended for use in the elaboration of Development Plans for the Saudi economy. Although the planning process is currently centred around five-year plans, each plan needs to be considered in a somewhat more long-term perspective. To take one simple example, an investment programme undertaken during the current five year period, may 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 warranted. This does not imply that the model only focuses on the supply side of the economy. Rather it is the interaction between supply and demand that is at the centre of our attention.

4.1.1 Outline of the model

The Selection Model is closely linked to the Implementation Model in that the data and aggregation level are the same. Also the variable names in the computer program are identical as much as possible in order to facilitate the interactive use of both models in the planning process. However, the economic structure of the Selection Model is quite different from the Implementation Model. This is partly illustrated in chapter 5. The reason for the difference lies in the number of additional assumptions that have been added to the Selection Model. First of all, we assume that labour supply is exogenous so that unemployment is non-existent. This feature changes the way the model behaves quite markedly when subjected to an economic shock compared to the Implementation Model.

Second, the way we have modelled different sectors also varies. Some of the most important production sectors of the Saudi economy - those related to the extraction and processing of crude oil - are assumed to be linked to the world market in a way that changes their behaviour compared to other private industries. For these sectors output prices are assumed to be determined on the world market and gross investment by sector is exogenously given by the plan. Consequently, exports for each of these commodities are endogenous. For most other private sectors, exports are negligible and exogenous. Third, capital is mobile between most private sectors of the economy and the 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 an alternative investment abroad.

The way the labour market is modelled is crucial to the functioning of the model. While labour supply of Saudis are related to the size of the population, the labour supply of non-Saudis is exogenous. On the demand side however, there is no distinction between Saudis and non-Saudis. The latter assumption is not one that we consider plausible. Except for some small groups of experts, most foreign labour is non-skilled and is employed in the service sectors. The supply of this labour is probably highly elastic and regulations of immigration play a role in limiting the supply, although it is not certain to what extent such regulations are effective. The nominal wage rate is also assumed exogenous, but can to some extent be considered as a numeraire in the model. This interpretation is at least defendable if imports are considered as non-competitive which is fairly reasonable in the Saudi context. If however, we had more data on employment and wages by Saudis and non-Saudis, we could have introduced an assumption of imperfect substitutability between different groups of labour. 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 extension 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.

4.1.2 Data
The data sources from the Implementation Model have been utilized in the Selection Model, also many equations are identical. Accordingly, the main data source is the annual national accounts data. None of the new parameters have been estimated from time series techniques, hence most of the data needed are from 1989, the base year of the model. The only additional source of data to those of the Implementation Model is the employment by sector data for 1989, taken from Ministry of Planning (1996), Table 2.5 and investment by sector in 1989, according to Table 4.6 in the same document. These data are used for calibration of the coefficients of the production functions, see Annex B for a detailed documentation.

It should be underlined that the capital stock data are 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 sectoral data on employment for Saudis and non-Saudis.

4.1.3 Policy variables
Some of the policy variables from the Implementation Model are also included in the Selection Model. These include net taxes and controlled prices which enter directly into the price equations. Government consumption and gross fixed capital formation are important policy variables as well, but the effects of these are rather different from what they are in the Implementation Model. In addition, investments are also important policy variables for other production sectors, notably the Oil and gas sector where production is also treated as exogenous, and for Petroleum refining and Petrochemicals.

Government transfers to households and disbursement of investment credits are important policy variables in the Implementation Model. However, these variables do not play a similar role in the Selection Model, since there is no macro consumption function and investment is determined from the supply side.

4.1.4 Aggregation level
The industries specified in the Selection Model are the same as in the Implementation Model.

Production sectors: (abbreviations in parentheses)
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 in the model allocated to nine consumer groups by means of a linear expenditure system. The consumption groups are those defined in the national accounts. The composition of consumption groups also coincides with that of the Cost of Living Index.

Consumption items: (abbreviations in parentheses)
1. Food, beverage, tobacco (OF)
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 industry in the Selection Model, despite the lack of such data in the national accounts. The 13 sectors included are all production sectors above less Government services, Import duties and Imputed bank charges. In addition investment is divided between institutional sectors, i.e. Government, Oil and the Private, non-oil sector. For the Government and the Oil sector two categories of investments are defined (categories 2 and 3 below), while Private, non-oil sector investments also include residential buildings.

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

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

Export categories: (abbreviations in parentheses)
1. Crude oil and natural gas (OG)
2. Petroleum refining (PR)
3. Petrochemicals (PS)
4. Non-resident direct purchase (CPN)
5. Other exports (XX)

4.2 Consumer demand

Total private consumption is in the Selection Model determined residually, i.e. a macro consumption function is not needed. However, we include the macro consumption function, which is identical to the one in the Implementation Model, so that savings (represented as the residual of the macro consumption function) can be determined. In future work with the model, one may also want to change the model by making e.g. the nominal wage level endogenous. Then the macro consumption function can be used to determine aggregate consumer demand as in the Implementation Model.

The macro consumption function in general form can be written as

$$CPR = f (HR/PCPR, HW/PCPR, POIL/PCPR, D9091)$$

where CPR = private consumption by residents
       PCPR = the price index for CPR
       HR = household disposable income
       HW = household net financial wealth
       POIL = crude oil price, Arabian light
       D9091 = a Gulf-war dummy

The definitions of disposable income and financial wealth are as follows

$$HR = VYW + VYSH + GESS$$

$$HW = (M2 - M0) - LIABP$$

where VYW = wage income
       VYSH = households' share of operating surplus
       GESS = (Government expenditures on) social security services
       M2 = money supply; currency outside banks, demand and time deposits
       M0 = money supply; currency outside banks
       LIABP = liabilities (i.e. banks' claims on private sector)

In the long run the sum of the elasticities of disposable income and wealth is equal to 1. The long-run effect of disposable income is estimated to 0.85 while the wealth elasticity accordingly is equal to 0.15. In the short run the effect of an increase in income is, however, considerably larger. The real oil price has a relatively small positive impact on consumption - a 1 percent increase in the oil price lifts consumption by 0.2 percent.

Total consumption by resident households is divided into nine consumer items (in accordance with the National Accounts), by a linear expenditure system. The important feature of this system is that it takes account of both income and direct and indirect price effects.

A price increase for one of the consumer groups, e.g. due to an increase in indirect taxes, will affect both the consumption of the respective group negatively and consumption of all other groups positively. All groups are regarded as gross substitutes by the consumer (as opposed to complements). This assumption is viewed as reasonable for groups at the aggregation level in the national accounts because complementary goods will tend to be included within the respective groups. The income effect shows which of the consumption groups that can be characterized as luxury goods i.e. with an income elasticity above 1, and which can be seen as necessity goods with elasticities below 1.

The coefficients in this system have not been estimated (due to lack of genuine time series data), 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 seem 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, 1989. The coefficients should therefore be viewed as preliminary estimates.

A representative equation can be written

$$CPRi = gi(VCPR, PCPj), \quad i, j = 1,....,9$$

where CPRi = consumption by residents of consumption item i
 VCPR = value of total consumption by residents
 PCPj = price index for consumption item j

Table 4.1 shows the direct price elasticities (Cournot elasticities) and expenditure elasticities (Engel elasticities) for each of the consumer groups. Cross price elasticities can also be derived from the linear expenditure system.

Table 4.1 Expenditure and direct price elasticities for different consumer groups

Consumer group	Expenditure elasticities	Direct price elasticities
1. Food, beverage, 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

As can be seen from the table, only two items can be seen as necessity goods: Food, beverage and tobacco, and Clothing and footwear. The other items are to different degrees luxury items.

The LES system determines consumption for resident households by item. By adding consumption by non-residents for each item, total consumption by item, which is needed in the Input-Output value added determination, is obtained. Consumption by non-residents is divided into five of the consumer items by using (fixed) weights showing that 7 percent of non-residential consumption is Food, beverage and tobacco, 6 percent is Clothing and footwear, 22 percent is Furniture and household equipment, 1 percent is Transport and communication and the remaining 64 percent is Other goods and services. Although these weights build on information from 1976, they are relied on until more recent estimates can be provided.

4.3. Labour supply

Data for Saudi labour supply by gender are included in the model, based on information from the Fifth Development Plan, which incorporates labour supply estimates for the years 1989 and 1994. The labour supply data LR is modelled as function of the total population in Saudi Arabia, POPSA

LR = LRRATE*POPSA

where LR = labour supply
         LRRATE = labour supply divided on total population
         POPSA = population in Saudi Arabia

4.4 Imports

Total imports is determined by weighting together all final demand components by use of the import shares for each category in the base year (1989), adjusted for the average change in import shares from the base year. The import equation can be written

M= MS m(CPj, CG, Jkl, Xm, DS)

where M = total imports
         CPj = private resident and non-resident consumption by item (j = 1,...,9)
         CG = government final consumption
         Jkl = gross fixed capital formation by sector (k = G, P, O) and category
         (l = H, B, TM)
         Xm = exports by category (m = OG, PS, PR, XX)
         DS = increase in inventories
         MS = the average import market share relative to the shares in the base year

The function m(.) gives total imports as the sum of actual demand by category multiplied by each category's import share in the base year. The import shares in the base year are defined by the input/output coefficients between imports and final demand. Hence the function m(.) is the same as the input/output equation for imports.

The average change in the import share is aimed at taking account of changes in imports that are not caused by changes in the composition of final demand. The aggregate import share is hence treated as exogenous.

4.5 Production/demand by industry

Value added by industry is related to final demand by the I/O equations - weighting together all final demand components by use of the input/output coefficients

Yi = yi(CPj, CG, Jkl, Xm, DS, MS)

where Yi = value added by sector (i = 1,...16), and other symbols as for the import equations.

Just as each I/O coefficient for imports is adjusted for changes in import shares, the I/O coefficients for domestic production by industry are changed in the opposite direction, so obviously, MS has to enter these equations. However, this time we have entered MS inside the function symbol. Since the I/O coefficients for imports and domestic production have to add up to 1 for each category of final demand, this adjustment must be made for every final demand component, i.e. every I/O coefficient. The adjustment is distributed to each industry by the industry's share of deliveries to each final demand category.

4.6 Prices on final demand

Prices of final demand components are determined by I/O-equations which corresponds to the value added equations presented in 3.5. As in the value added equations, the aggregate import share enters the price equations, adjusting each I/O coefficient. Consumer prices, price indices for private investment by institutional sector, the prices index for government consumption and export prices are all dependent on import prices and value added prices in all production sectors. These equations therefore contain the same explanatory variables and can thus be written in the following manner

$$PCPi = a1 \ (MS, PM, PYi)$$

$$PJkl = a2 \ (MS, PM, PYi)$$

$$PCG = a3 \ (MS, PM, PYi)$$

$$PXm = a4 \ (MS, PM, PYi), \ m = OG, PS, PR, X$$

where PCPi = price index for consumption item i = FOO, CLO, REN, FUR, MED, TRA, ENT, OTH, ABR
MS = aggregate import share
PM = import price index
PYi = value added price indices for all industries (i = 1,...,16)
PJkl = price index for gross fixed capital formation, k = P, G, O , l = B, H, TM
PCG = price index for government consumption
PXm = price index of exports by category

The price index of change in stocks is determined by utilizing the fact that change in stocks is one component of aggregate demand, that should be equal to the sum aggregate production (GDP) and imports. This relationship holds not only in volume terms but also in value terms, and the price index is therefore defined as

$$PDS = (VY + VM - VCP - VJ - VX)/DS$$
where DS = change in stocks, at constant prices
PDS = price index for DS
VY = value of GDP
VM = value of imports
VCP = value of final consumption
VJ = value of total gross fixed capital formation
VX = value of total exports

The last prices index to be determined is the one for consumption by non-residents, and here the estimates of the composition of non-resident consumption on consumption items are utilized. The five relevant price indices are given weights equal the ones used when adding non-resident consumption by item to resident consumption by item, and the weighted sum is an estimate of the price index of non-resident consumption

$$PCPN = 0.07*PCPFOO + 0.06*PCPCLO + 0.22*PCPFUR + 0.01*PCPTRA + 0.64*PCOTH$$
where PCPN = price index for consumption by non-residents
PCFOO = price index for Food etc.
PCCLO = prices index for Clothing etc.
PCFUR = price index for Furniture etc.
PCTRA = price index for Transport etc.
PCOTH = price index for other goods and services

4.7. Production/supply by industry

This section describes in detail the modelling of producer behaviour in the Selection Model. The assumptions used vary between industries and section 4.7.5 summarizes the differences. The data used in the modelling of industries exist only at an aggregate level. By using a number of simplifying assumptions, we have constructed sector data that are not observed. This «guesstimation» procedure is described in Annex B.

4.7.1 Production functions

We have specified production functions for all 13 private sectors. They are all of the same form in that they relate value added by industry (Yii) to employment (Eii) and the capital stock (Kii) by industry. The functional form chosen is Cobb-Douglas with constant returns to scale

$$Yii = TFPii*EiiAii *Kii\ (1-Aii)$$

TFPii (total factor productivity) is normally an exogenous variable. However in the oil and gas industry (OG) it is endogenous as output (value added) is assumed to be exogenous for that sector.

4.7.2 Labour demand

Using standard marginal conditions for profit maximization we have for all private sectors

$$Eii = Aii*(PYFii/Wii)*Yii$$

where PYFii is the price index for value added at factor costs and Wii is the wage rate for sector ii. The wage rate in each sector is assumed to be proportional to the average wage rate in the private sector (WP)

$$Wii = W.ii*WP$$

Thus the model does not attempt to explain the structure of relative wages in the economy. In order to do so we would need information on employment and wages by sector and education or skills. Given the fact that two thirds of employment is by foreign workers in Saudi Arabia, information on the role of foreign labour in different sectors would improve the modelling of the labour market. That is left for future work. In the present version of the Selection Model WP is exogenous.

4.7.3 Capital accumulation

Similar to the labour demand equations we have a capital demand equation

$$Kii = (1-Aii)*[PYFii/PKii]*Yii$$

where PKii is the user cost of capital defined by

$$PKii = PJP*(IRii + DELTA.ii)$$

where PJP is the gross investment price index, IRii is the real rate of return on capital in sector ii, and DELTA.ii is the geometric depreciation rate for sector ii. IRii by sector is related to the average real rate of return in the private sector (as for wage rates) except for the oil and gas sector (OG), petroleum refining (PR), petrochemicals (PS) and electricity and water (EW). For these sectors investment is exogenous and then the capital stock follows from the standard accumulation equation relating stock and flow

$$Jii = Kii - (1-DELTA.ii)*Kii(-1)$$

For these sectors the user cost then follows from the capital demand equation and the rate of return from the definition of the user cost equation. For all other private sectors the real rate of return (IR) is linked to the exogenous average real rate of return and since DELTA is a coefficient and PJP is determined elsewhere in the model the user cost is determined. Then follows the capital demand and finally investment by the stock/flow equation.

4.7.4 Producer prices

There are no «producer price equation» in the model. The reason is simply that it is superfluous. To be more precise a producer price equation follows from the equations presented in the sections above so that including a price equation in addition would make the model overdetermined. If one inserts the labour demand and capital demand equations into the production function, one gets

$$Yii = TFPii*(PYFii/Wii)Aii *(PYFii/PKii)(1-Aii)*Yii*const$$

By solving for PYFii we get

$$PYFii = const*TFPii-1*WiiAii*PKii(1-Aii)$$

From this implied price equation we see that the producer price is independent of output so that the supply function is horizontal. This follows from the assumption of constant returns to scale. But again, this equation is not explicitly in the model, it follows from the other equations.

In those sectors where investment is exogenous and output endogenous (EW, PR and PS), the capital stock can be treated as predetermined. By inserting the labour demand equation into the production function we arrive at a more traditional upward sloping supply function

$$Yii = F(PYFii/Wii, Kii, TFPii), \qquad ii = EW, PR, PS$$

where the partial derivatives with respect to all variables are positive except for the wage rate which is negative. In general we may say that PYFii is determined by the demand equation for value added by industry (through the I-O structure), the production function and factor demand equations by industry as will be explained in the following section.

4.7.5 The structure of the industry models

In chapter 3 we presented some stylized aggregated CGE models. In this section we shall describe how the various sectors or industries are modelled within the Selection Model. In doing this we shall draw on some of the discussion in chapter 3. The table below summarizes some important aspects of the various industries in the model.

Table 4.2 The modelling of various industries in the Selection Model

Industry	Price	Supply	Demand	Exports	Investment
Oil and gas (OG)	X	X	E	E	X
Petrochemicals (PS)	X	E	E	E	X
Petroleum refining (PR)	X	E	E	E	X
Electricity, water (EW)	E	E	E	0	X
Other private sectors	E	E	E	X	E
Governm. services (GS)	E	E	X	0	X

Note: X=Exogenous, E=Endogenous, 0=Zero

Let us start with the oil and gas industry. This is of course a special sector in the Saudi Arabian economy as the country is by far the world leading exporter of crude oil. It is also clear that the assumed exogenous production or supply decision has an effect on the price. The reason why we have

assumed both supply and price to be exogenous, is simply that this model is not a world oil model which one really needs in order to relate these two variables. As described earlier, the production function is not really effective for this sector as the total factor productivity term is endogenous. Given output and investment, the capital stock follows and this determines the real rate of return of capital residually. The labour demand equation determines employment as shown in section 4.7.2.

A graphical representation of the market for oil and gas is shown in figure 4.1 below. Since output is exogenous it is represented by a vertical line in the figure. The output price is also exogenous and is represented by a horizontal line. Domestic demand is represented by a downward sloping curve which together with the price line determine domestic demand. The residual between total output and domestic demand is then exports which is endogenous. It is important to notice that a change in the output of oil and gas will not only change exports but also change domestic demand. The reason for the latter effect is due to I-O effects from the oil sector which changes the output of other sectors. In addition higher labour demand in the oil sector will reduce the number of people available for jobs in other sectors which also has effects on domestic demand for oil and gas. Thus when interpreting the partial equilibrium depicted in figure 4.1 one must be careful not to jump to general equilibrium conclusions.

Figure 4.1 Partial equilibrium in the OG-industry
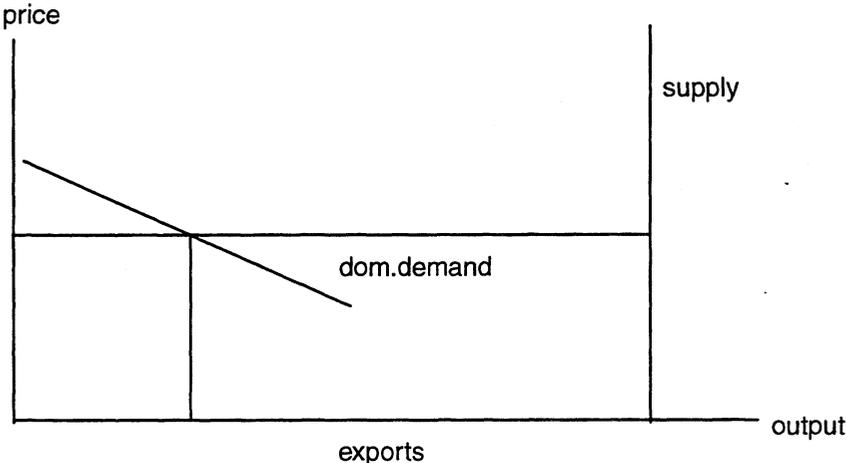
The model for petrochemicals (PS) and petroleum refining (PR) are basically the same as shown in table 4.1. It is a typical version of the small open economy (SOE) model where the output price is determined on the world market and the supply curve is upward bending due to the assumption of a fixed capital stock that follows from the assumption of exogenous investment. Again exports are endogenous in both industries and is the residual between total output and domestic demand. Notice that in principle (as is also the case in the oil and gas industry) exports can be negative if domestic demand increases and or supply decreases. In that case the country becomes 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 homogenous and the «law of one price» prevails.

Figure 4.2 Partial equilibrium in the PS- and PR-industries
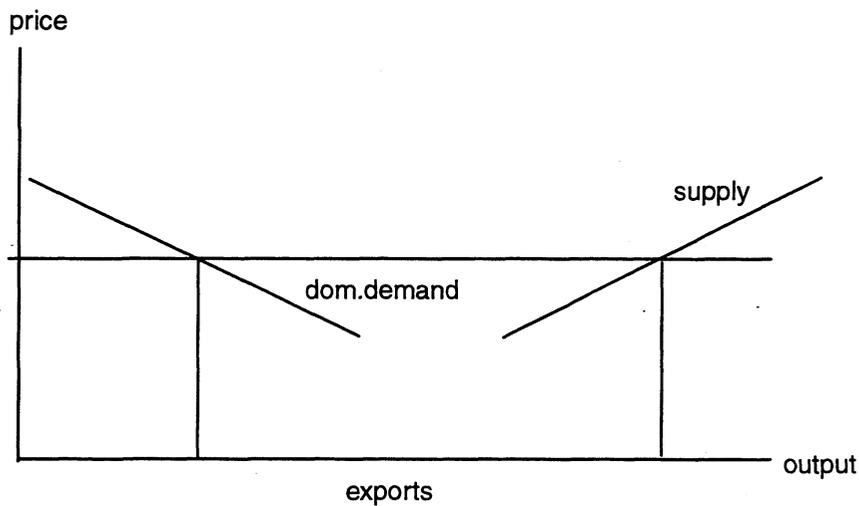
The sector producing electricity and water (EW) is assumed to have no exports i.e. produces non-tradables. Thus price and output are determined by domestic factors and in a way similar to the simple textbook description of a market. Gross investment is exogenous and thus the capital stock is predetermined producing an upward sloping supply curve. Where we have intersection between demand and supply, price and output is determined as exports are zero.

Figure 4.3 Partial equilibrium in the EW-industry
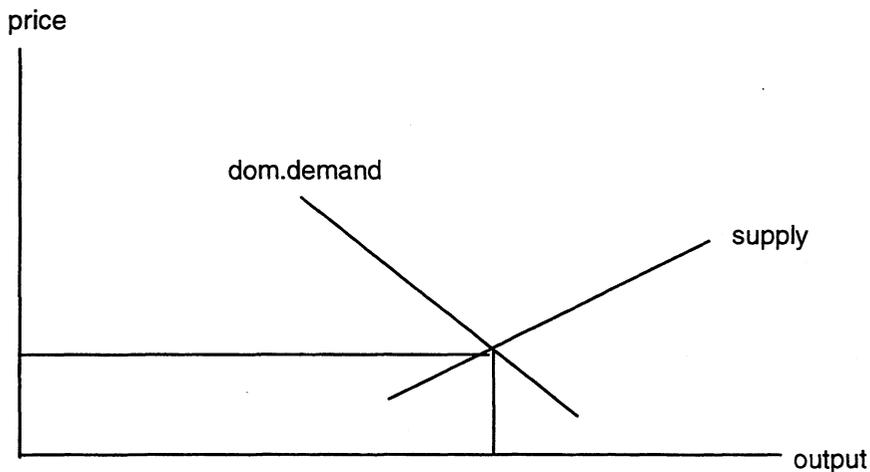
Finally the other private industries can be described as sectors where exports is exogenous (and very small) thus demand includes a positive fixed element representing exports. Due to the fact that both employment and capital are endogenous, the supply function (or the price function) is horizontal as we are assuming constant returns to scale, cf. section 4.7.4. Thus the supply side determines the price while the demand side determines output, cf. figure 4.4.

Figure 4.4 Partial equilibrium in other private industries
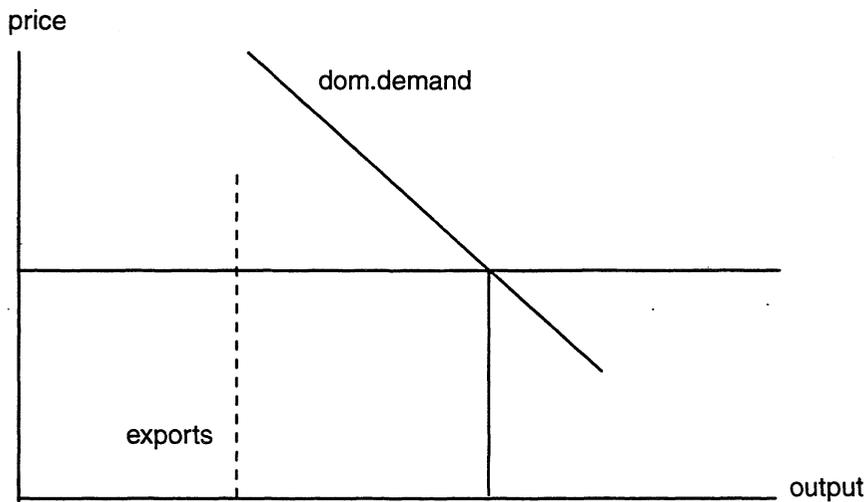
However, the representation in figure 4.4 gives a false picture of how the Selection Model works for private industries as a whole or how the main macroeconomic mechanism is operating. The reason for this is that as we assume that total employment is exogenous in the model. This implies that total domestic demand is adjusted so that all available labour is used. In the model it is private consumption that has this role as an adjustment mechanism. This is shown in figure 4.5 where the vertical line represents total supply (by other industries) which is determined by the exogenous labour supply and domestic demand will adjust so that it intersects the supply and price functions where they cross.

Figure 4.5 General equilibrium for other private industries
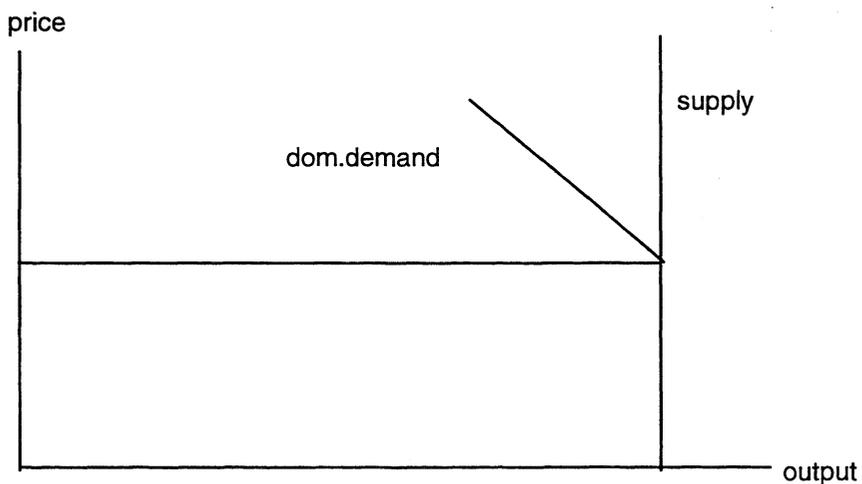
5. Multiplier Analyses

In a highly simultaneous model as the Selection Model, it is of vast importance to investigate multiplier analyses, i.e. the effects on endogenous variables of shocks to exogenous variables. Only one or a few variables should be considered at a time, in order not to mix effects of different variables. In this chapter we report two set of multipliers

- a reduction of 10 percent in total government expenditure
- an increase of 10 percent in the wage level for the private sector

If analyses are undertaken with the historical simulation as a reference path, the multiplier effects could be distorted by the actual development in the exogenous variables. In order to avoid this problem, the multiplier analysis is undertaken by extending all the exogenous variables from 1991 to 2010, while keeping the 1991-level constant over this period, and the corresponding series for endogenous variables were simulated by the model.

5.1 A reduction of 10 percent of total government expenditure

Government consumption and investment were reduced by 10 percent from 1996 to 2010, and effects on endogenous variables studied. This policy change is similar to the one undertaken for the Implementation Model, and results show the main differences of the working of the two models. Some results are reported in charts 5.1 - 5.7.

A drop in governmental consumption and fixed capital formation immediately increase GDP, employment and the capital stock for private sector, see chart 5.1. With fixed supply of labour, lower public employment implies that private employment has to increase, which also means that production and the use of capital will increase. This result is in sharp contrast to the Implementation Model where private activity and use of labour were reduced. For Private non-oil GDP (value added) the effect stabilises after around 2-3 years, as is also the case for employment. The capital stock takes a longer period to adjust. Apparently there is a paradox in that both the capital stock and employment increase more than GDP for private sector, when the Cobb-Douglas production function should imply that the GDP effect is some average of the employment and capitals stock effect. However, when aggregating up the effects from several sectors, this might not be true due to composition effects.

Prices increase somewhat while the wage rate, being exogenous in the model, is obviously unaffected by the increase of government expenditure, see chart 5.2. As have been pointed out in section 4.7.5 prices are unaffected of demand in all but one sector; electricity and water. Accordingly, the rise in the consumer price is stemming from this sector.

Chart 5.3. displays the negative effects on private consumption and fixed capital formation in the private sector. The immediate rise in investment is almost 16 percent. Then the positive effects diminish gradually to stabilise after around 10 years, roughly 1 percent above base level. The rapid immediate response is due to the fact that more investment is needed for building up of the capital stock. When this process has been finished, some more investment is needed to account for the higher level of depreciation than before. Consumption, which is determined residually, increases gradually as rise in investment is reduced and gives more room for consumption.

Reducing government expenditure has an unambiguous positive effect on the government budgets, which is clearly improved according to chart 5.4. However, compared to the effects in the Implementation Model, the improvement of the budget is smaller here. This is because increased private sector activity also implies an escalation of subsidies to this sector, increasing government expenses. Reduced government expenditure has a direct negative effect on imports, but higher private

activity gives positive (indirect) effects on imports. Consequently the current account is only slightly reduced, see also chart 5.4.

Charts 5.5-5.7 displays effects for 9 production sector. As similar results were not presented for the Implementation Model, no comparison is made here. Effects for both trade and transport are positive both in the short run and in the long run, see chart 5.5. For Community services the immediate effects is negative, probably due to lower demand effects for public sector. In the longer run, positive effects from increased private sector activity dominates. From chart 5.6 we see that agriculture is the sector benefiting most from the contractive policy, with an increase in value added of around 5 percent. The positive effects for electricity and water is about half the size of the effect on agriculture, while manufacturing is hardly affected at all, only a very small positive impact in the long run. According to chart 5.7 value added in the construction industry increases first, but decrease in the long run. The positive impact due to the rapid rise in demand for private investment goods, while the reduced demand from public sector dominates in the long run. It seems somewhat puzzling that value added in real estate increases while the one for finance is reduced. The reason has to be that finance is more connected to public sector, which can be seen from the I-O coefficients.

Figure 5.1. Deviations from base scenario in per cent
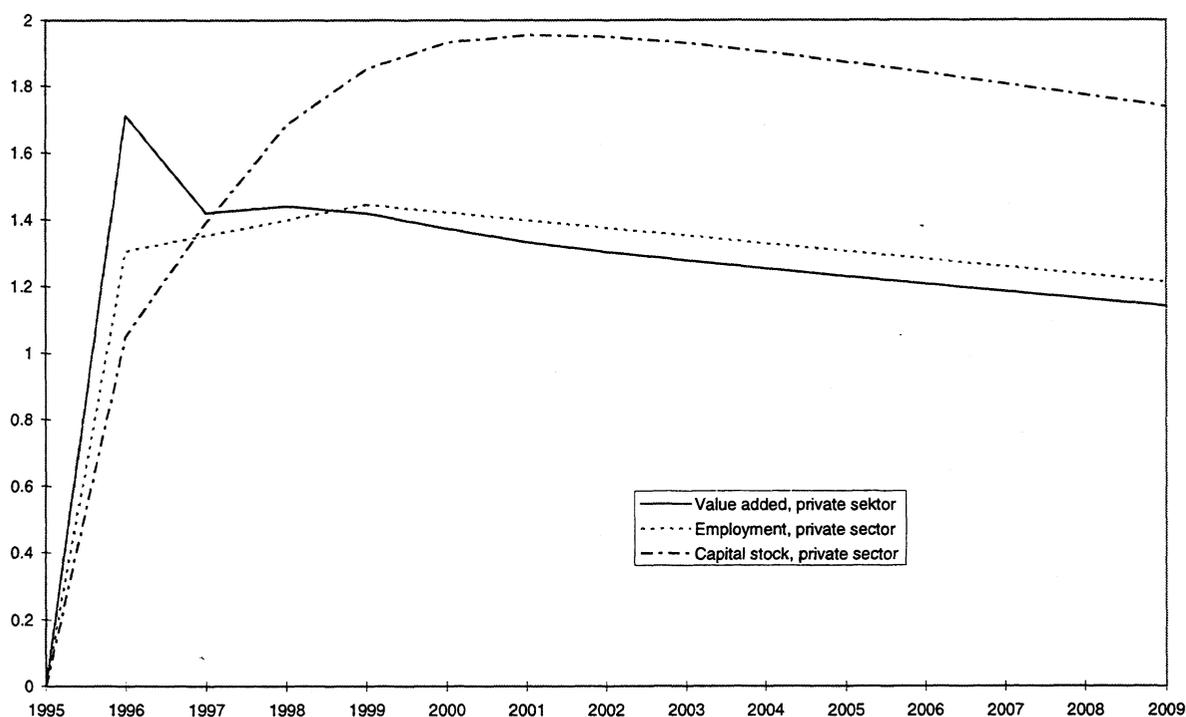
Figure 5.2. Deviations from base scenario in per cent
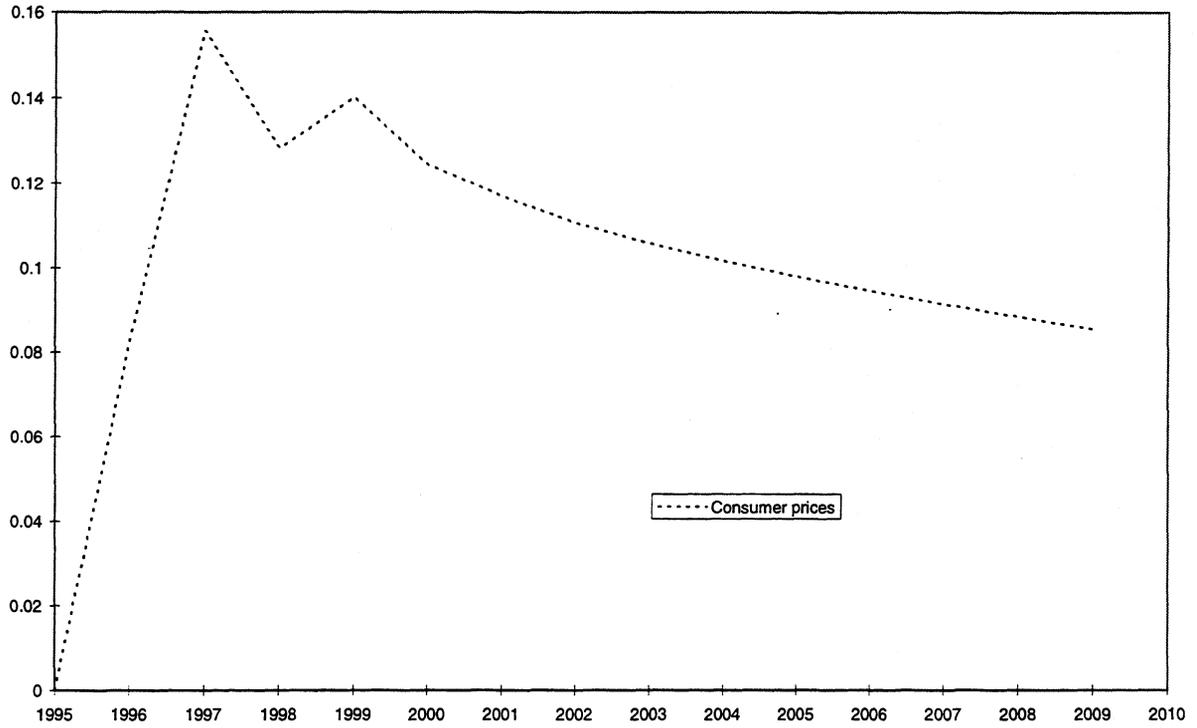
Figure 5.3. Deviations from base scenario in per cent
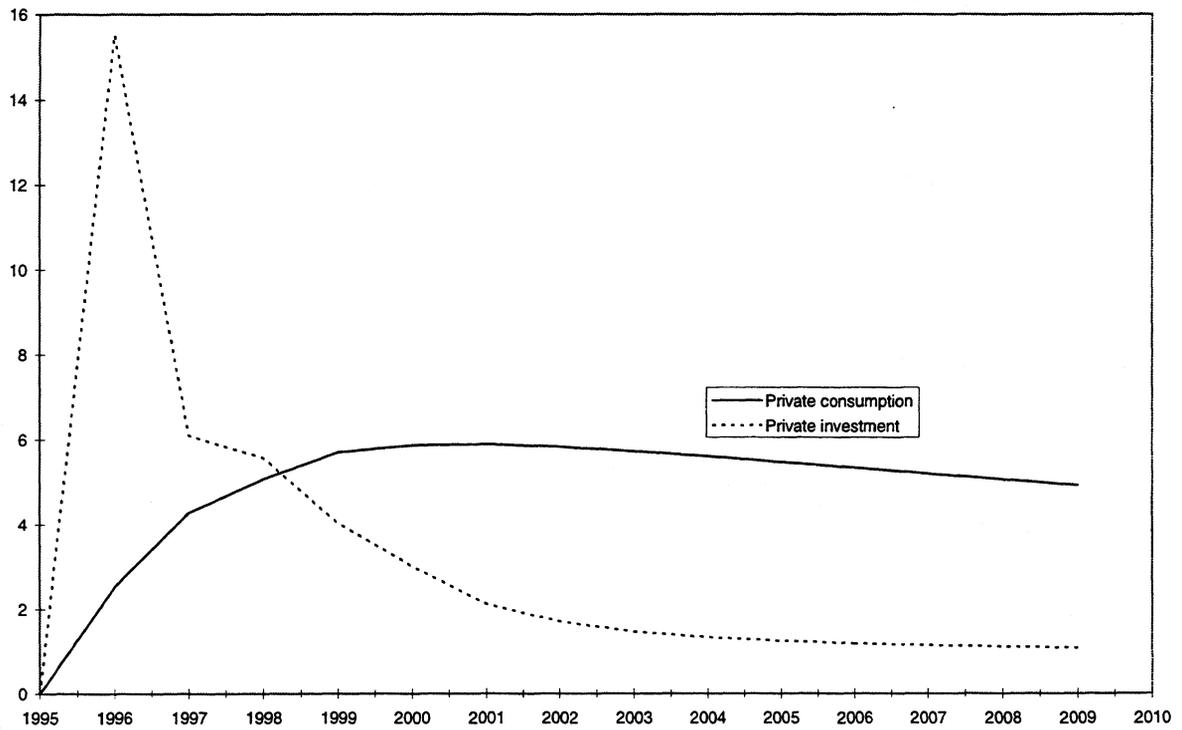
Figure 5.4 Deviations from base scenario. Mill. SR
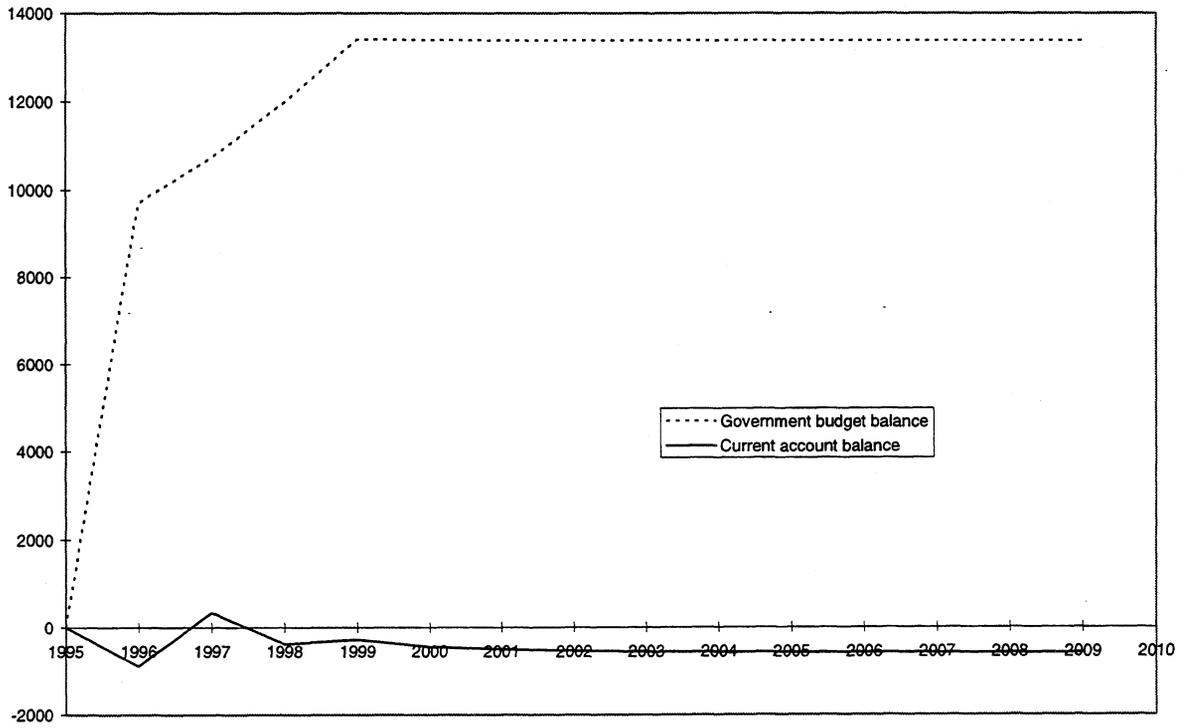
Figure 5.5. Value added by sector. Deviations from base in per cent
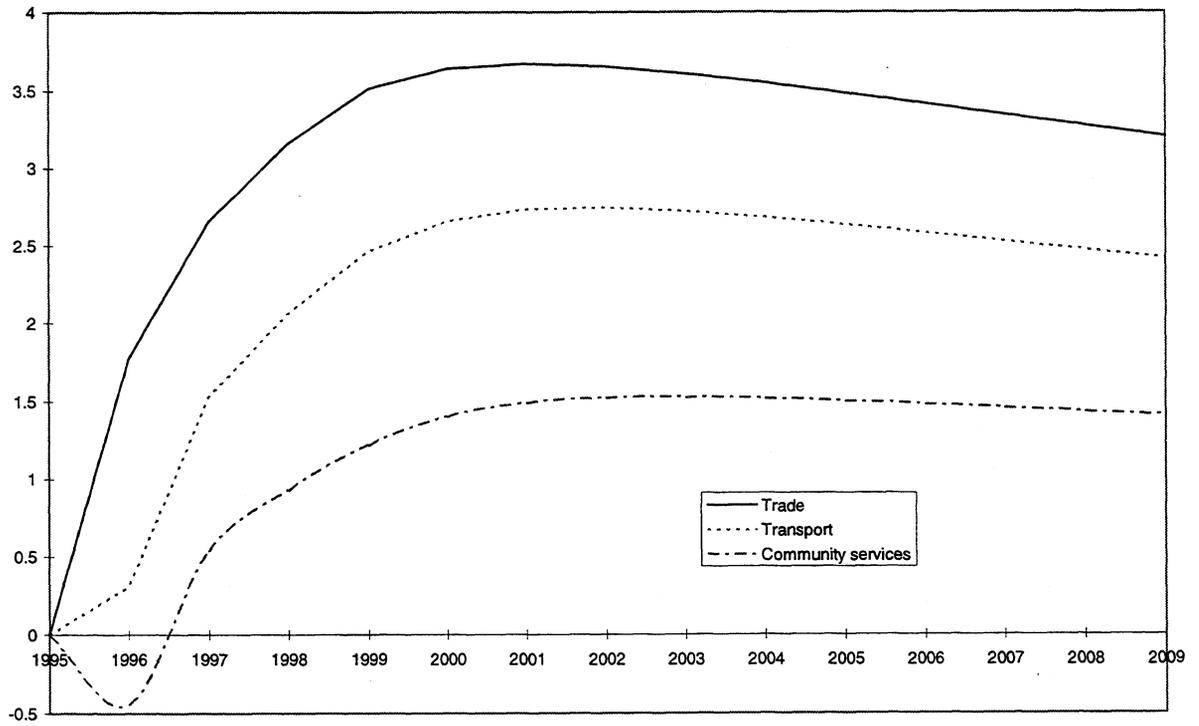
Figure 5.6. Value added by sectors. Deviations from base in per cent
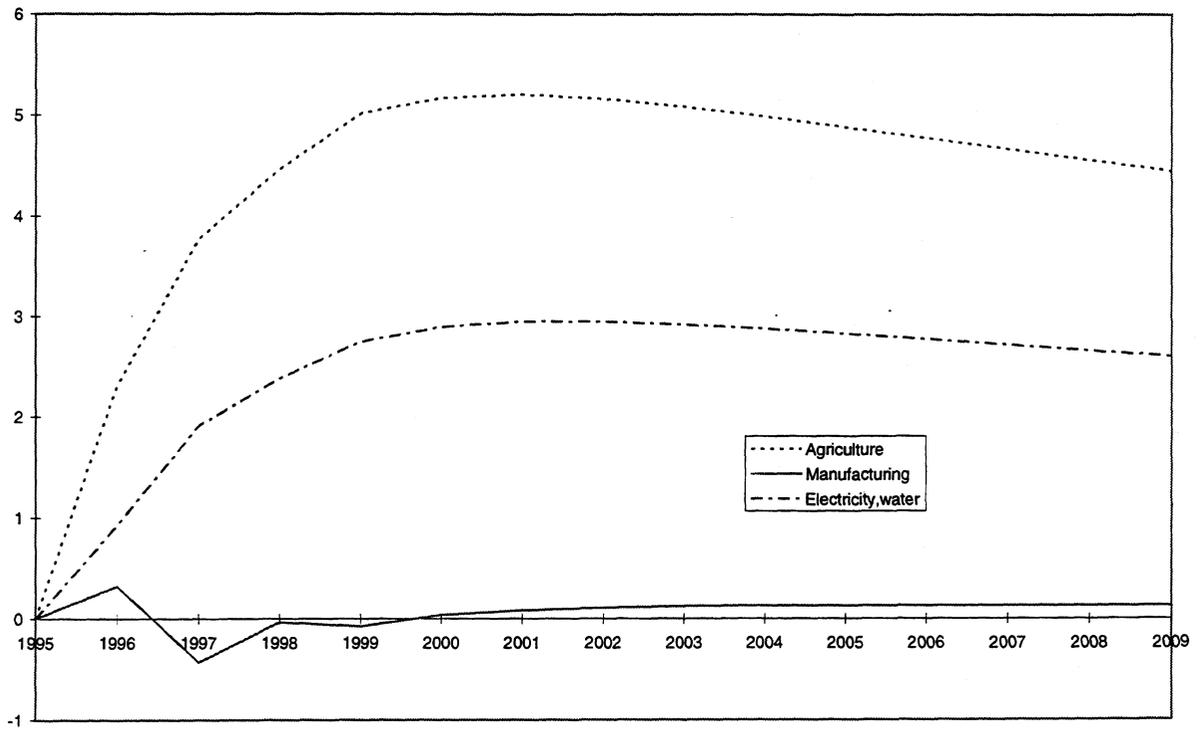
Figure 5.7. Value added by sectors. Deviations from base in per cent
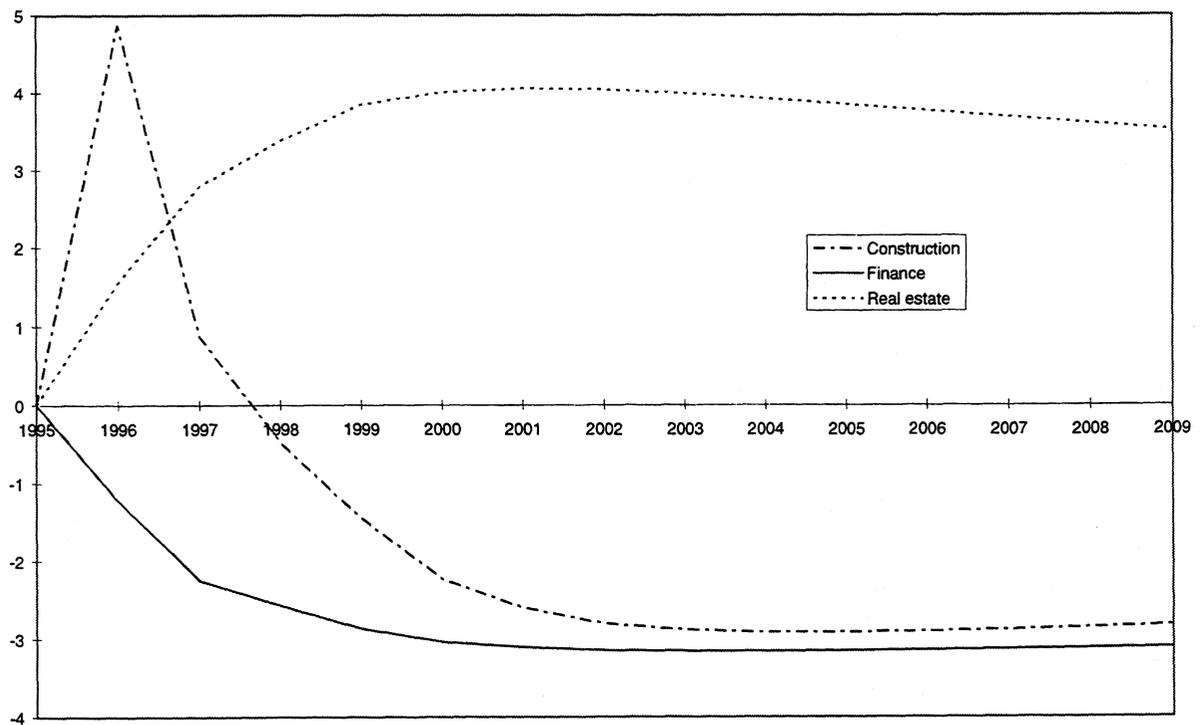
5.2 An increase of 10 percent in private sector wages

The effects of this shock is also sector dependent, even though nominal wages increase by the same proportion for all sectors. Take first a look at the oil and gas industry where production is fixed. The wage increase induces a similar rise in the producer real wage (nominal wages divided by the producer price), reducing employment by the same amount, but leaves the capital stock unaffected.

In the Petrochemical and the Petroleum refining industries producer prices are given and the nominal wage rise therefore gives an identical increase in real wages for the producers. Accordingly, employment decreases by around 20 percent. The real user cost of capital also rises by around 10 per cent, but this has no effects on use of capital or production. Value added is reduced by approximately 12 per cent for Petrochemicals and around 8 per cent for Petroleum Refining. Since domestic demand for these product is only marginally affected by the wage rise, exports decline in line with value added.

For the Electricity and water industry there is a large producer price effect, which gives a large reduction of the producer real wage and a strong increase in employment (7 percent in the long run). Value added increases by 2.4 per cent in the long run.

For all other private sectors, value added increases in the long run, while the short run effects are somewhat mixed. For agriculture, transport, real estate and community services the first year effect is negative. For these sectors a pronounced decline in employment is not counteracted by increased use of capital before the second year. For Mining, Manufacturing and Construction employment increases considerably the first year, despite a real wage rise.

For private sector as a whole, value added increases by 3 per cent in the long run, the employment rises only marginally while the capital stock will increase by 4.5 per cent. The GDP effect is lower due to the reduction of value added in Petroleum Refining sector. Private investment and consumption grow by 4-5 per cent in the long run. As in section 5.1. there is a sharp immediate rise in investment to care for the higher demand for capital, leading to small reduction in consumption the first year. Consumer prices rise by around 3.5 percent. Higher domestic demand implies a deterioration of the current account and higher economic activity also reduce the government budget balance.

Table 5.1. Effects in % of a permanent increase in private sector wage by 10%

Sector	Value added			Real producer wages			Real user cost		
	1.year	2.year	10.year	1.year	2.year	10.year	1.year	2.year	10.year
Agriculture	-0.8	3.0	4.7	3.7	2.6	3.4	-2.9	-2.0	-2.6
Mining etc.	0.2	0.1	0.0	1.3	0.9	1.1	-5.1	-3.7	-4.8
Petrochem.	-12.1	-12.3	-12.0	10.0	10.0	10.0	-12.1	-12.3	-12.0
Manufact.	8.6	0.6	3.5	3.1	2.1	2.8	-3.4	-2.5	-3.2
Electricity	-0.3	2.1	2.4	2.8	-14.9	-16.8	-	-	-
Construction	18.4	5.5	2.5	3.3	2.3	3.0	-3.3	-2.4	-3.0
Trade	1.4	3.0	4.5	5.2	3.6	4.7	-1.5	-1.1	-1.4
Transport	-1.2	2.0	3.4	2.1	1.3	1.7	-4.4	-3.3	-4.2
Real estate	-0.9	2.2	3.7	5.8	4.1	5.3	-0.9	-0.6	-0.8
Finance	4.9	1.1	0.8	5.8	4.1	5.3	-0.9	-0.6	-0.8
Comm.serv.	-0.7	2.1	3.4	3.2	2.3	3.0	-3.3	-2.4	-3.0
Oil and gas	0.0	0.0	0.0	10.0	10.0	10.0	0.0	0.0	0.0
Pet. Refining	-7.8	-7.9	-8.5	10.0	10.0	10.0	-7.8	-7.9	-8.5
Total, private	4.5	2.6	3.0						
Total (GDP)	1.9	1.1	1.4						

Table 5.2. Effects in % of a permanent increase in private sector wages by 10%

Sector	Employment					Capital stock		
	1.year	2.year	3.year	4.year	10.year	1.year	2.year	10.year
Agriculture	-4.8	0.4	-0.3	1.2	1.4	2.0	4.8	7.0
Mining etc.	17.6	5.4	7.3	3.6	2.4	22.8	9.4	8.0
Petrochem.	-22.8	-23.1	-23.5	-24.0	-22.6	0.0	0.0	0.0
Manufact.	5.8	-1.7	1.3	0.3	0.7	11.4	2.9	6.4
Electricity	-0.7	4.5	5.1	6.5	7.2	0.0	0.0	0.0
Construction	15.2	3.2	4.2	0.8	-0.5	21.7	7.8	5.5
Trade	-3.8	-0.6	-1.2	-0.3	-0.2	2.7	3.9	5.7
Transport	-3.2	0.7	0.4	1.3	1.6	3.2	5.3	7.7
Real estate	-5.9	-1.7	-2.7	-1.5	-1.4	0.0	2.9	4.7
Finance	-0.8	-2.7	-3.1	-3.8	-4.0	5.9	1.8	1.7
Comm.serv.	-13.9	-0.2	-0.9	0.1	0.4	2.7	4.4	6.5
Oil and gas	-10.6	-10.6	-10.5	-10.5	-10.5	0.0	0.0	0.0
Pet. refining	-18.3	-18.5	-18.6	-18.8	-19.9	0.0	0.0	0.0
Total, private	0.2	0.2	0.2	0.2	0.2	3.4	3.2	4.5

6. Concluding remarks

Capital data are of paramount importance for the Selection Model. The data used in the model now are only rough estimates, not firmly based on empirical observations. Sectoral time series data on capital, investments and employment is highly needed for further improvements of the model, in particular for estimation of production functions.

The labour market is modelled in a rather superficial way at present and should be extended to include employment and wages by labour category. The distinction between Saudis and non-Saudis is also of great importance in the labour market and data for the separate groups are needed for improvements of the model in this area. It should also be an aim towards building a more complete population model to secure consistency between the growth of the population and supply of labour. Such a module could also be utilized in the Implementation Model and possibly also in the Century Model.

The focus of the Selection Model is on a the medium to long term horizon. In order to evaluate the sustainability of Government policies etc., the development of financial assets is of importance. In order to include such variables, there is a need for figures on public debt and foreign assets, at least for the base year. Financial assets for the private sector of the economy, would also contribute to enhance the use of the model.

The modelling of demand from Government sector is at present very aggregate in the model and it would be a clear advantage if government consumption is divided on demand for labour and for intermediary goods and services respectively. However, this extension would also demand an adjustment of the Input-Output core of the model.

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Annex A: A list of variables

This list includes variables based on the National Accounts from spreadsheets provided by the Ministry of Planning, used either directly in the model or for calculation of model variables. We differentiate between variables in constant prices, in current prices, price indices, and other variables and residuals.

A.1. Variables in constant 1989-prices

A.1.1 GDP by economic activity

	Name in model/databank
- 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	JPRM
- 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 (1989=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
- Labour supply, total   LR

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

- 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 on capital by sector

- 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
- Dummy variable, equal to 1 in 1990, 0.5 in 1991, 0 elsewhere	D9091
- Private sector net financial investment	ZP

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

A.4.8 Current account balance

- Current account balance	Z
- Net transfers and primary income	ZR

A.5. Residuals in I-O equations etc.

A.5.1. GDP by economic activity, residuals

- Agriculture, forestry and fishing	RYAG
- Other mining, quarrying	RYMI
- Petrochemicals	RYPS
- Other manufacturing	RYMA
- Electricity, gas and water	RYEW
- Construction	RYCN
- Wholesale and retail trade	RYTD
- Transport and communication	RYTC
- Finance, insurance, real estate	RYFR
- Real estate	RYRE
- Community services	RYCS
- Government services	RYGS
- Imputed bank charges	RYBC
- Crude oil and natural gas	RYOG
- Petroleum refining	RYPR
- Import duties	RYID

A.5.2. Prices, private and government consumption, residuals

- Food, beverage, tobacco	RPCPFOO
- Clothing and footwear	RPCPCLO
- Rent, fuel and power	RPCPREN
- Furniture and household equipment	RPCPFUR
- Medical health care	RPCPMED
- Transport and communication	RPCPTRA
- Entertainment and education	RPCPENT
- Other goods and services	RPCPOTH
- Resident direct purchase abroad	RPCPABR
- Government final consumption	RPCG

A.5.3. Private consumption, residuals

- Consumption by non-residents	RPCPN
- Value of private consumption by residents	RVCPR
- Private consumption by residents	RCPR
- Food, beverage, tobacco	RCPRFOO
- Clothing and footwear	RCPRCLO
- Rent, fuel and power	RCPRREN
- Furniture and household equipment	RCPRFUR
- Medical health care	RCPRMED

- Transport and communication	RCPRTRA
- Entertainment and education	RCPRENT
- Other goods and services	RCPROTH

A.5.4. *Gross fixed capital formation, residuals*

- Government investment, non-residential building	RPJGB
- Government investment, transport and machinery equipment	RPJGTM
- Oil-sector investment, non-residential building	RPJOB
- Oil-sector investment, transport and machinery equipment	RPJOTM
- Non-oil private, residential building	RPJPH
- Non-oil private, non-residential building	RPJPB
- Non-oil private, transport and machinery equipment	RPJPTM

A.5.5. *Current account, residuals*

- Exports of oil and gas	RPXOG
- Exports of petrochemicals	RPXPS
- Exports of refined products	RPXPR
- Exports of goods and services, less export of oil, gas, petrochemicals, refined products and non-resident direct purchase	RPXX

A.5.6. *Government balance, residuals*

- Governmnet, other revenues	RGROTH
- Government expenditure, chapter 1	RGECH12
- Government expenditure, chapter 3	RGECH3
- Government expenditure, chapter 4	RGECH4

Annex B: Estimation of production functions

In order to estimate the production functions by sector we have to make some very strong assumptions because data on capital stock and investment by sector is not available. We have however, figures for the private sector as a whole. In addition we do not have wage rates per sector and user cost of capital figures by sector. This annex describes how we have estimated all these variables using available data using a number of assumptions.

The choice of a Cobb-Douglas production function is dictated by the fact that in order to estimate the parameters of that function, we only need factor shares. We have data for the share of wages in total factor income by sector. By using the marginal conditions for profit maximisation we can estimate the Aii as the share of wages in factor income

(B2.1) $Aii = VYWii / (PYFii * Yii)$

The obtained coefficients, after some adjustments, are

A.AG = 0.4	A.MI = 0.8	A.PS = 0.5	A.MA = 0.5
A.EW = 0.45	A.CN = 0.5	A.TD = 0.2	A.TC = 0.7
A.RE = 0.15	A.FI = 0.15	A.CS = 0.5	A.OG = 0.1
A.PR = 0.4			

Using the assumption of constant returns to scale, the shares of capital then follow as

(B2.2) $1 - Aii$

Employment by sector is available for 1989 according to table 2.5 in the Fifth Development Plan. Using this information we can then estimate the wage rate in each sector in the base year (1989) as

(B2.3) $Wii = VYWii / Eii$

We can then also estimate the coefficients that relate the sectoral wage rate to the wage rate in the private sector (WP)

(B2.4) $W.ii = Wii / WP$

the following coefficients are obtained

W.AG = 1.688	W.MI = 31.352	W.MA = 0.923	W.PS = 22.735
W.TC = 5.148	W.TD = 0.439	W.FI = 0.824	W.RE = 1.616
W.EW = 1.198	W.CS = 0.234	W.CN = 1.396	W.OG = 10.992
W.PR = 18.439			

The capital stock data by sector are estimated as follows. In the base year, the investment price index is equal to one. Thus the user cost of capital (PK) is equal to the sum of the real rate of return on capital (IR) and the depreciation rate (DELTA) for the private sector as a whole. We use information on depreciation for the private sector as a whole from the MOP. By assuming that DELTA is equal to 0.05 for each sector except for production of residental services, the depreciation rate for the latter sector was residually determined to be 0.03634. The lower rate of depreciation is reasonable as buildings depreciates much slower than capital in general. Real rate of return on capital in the private sector as a whole (IR) was set equal to 0.15. By assuming this to be similar in all sectors, tentatively, we estimate the capital stock by sector, again using the marginal conditions for profit maximisation

(B2.5) Kii = [(1-Aii)*PYFii*Yii] / [IR + DELTA]

where PYFii are one in the base year. We know the sum of capital over all sectors, so that we adjust our sectoral data in an ad hoc way in order to assure that the sectoral figures sum up.

Using the capital data together with the assumption on depreciation by sector, real rate of return on capital by sector is estimated

(B2.6) IRii = VYSii / Kii - 0.05   (0.03634 for the RE-sector)

And the user cost of capital by sector is, in the base year, equal to

(B2.7) PKii = IRii + 0.05   (0.03634 for the RE-sector)

As for wages we can then also estimate the coefficients that relate the sectoral capital real rate of return rates to the rate in the private sector IR

(B2.8) RHO.ii = IRii / IR

This gives the following coefficients

RHO.AG = 2.169	RHO.MI = 0.199	RHO.MA = 0.905
RHO.PS = 0.4	RHO.TC = 0.886	RHO.TD = 2.662
RHO.FI = 1.247	RHO.RE = -0.073	RHO.CS = 1.645
RHO.CN = 3.419	RHO.OG = 3.286	RHO.PR = 0.998

Now that we have both Eii, Kii and Yii in addition to the estimated Aii, we can estimate TFP by sector using the production function

(B2.9) $\text{TFPii} = \text{Yii} / [(\text{Eii}^{\text{Aii}}) * (\text{Kii}^{(1-\text{Aii})})]$

Gross investment by sector is then estimated using the accumulation function and our knowledge about the sum of investment by sector again using an ad hoc adjustment of the sectoral data.

In the model we have introduced error terms in the capital demand equations, labour demand equations and gross investment (capital accumulation) equations in order to calibrate the model to these adjusted base year figures.

Annex C: A list of the equations in the model

This annex gives the equations in the Selection Model, with the attached equation numbers and a short description of each equation. A list of endogenous variables and coeffient is added at the end.

C.1. Private consumption

C.1.1. Total consumption by residents
(1) The macro consumption function

$$\text{LOG(CPR)} - \text{LOG(CPR(-1))} = \text{CPR.1} + \text{CPR.2} * (\text{LOG((HR} * (1 - \text{THR})) / \text{PCPR}) - \text{LOG((HR(-1)} * (1 - \text{THR(-1)))} / \text{PCPR(-1)})) + \text{CPR.3} * (\text{LOG(CPR(-1))} - \text{LOG((HR(-1)} * (1 - \text{THR(-1))} / \text{PCPR(-1)}))) + \text{CPR.4} * (\text{LOG(CPR(-1))} - \text{LOG(HW(-2)} / \text{PCPR(-2)})) + \text{CPR.5} * (\text{POIL} / \text{PCPR}) + \text{CPR.6} * \text{D9091} + \text{RCPR}$$

(2) Total consumption by residents, value

$$\text{VCPR} = \text{PCPFOO} * \text{CPRFOO} + \text{PCPCLO} * \text{CPRCLO} + \text{PCPREN} * \text{CPRREN} + \text{PCPFUR} * \text{CPRFUR} + \text{PCPMED} * \text{CPRMED} + \text{PCPTRA} * \text{CPRTRA} + \text{PCPENT} * \text{CPRENT} + \text{PCPOTH} * \text{CPROTH} + \text{PCPABR} * \text{CPRABR} + \text{RVCPR}$$

C.1.2. The linear expenditure system (LES)
(3) Food, beverages and tobacco

$$\text{CPRFOO} = \text{CPRFOO.1} + (\text{CPRFOO.2} / \text{PCPFOO}) * (\text{VCPR} - (\text{CPRFOO.1} * \text{PCPFOO} + \text{CPRCLO.1} * \text{PCPCLO} + \text{CPRREN.1} * \text{PCPREN} + \text{CPRFUR.1} * \text{PCPFUR} + \text{CPRMED.1} * \text{PCPMED} + \text{CPRTRA.1} * \text{PCPTRA} + \text{CPRENT.1} * \text{PCPENT} + \text{CPROTH.1} * \text{PCPOTH} + \text{CPRABR.1} * \text{PCPABR})) + \text{RCPRFOO}$$

(4) Clothing and footwear

$$\text{CPRCLO} = \text{CPRCLO.1} + (\text{CPRCLO.2} / \text{PCPCLO}) * (\text{VCPR} - (\text{CPRFOO.1} * \text{PCPFOO} + \text{CPRCLO.1} * \text{PCPCLO} + \text{CPRREN.1} * \text{PCPREN} + \text{CPRFUR.1} * \text{PCPFUR} + \text{CPRMED.1} * \text{PCPMED} + \text{CPRTRA.1} * \text{PCPTRA} + \text{CPRENT.1} * \text{PCPENT} + \text{CPROTH.1} * \text{PCPOTH} + \text{CPRABR.1} * \text{PCPABR})) + \text{RCPRCLO}$$

(5) Rent fuel and power

$$\text{CPRREN} = \text{CPRREN.1} + (\text{CPRREN.2} / \text{PCPREN}) * (\text{VCPR} - (\text{CPRFOO.1} * \text{PCPFOO} + \text{CPRCLO.1} * \text{PCPCLO} + \text{CPRREN.1} * \text{PCPREN} + \text{CPRFUR.1} * \text{PCPFUR} + \text{CPRMED.1} * \text{PCPMED} + \text{CPRTRA.1} * \text{PCPTRA} + \text{CPRENT.1} * \text{PCPENT} + \text{CPROTH.1} * \text{PCPOTH} + \text{CPRABR.1} * \text{PCPABR})) + \text{RCPRREN}$$

(6) Furniture and household equipment

$$\text{CPRFUR} = \text{CPRFUR.1} + (\text{CPRFUR.2} / \text{PCPFUR}) * (\text{VCPR} - (\text{CPRFOO.1} * \text{PCPFOO} + \text{CPRCLO.1} * \text{PCPCLO} + \text{CPRREN.1} * \text{PCPREN} + \text{CPRFUR.1} * \text{PCPFUR} + \text{CPRMED.1} * \text{PCPMED} + \text{CPRTRA.1} * \text{PCPTRA} + \text{CPRENT.1} * \text{PCPENT} + \text{CPROTH.1} * \text{PCPOTH} + \text{CPRABR.1} * \text{PCPABR})) + \text{RCPRFUR}$$

(7) Medical health care

$$\text{CPRMED} = \text{CPRMED.1} + (\text{CPRMED.2} / \text{PCPMED}) * (\text{VCPR} - (\text{CPRFOO.1} * \text{PCPFOO} + \text{CPRCLO.1} * \text{PCPCLO} + \text{CPRREN.1} * \text{PCPREN} + \text{CPRFUR.1} * \text{PCPFUR} + \text{CPRMED.1} * \text{PCPMED} + \text{CPRTRA.1} * \text{PCPTRA} + \text{CPRENT.1} * \text{PCPENT} + \text{CPROTH.1} * \text{PCPOTH} + \text{CPRABR.1} * \text{PCPABR})) + \text{RCPRMED}$$

(8) Transport and communication

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

(9) Entertainment and education

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

(10) Other goods and services

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

(11) Resident direct purchase abroad

CPRABR = CPR - (CPRFOO + CPRCLO + CPRREN + CPRFUR + CPRMED + CPRTRA +
CPRENT + CPROTH)

C.1.3. Total private consumption by object of expenditure
(12) Food, beverages and tobacco

CPFOO = CPRFOO + 0.07 * CPN

(13) Clothing and footwear

CPCLO = CPRCLO + 0.06 * CPN

(14) Rent fuel and power

CPREN = CPRREN

(15) Furniture and household equipment

CPFUR = CPRFUR + 0.22 * CPN

(16) Medical health care

CPMED = CPRMED

(17) Transport and communication

CPTRA = CPRTRA + 0.01 * CPN

(18) Entertainment and education

CPENT = CPRENT

(19 Other goods and services

CPOTH = CPROTH + 0.64 * CPN

(20) Resident direct purchase abroad

CPABR = CPRABR

C.1.4. Total private consumption
(21) Value

VCP = VCPR + VCPN

(22) Volume
CP = CPR + CPN

(23) Price deflator
PCP = VCP / CP

C.2. Government consumption

(24) Value
VCG = CG * PCG

C.3. Domestic absorption

(25) Domestic absorption
DA = CPR + CG + J + DS

C.4. Exports

(26) Total
X = XOG + XPR + XPS + XX + CPN

(27) Total, value
VX = VXOG + VXPR + VXPS + VXX + VCPN

(28) Oil and gas, value
VXOG = PXOG * XOG

(29) Petroleum refining, value
VXPR = PXPR * XPR

(30) Petrochemicals, value
VXPS = PXPS * XPS

(31) Other exports
VXX = PXX * XX

(32) Consumption by non-residents, value
VCPN = PCPN * CPN

C.5. Imports

(33) Total
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) + (1 - (RYAG + RYPS + RYMA + RYEW + RYCN + RYTD + RYTC + RYRE +
RYFI + RYCS + RYGS + RYBC + RYOG + RYPR + RYID))

(34) Total, value
VM = PM * M

C.6. Value added by sector

(35) Agriculture, forestry and fishing

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

(36) Other mining, quarrying

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

(37) Petrochemicals

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

(38) Other manufacturing

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) / (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

(39) Electricity, gas and water

YEW =

A.EW.CPFOO * (1 - MS * A.M.CPFOO) / (1 - A.M.CPFOO) * CPFOO +
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

(40) Construction

YCN =

A.CN.CPFOO * (1 - MS * A.M.CPFOO) / (1 - A.M.CPFOO) * CPFOO +
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

(41) Wholesale and retail trade

YTD =
A.TD.CPFOO * (1 - MS * A.M.CPFOO) / (1 - A.M.CPFOO) * CPFOO +
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

(42) Transport and communication

YTC =
A.TC.CPFOO * (1 - MS * A.M.CPFOO) / (1 - A.M.CPFOO) * CPFOO +
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

(43) Real estate

$$
\begin{aligned}
YRE = \\
& A.RE.CPFOO * (1 - MS * A.M.CPFOO) / (1 - A.M.CPFOO) * CPFOO + \\
& A.RE.CPCLO * (1 - MS * A.M.CPCLO) / (1 - A.M.CPCLO) * CPCLO + \\
& A.RE.CPREN * (1 - MS * A.M.CPREN) / (1 - A.M.CPREN) * CPREN + \\
& A.RE.CPFUR * (1 - MS * A.M.CPFUR) / (1 - A.M.CPFUR) * CPFUR + \\
& A.RE.CPMED * (1 - MS * A.M.CPMED) / (1 - A.M.CPMED) * CPMED + \\
& A.RE.CPTRA * (1 - MS * A.M.CPTRA) / (1 - A.M.CPTRA) * CPTRA + \\
& A.RE.CPENT * (1 - MS * A.M.CPENT) / (1 - A.M.CPENT) * CPENT + \\
& A.RE.CPOTH * (1 - MS * A.M.CPOTH) / (1 - A.M.CPOTH) * CPOTH + \\
& A.RE.CPABR * (1 - MS * A.M.CPABR) / (1 - A.M.CPABR) * CPABR + \\
& A.RE.JPH * (1 - MS * A.M.JPH) / (1 - A.M.JPH) * JPH + \\
& A.RE.JPB * (1 - MS * A.M.JPB) / (1 - A.M.JPB) * JPB + \\
& A.RE.JPTM * (1 - MS * A.M.JPTM) / (1 - A.M.JPTM) * JPTM + \\
& A.RE.JGB * (1 - MS * A.M.JGB) / (1 - A.M.JGB) * JGB + \\
& A.RE.JGTM * (1 - MS * A.M.JGTM) / (1 - A.M.JGTM) * JGTM + \\
& A.RE.JOB * (1 - MS * A.M.JOB) / (1 - A.M.JOB) * JOB + \\
& A.RE.JOTM * (1 - MS * A.M.JOTM) / (1 - A.M.JOTM) * JOTM + \\
& A.RE.CG * (1 - MS * A.M.CG) / (1 - A.M.CG) * CG + \\
& A.RE.DS * (1 - MS * A.M.DS) / (1 - A.M.DS) * DS + \\
& A.RE.XOG * (1 - MS * A.M.XOG) / (1 - A.M.XOG) * XOG + \\
& A.RE.XPR * (1 - MS * A.M.XPR) / (1 - A.M.XPR) * XPR + \\
& A.RE.XPS * (1 - MS * A.M.XPS) / (1 - A.M.XPS) * XPS + \\
& A.RE.XX * (1 - MS * A.M.XX) / (1 - A.M.XX) * XX + RYRE
\end{aligned}
$$

(44) Finance and insurance

$$
\begin{aligned}
YFI = \\
& A.FI.CPFOO * (1 - MS * A.M.CPFOO) / (1 - A.M.CPFOO) * CPFOO + \\
& A.FI.CPCLO * (1 - MS * A.M.CPCLO) / (1 - A.M.CPCLO) * CPCLO + \\
& A.FI.CPREN * (1 - MS * A.M.CPREN) / (1 - A.M.CPREN) * CPREN + \\
& A.FI.CPFUR * (1 - MS * A.M.CPFUR) / (1 - A.M.CPFUR) * CPFUR + \\
& A.FI.CPMED * (1 - MS * A.M.CPMED) / (1 - A.M.CPMED) * CPMED + \\
& A.FI.CPTRA * (1 - MS * A.M.CPTRA) / (1 - A.M.CPTRA) * CPTRA + \\
& A.FI.CPENT * (1 - MS * A.M.CPENT) / (1 - A.M.CPENT) * CPENT + \\
& A.FI.CPOTH * (1 - MS * A.M.CPOTH) / (1 - A.M.CPOTH) * CPOTH + \\
& A.FI.CPABR * (1 - MS * A.M.CPABR) / (1 - A.M.CPABR) * CPABR + \\
& A.FI.JPH * (1 - MS * A.M.JPH) / (1 - A.M.JPH) * JPH + \\
& A.FI.JPB * (1 - MS * A.M.JPB) / (1 - A.M.JPB) * JPB + \\
& A.FI.JPTM * (1 - MS * A.M.JPTM) / (1 - A.M.JPTM) * JPTM + \\
& A.FI.JGB * (1 - MS * A.M.JGB) / (1 - A.M.JGB) * JGB + \\
& A.FI.JGTM * (1 - MS * A.M.JGTM) / (1 - A.M.JGTM) * JGTM + \\
& A.FI.JOB * (1 - MS * A.M.JOB) / (1 - A.M.JOB) * JOB + \\
& A.FI.JOTM * (1 - MS * A.M.JOTM) / (1 - A.M.JOTM) * JOTM + \\
& A.FI.CG * (1 - MS * A.M.CG) / (1 - A.M.CG) * CG + \\
& A.FI.DS * (1 - MS * A.M.DS) / (1 - A.M.DS) * DS + \\
& A.FI.XOG * (1 - MS * A.M.XOG) / (1 - A.M.XOG) * XOG + \\
& A.FI.XPR * (1 - MS * A.M.XPR) / (1 - A.M.XPR) * XPR + \\
& A.FI.XPS * (1 - MS * A.M.XPS) / (1 - A.M.XPS) * XPS + \\
& A.FI.XX * (1 - MS * A.M.XX) / (1 - A.M.XX) * XX + RYFI
\end{aligned}
$$

(45) Community services

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

(46) Government services

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

(47) Imputed bank charges

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

(48) Crude oil and natural gas

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) / (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

(49) Petroleum refining

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

(50) Import duties

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

(51) Non-oil private sector

YP = YAG + YMI + YPS + YMA + YEW + YCN + YTD + YTC + YRE + YFI + YCS + YBC

(52) Non-oil private sector, value

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

(53) Oil sector

YO = YOG + YPR

(54) Government sector

YG = YGS

(55) GDP

Y = YP + YO + YG + YID

(56) Government sector, value

VYG = PYG * YG

(57) Import duties, value

VYID = PYID * YID

(58) GDP, value

VY = VYP + VYOG + VYPR + VYG + VYID

C.7. Compensation of employees

(59) Private sector

VYWP = WP * EP

(60) Government sector

VYWG = WG * EG

(61) Total

VYW = VYWP + VYWG + VYWO

C.8. Household disposable income and wealth

(62) Disposable income

HR = VYW + VYSH + GESS

(63) Wealth

HW = M2 - M0 - LIABP

C.9. Factor-prices including net indirect taxes

(64) Agriculture, forestry and fishing

PYAG = ((1 - TAG.0) / (1 - TAG)) * PYFAG

(65) Other mining, quarrying

PYMI = ((1 - TMI.0) / (1 - TMI)) * PYFMI

(66) Other manufacturing

PYMA = ((1 - TMA.0) / (1 - TMA)) * PYFMA

(67) Construction
PYCN = ((1 - TCN.0) / (1 - TCN)) * PYFCN

(68) Wholesale and retail trade
PYTD = ((1 - TTD.0) / (1 - TTD)) * PYFTD

(69) Transport and communication
PYTC = ((1 - TTC.0) / (1 - TTC)) * PYFTC

(70) Community services
PYCS = ((1 - TCS.0) / (1 - TCS)) * PYFCS

(71) Government services
PYGS = ((1 - TGS.0) / (1 - TGS)) * PYFGS

(72) Petrochemicals
PYPS = ((1 - TPS.0) / (1 - TPS)) * PYFPS

(73) Electricity and water
PYEW = ((1 - TEW.0) / (1 - TEW)) * PYFEW

(74) Real estate
PYRE = ((1 - TRE.0) / (1 - TRE)) * PYFRE

(75) Finance and insurance
PYFI = ((1 - TFI.0) / (1 - TFI)) * PYFFI

(76) Impued bank charges
PYBC = ((1 - TBC.0) / (1 - TBC)) * PYFBC

(77) Petroleum refining
PYPR = ((1 - TPR.0) / (1 - TPR)) * PYFPR

(78) Crude oil and natural gas
PYOG = ((1 - TOG.0) / (1 - TOG)) * PYFOG

(79) Private sector
PYP = VYP / YP

C.10. Factor-prices excluding net indirect taxes

(80) Government services
PYFGS= WG *RPYFGS,

C.11. Final demand prices

(81) Food,beverages and tobacco
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 +

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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

(82) Clothing and footware
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

(83) Rent, fuel and power
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

(84) Furniture and household equipment

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

(85) Medical health care

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

(86) Transport and communication

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

(87) Entertainment and education
PCPENT =
(MS * A.M.CPENT * PM +
A.AG.CPENT * (1 - MS * A.M.CPENT) / (1 - 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

(88) Other goods and services
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

(89) Resident direct purchase abroad
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

(90) Total resident
PCPR = VCPR / CPR

(91) Private non-oil, residential buildings
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

(92) Private non-oil, non-residential buildings
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

(93) Private non-oil, transport and machinery equipment
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

(94) Government investment, non-residential building
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) / (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

(95) Government investment, transport and machinery equipment
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

(96) Oil-sector investment, non-residential buildings
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

(97) Oil-sector investment, transport and machinery equipment
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

(98) Private sector
PJP = VJP / JP,

(99) Government final consumption
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

(100) Increase in stocks
PDS = (VY + VM - VCP - VCG - VJ - VX) / DS

(101) Exports of oil and gas
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

(102) Exports of refined products
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) / (1 - A.M.XPR) * PYPR +
A.ID.XPR * (1 - MS * A.M.XPR) / (1 - A.M.XPR) * PYID) * RPXPR

(103) Exports of petrochemicals
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

(104) Exports of goods and services, less export of oil, gas, petrochemicals, refined products and non-resident direct purchase
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

(105) Non-resident direct purchase
PCPN = 0.07 * PCPFOO + 0.06 * PCPCLO + 0.22 * PCPFUR + 0.01 * PCPTRA + 0.64 * PCPOTH
+ RPCPN

C.12. Value of sectoral production
(106) Agriculture, forestry and fishing
VYAG = PYAG * YAG

(107) Other mining, quarrying
VYMI = PYMI * YMI

(108) Petrochemicals
VYPS = PYPS * YPS

(109) Other manufacturing
VYMA = PYMA * YMA

(110) Electricity, gas and water
VYEW = PYEW * YEW

(111) Construction
VYCN = PYCN * YCN

(112) Wholesale and retail trade
VYTD = PYTD * YTD

(113) Transport and communication
VYTC = PYTC * YTC

(114) Real estate
VYRE = PYRE * YRE

(115) Finance, insurance
VYFI = PYFI * YFI

(116) Community services
VYCS = PYCS * YCS

(117) Imputed bank charges
VYBC = PYBC * YBC
(118) Petroleum refining
VYPR = PYPR * YPR

(119) Crude oil and natural gas
VYOG = PYOG * YOG

C.13. Net indirect taxes

(120) Agriculture, forestry and fishing

$VYTAG = VYAG - PYFAG * (1 - TAG.0) * YAG$

(121) Other mining, quarrying

$VYTMI = VYMI - PYFMI * (1 - TMI.0) * YMI$

(122) Petrochemicals

$VYTPS = VYPS - PYFPS * (1 - TPS.0) * YPS$

(123) Other manufacturing

$VYTMA = VYMA - PYFMA * (1 - TMA.0) * YMA$

(124) Electricity, gas and water

$VYTEW = VYEW - PYFEW * (1 - TEW.0) * YEW$

(125) Construction

$VYTCN = VYCN - PYFCN * (1 - TCN.0) * YCN$

(126) Wholesale and retail trade

$VYTTD = VYTD - PYFTD * (1 - TTD.0) * YTD$

(127) Transport and communication

$VYTTC = VYTC - PYFTC * (1 - TTC.0) * YTC$

(128) Real estate

$VYTRE = VYRE - PYFRE * (1 - TRE.0) * YRE$

(129) Finance, insurance

$VYTFI = VYFI - PYFFI * (1 - TFI.0) * YFI$

(130) Community services

$VYTCS = VYCS - PYFCS * (1 - TCS.0) * YCS$

(131) Imputed bank charges

$VYTBC = VYBC - PYFBC * (1 - TBC.0) * YBC$

(132) Petroleum refining

$VYTPR = VYPR - PYFPR * (1 - TPR.0) * YPR$

(133) Crude oil and natural gas

$VYTOG = VYOG - PYFOG * (1 - TOG.0) * YOG$

(134) Private sector

$VYTP = VYTAG + VYTMI + VYTPS + VYTMA + VYTEW + VYTCN + VYTTD + VYTTC + VYTRE + VYTFI + VYTCS + VYTBC$

(135) Total

$VYT = VYTP + VYTOG + VYTPR$

C.14. Gross operating surplus

(136) Private, total
VYSP = VYP - VYTP - WP * EP

(137) Household share
VYSH = VYSSHARE * VYSP

(138) Company share
VYSC = (1 - VYSSHARE) * VYSP

(139) Total
VYSO = VYOG + VYPR - VYTOG - VYTPR - VYWO

C.15. Current account balance

(140) Total
Z = VX - VM + ZR

C.16. Government budget

(141) Chapter 1 and 2
GECH12 = VYWG + RGECH12

(142) Chapter 3
GECH3 = GESS - VYT + RGECH3

(143) Chapter 4
GECH4 = VJG + RGECH4

(144) Other revenues
GROTH = VYID + RGROTH

(145) Oil revenues
GROIL = GROSHARE * VYSO

(146) Budget balance
ZG = GROIL + GROTH + THR * HR - GECH12 - GECH3 - GECH4

C.17. Private sector net financial investment

(147) Total
ZP = Z - ZG

C.18. Production functions by sector

(148) Agriculture, forestry and fishing
YAG = TFPAG * EAG ** A.AG*KAG ** (1-A.AG),

(149) Other mining, quarrying
YMI = TFPMI * EMI ** A.MI*KMI ** (1-A.MI),

(150) Petrochemicals
YPS = TFPPS * EPS ** A.PS*KPS ** (1-A.PS),

(151) Other manufacturing

YMA = TFPMA * EMA ** A.MA*KMA ** (1-A.MA),

(152) Electricity, gas and water

YEW = TFPEW * EEW ** A.EW*KEW ** (1-A.EW),

(153) Construction

YCN = TFPCN * ECN ** A.CN*KCN ** (1-A.CN),

(154) Wholesale and retail trade

YTD = TFPTD * ETD ** A.TD*KTD ** (1-A.TD),

(155) Transport and communication

YTC = TFPTC * ETC ** A.TC*KTC ** (1-A.TC),

(156) Real estate

YRE = TFPRE * ERE ** A.RE*KRE ** (1-A.RE),

(157) Finance, insurance

YFI = TFPFI * EFI ** A.FI*KFI ** (1-A.FI),

(158) Community services

YCS = TFPCS * ECS ** A.CS*KCS ** (1-A.CS),

(159) Crude oil and natural gas

YOG = TFPOG * EOG ** A.OG*KOG ** (1-A.OG),

(160) Petroleum refining

YPR = TFPPR * EPR ** A.PR*KPR ** (1-A.PR),

C.19. Employment and labour supply

(161) Agriculture, forestry and fishing

EAG = A.AG * PYFAG / WAG * YAG + REAG,

(162) Other mining, quarrying

EMI = A.MI * PYFMI / WMI * YMI + REMI,

(163) Petrochemicals

EPS = A.PS * PYFPS / WPS * YPS + REPS,

(164) Other manufacturing

EMA = A.MA * PYFMA / WMA * YMA + REMA,

(165) Electricity, gas and water

EEW = A.EW * PYFEW / WEW * YEW + REEW,

(166) Construction

ECN = A.CN * PYFCN / WCN * YCN + RECN,

(167) Wholesale and retail trade

ETD = A.TD * PYFTD / WTD * YTD + RETD,

(168) Transport and communication
ETC = A.TC * PYFTC / WTC * YTC + RETC,

(169) Real estate
ERE = A.RE * PYFRE / WRE * YRE + RERE,

(170) Finance, insurance
EFI = A.FI * PYFFI / WFI * YFI + REFI,

(171) Community services
ECS = A.CS * PYFCS / WCS * YCS + RECS,

(172) Crude oil and natural gas
EOG = A.OG * PYFOG / WOG * YOG + REOG,

(173) Petroleum refining
EPR = A.PR * PYFPR / WPR * YPR + REPR,

(174) Total , private sector
EP=EAG+EMI+EPS+EMA+EEW+ECN+ETD+ETC+ERE+EFI+ECS,

(175) Government sector
EG = YG / QG

(176) Total
E = EP + EG + EOG + EPR

(177) Labour supply
LR = LRRATE*POPSA

(178) Labour market equilibrium
EN + LR = E

C.20. Productivity

(179) Private non-oil sector
QP = YP / EP

C.21. Capital demand functions by sector

(180) Agriculture, forestry and fishing
KAG = (1-A.AG) * PYFAG / PKAG * YAG + RKAG

(181) Other mining, quarrying
KMI = (1-A.MI) * PYFMI / PKMI * YMI + RKMI

(182) Petrochemicals
KPS = (1-A.PS) * PYFPS / PKPS * YPS + RKPS

(183) Other manufacturing
KMA = (1-A.MA) * PYFMA / PKMA * YMA + RKMA

(184) Construction
KCN = (1-A.CN) * PYFCN / PKCN * YCN + RKCN

(185) Wholesale and retail trade
KTD = (1-A.TD) * PYFTD / PKTD * YTD + RKTD

(186) Transport and communication
KTC = (1-A.TC) * PYFTC / PKTC * YTC + RKTC

(187) Real estate
KRE = (1-A.RE) * PYFRE / PKRE * YRE + RKRE

(188) Finance, insurance
KFI = (1-A.FI) * PYFFI / PKFI * YFI + RKFI

(189) Community services
KCS = (1-A.CS) * PYFCS / PKCS * YCS + RKCS

(190) Crude oil and natural gas
KOG = (1-A.OG) * PYFOG / PKOG * YOG + RKOG

(191) Petroleum refining
KPR = (1-A.PR) * PYFPR / PKPR * YPR + RKPR

(192) Total , private sector
KP=KAG+KMI+KPS+KMA+KEW+KCN+KTD+KTC+KRE+KFI+KCS

C.22. Capital formation by sector

(193) Agriculture, forestry and fishing
JAG = KAG - (1-DELTA.AG)*KAG(-1)+RJAG

(194) Other mining, quarrying
JMI = KMI - (1-DELTA.MI)*KMI(-1)+RJMI

(195) Petrochemicals
JPS = KPS - (1-DELTA.PS)*KPS(-1)+RJPS

(196) Other manufacturing
JMA = KMA - (1-DELTA.MA)*KMA(-1)+RJMA

(197) Electricity, gas and water
JEW = KEW - (1-DELTA.EW)*KEW(-1)+RJEW

(198) Construction
JCN = KCN - (1-DELTA.CN)*KCN(-1)+RJCN

(199) Wholesale and retail trade
JTD = KTD - (1-DELTA.TD)*KTD(-1)+RJTD

(200) Transport and communication
JTC = KTC - (1-DELTA.TC)*KTC(-1)+RJTC

(201) Real estate
JRE = KRE - (1-DELTA.RE)*KRE(-1)+RJRE

(202) Finance, insurance
JFI = KFI - (1-DELTA.FI)*KFI(-1)+RJFI

(203) Community services
JCS = KCS - (1-DELTA.CS)*KCS(-1)+RJCS

(204) Crude oil and natural gas
JOG = KOG - (1-DELTA.OG)*KOG(-1)+RJOG

(205) Petroleum refining
JPR = KPR - (1-DELTA.PR)*KPR(-1)+RJPR

(206) Crude oil and natural gas, buildings
JOB=JOGB+JPRB

(207) Crude oil and natural gas, machienery and transport
JOTM=JOGTM+JPRTM

(208) Crude oil and natural gas
JOG=JOGB+JOGTM

(209) Petroleum refining
JPR=JPRB+JPRTM

(210) Housing
JPH=JRE

(211) Private sector, buildings
JPB=0.53*(JAG+JMI+JPS+JMA+JEW+JCN+JTD+JTC+JFI+JCS)

(212) Private sector, machienery and transport
JPTM=0.47*(JAG+JMI+JPS+JMA+JEW+JCN+JTD+JTC+JFI+JCS)

(213) Private non-oil sector
JP = JPH + JPB + JPTM

(214) Government sector
JG = JGB + JGTM

(215) Oil sector
JO = JOB + JOTM

(216) Total
J = JP + JG + JO

(217) Private non-oil sector, value
VJP = PJPH * JPH + PJPB * JPB + PJPTM * JPTM

(218) Government sector, value
VJG = PJGB * JGB + PJGTM * JGTM

74

(219) Oil sector, value
VJO = PJOB * JOB + PJOTM * JOTM

(220) Total, value
VJ = VJP + VJG + VJO

C.23. User cost of capital by sector

(221) Agriculture, forestry and fishing
PKAG = PJP*(IRAG + DELTA.AG)

(222) Other mining, quarrying
PKMI = PJP*(IRMI + DELTA.MI)

(223) Petrochemicals
PKPS = PJP*(IRPS + DELTA.PS)

(224) Other manufacturing
PKMA = PJP*(IRMA + DELTA.MA)

(225) Construction
PKCN = PJP*(IRCN + DELTA.CN)

(226) Wholesale and retail trade
PKTD = PJP*(IRTD + DELTA.TD)

(227) Transport and communication
PKTC = PJP*(IRTC + DELTA.TC)

(228) Real estate
PKRE = PJP*(IRRE + DELTA.RE)

(229) Finance, insurance
PKFI = PJP*(IRFI + DELTA.FI)

(230) Community services
PKCS = PJP*(IRCS + DELTA.CS)

(231) Crude oil and natural gas
PKOG = PJP*(IROG + DELTA.OG)

(232) Petroleum refining
PKPR = PJP*(IRPR + DELTA.PR)

C.24. Real rate of return on capital by sector

(233) Agriculture, forestry and fishing
IRAG = RHO.AG * IR

(234) Other mining, quarrying
IRMI = RHO.MI * IR

(235) Other manufacturing
IRMA = RHO.MA * IR

75

(236) Construction
IRCN = RHO.CN * IR

(237) Wholesale and retail trade
IRTD = RHO.TD * IR

(238) Transport and communication
IRTC = RHO.TC * IR

(239) Real estate
IRRE = RHO.RE * IR

(240) Finance, insurance
IRFI = RHO.FI * IR

(241) Community services
IRCS = RHO.CS * IR

C.25. Wage rates by sector

(242) Agriculture, forestry and fishing
WAG=W.AG * WP

(243) Other mining, quarrying
WMI=W.MI * WP

(244) Petrochemicals
WPS=W.PS * WP

(245) Other manufacturing
WMA=W.MA * WP

(246) Electricity, gas and water
WEW=W.EW * WP

(247) Construction
WCN=W.CN * WP

(248) Wholesale and retail trade
WTD=W.TD * WP

(249) Transport and communication
WTC=W.TC * WP

(250) Real estate
WRE=W.RE * WP

(251) Finance, insurance
WFI=W.FI * WP

(252) Community services
WCS=W.CS * WP

(253) Crude oil and natural gas
WOG=W.OG * WP

(254) Petroleum refining
WPR=W.PR * WP

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

COEFFICIENTS
CPRFOO.1 CPRFOO.2 CPRCLO.1 CPRCLO.2 CPRREN.1 CPRREN.2 CPRFUR.1 CPRFUR.2
CPRMED.1 CPRMED.2 CPRTRA.1 CPRTRA.2 CPRENT.1 CPRENT.2 CPROTH.1 CPROTH.2
CPRABR.1 TAG.0 TMI.0 TMA.0 TCN.0 TTD.0 TTC.0 TCS.0 TGS.0 TBC.0 TEW.0 TFI.0 TOG.0
TPR.0 TPS.0 TRE.0 A.AG.CG A.AG.CPCLO A.AG.CPENT A.AG.CPFOO A.AG.CPFUR
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A.AG.JGTM A.AG.JOB A.AG.JOTM A.AG.JPH A.AG.JPB A.AG.JPTM A.AG.XOG A.AG.XPR
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DELTA.TD DELTA.TC DELTA.RE DELTA.FI DELTA.CS DELTA.OG
DELTA.PR W.AG W.MI W.PS W.MA W.EW W.CN W.TD W.TC W.RE W.FI W.CS W.OG
W.PR RHO.AG RHO.MI RHO.MA RHO.CN RHO.TD RHO.TC RHO.FI RHO.CS ;

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