TECHNICAL SPECIFICATIONS
for Swedish Micro Based Macro Model

Gunnar Eliasson, IUI, Mats Heiman and Gösta Olavi,
IBM Sweden

These specifications cover the so called 96 model version in full. They are almost identical to the technical specifications chapter (pages 195–267) in Eliasson – Heiman – Olavi: "A Micro-Macro Interactive Simulation Model of the Swedish Economy", December 1976, Federation of Swedish Industries, Economic Research Report B 15. – The 96 version can be run on the IBM 5100 Desk Computer (64K).

MODEL SPECIFICATIONS

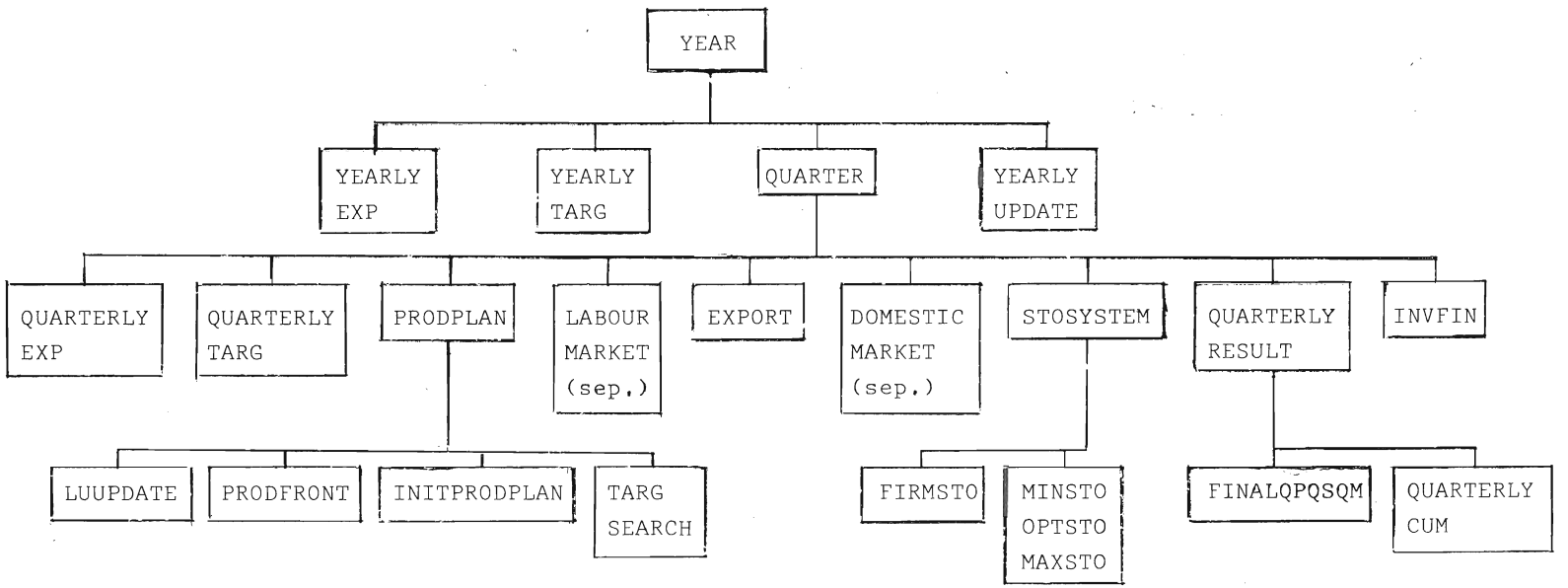
The computer simulation program of this model is written in the APL language. In this publication we do not include a listing of the program: instead we give the following specifications, which in a more English-like syntax depict the APL program.

The computer simulation is forwarded through time in a very straightforward way. Unless otherwise indicated by branching instructions, etc, the equations are executed one by one. (For one year, the quarterly blocks 3–9 are repeated 4 times.)

Note that we have a micro-based model. The execution of one equation thus often means several assignments, for firms, markets, household groups, etc. We do not use an indexing system in the pseudo-code; in general it will be clear from the context if equations (and variables and parameters) refer to global entities or to firms, markets, etc. This information can also be found in the variable listing which concludes this section.

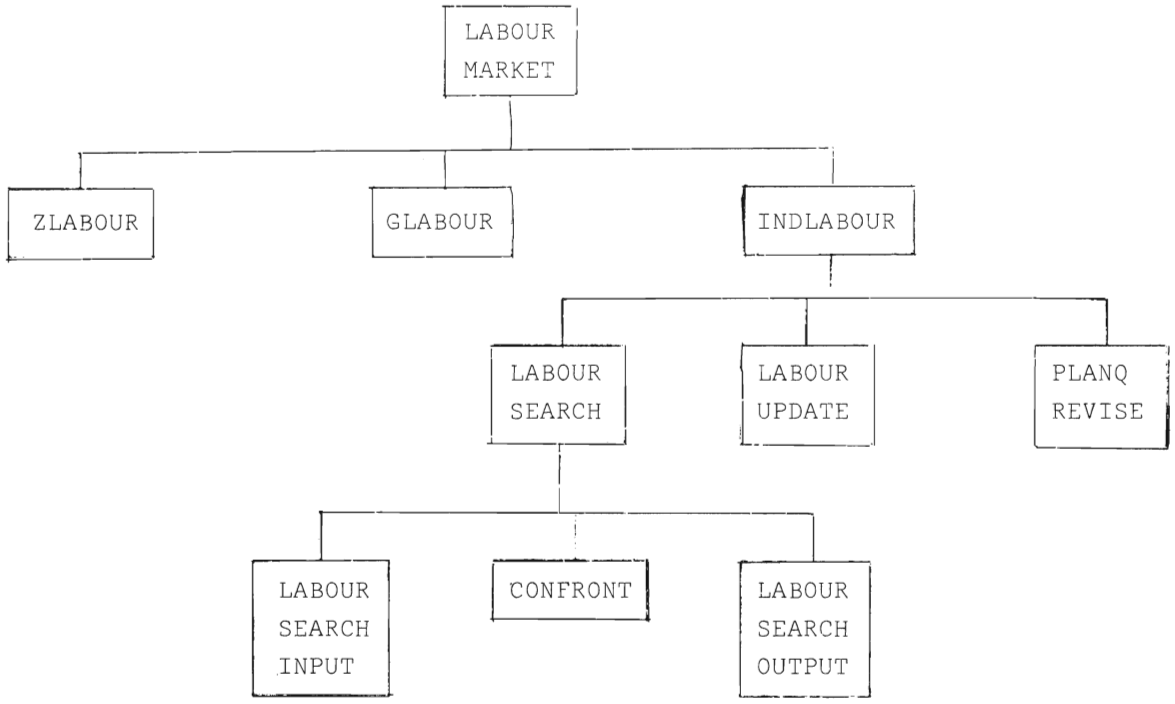
We use the acronym MOSES to denote the model program. This stands for "Model for Simulation of the Economy in Sweden".

Part 1 of 3



MOSES Block Diagram

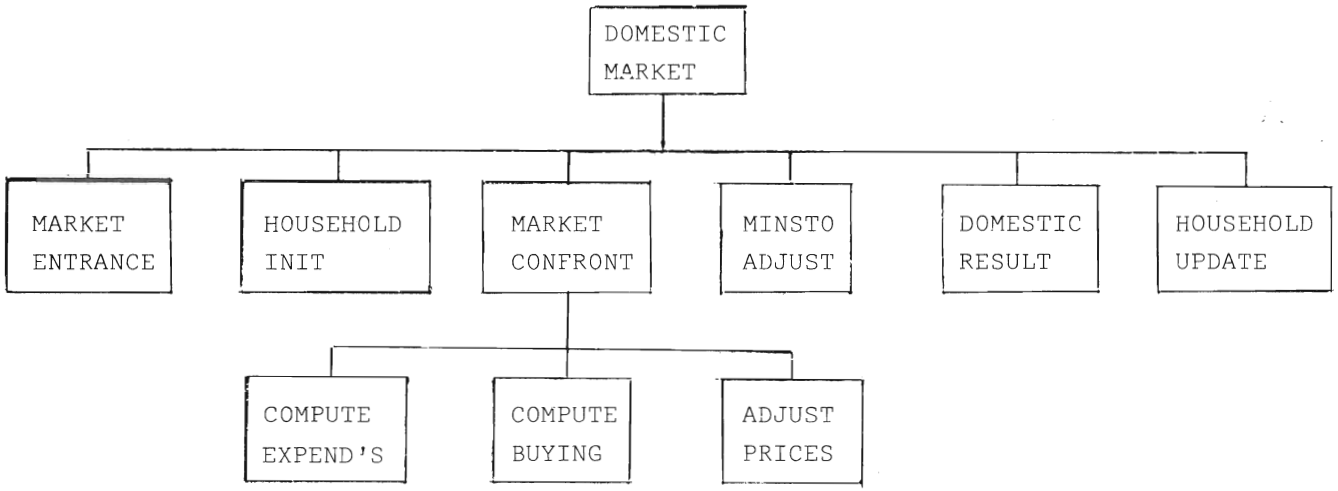
Part 2 of 3



MOSES Block Diagram:

Detail of Labour Market block

Part 3 of 3



MOSES Block Diagram:

Detail of Domestic Market block

0. Yearly initialization
(YEARLY INIT)

At the beginning of each year, the following variables are set to zero:

CUMQ, CUMM, CUMSU, CUMS, CUMWS, CUML

They are all updated each quarter in the block "Quarterly Cumulation".

1. Yearly Expectations
(YEARLY EXP)

Exponential smoothing is used as a special case of weighted time averages in chapter II. The smoothing factors SMP, SMW, SMS and the exogenous constants E1, E2 and the "extroversion" coefficient R do not vary between firms. DP, DW, DS were computed last year in block "Yearly update".

1.1 Prices

1.1.1 EXPIDP:= SMP x EXPIDP +
{1-SMP } x {DP + E1 x (DP-EXPDP) - E2 x (DP-EXPDP)^2}

1.1.2 EXPXDP:= EXOGENOUS

1.1.3 EXPDP:= (1-R) x EXPIDP + R x EXPXDP

1.2 Wages

1.2.1 EXPIDW:= SMW x EXPIDW
+ {1-SMW} x {DW+E1 x (DW-EXPDW) - E2 x (DW-EXPDW)^2}

1.2.2 EXPXDW:= EXOGENOUS

1.2.3 EXPDW:= (1-R) x EXPIDW + R x EXPXDW

1.3 Sales.

1.3.1 EXPIDS:= SMS x EXPIDS
+ {1-SMS} x {DS + E1 x (DS-EXPDS) - E2 x $(DS-EXPDS)^2$}

1.3.2 EXPXDS:= EXOGENOUS

1.3.3 EXPDS:= (1-R) x EXPIDS + R x EXPXDS

2. Yearly Targeting
(YEARLY TARG)

The targeting function is a special case of the smoothing device in block 1, with R = E1 = E2 = 0. The fed-back value of margin M is computed in the block "Yearly update". The fraction EPS increases target pressure (if it is not = zero).

2.1 MHIST:= SMT x MHIST + (1-SMT) x M

2.2 TARGM:= MHIST x (1 + EPS)

3.1 Quarterly Expectations
(QUARTERLY EXP)

Long-term expectations are transformed to a quarterly basis. In all quarters except the first one, a trade-off takes place with respect to immediate experience.

3.1.1 $QEXPDP := \frac{EXPDP}{4}$

$QEXPDW := \frac{EXPDW}{4}$

$QEXPDS := \frac{EXPDS}{4}$

3.1.2 (Not in the first quarter each year)

QEXPDP:= QEXPDP + FIP x (QDP - QEXPDP)
QEXPDW:= QEXPDW + FIW x (QDW - QEXPDW)
QEXPDS:= QEXPDS + FIS x (QDS - QEXPDS)

3.1.3 QEXPP:= QP x (1 + QEXPDP)
QEXPW:= QW x (1 + QEXPDW)
QEXPS:= QS x (1 + QEXPDS)

3.2 Quarterly Targeting
(QUARTERLY TARG)

CUMM from block "Quarterly cumulation"

3.2.1 $QTARGM := TARGM + \frac{NRS-1}{5-NRS} \times (TARGM-CUMM)$

(This formula may generate too high "target pressure" on firms. As a consequence, an unrealistically large number of firms contract production to zero and go out of production. A device called NOPRESSURE can be used in simulation experiments to assure that always QTARGM = TARGM)

4.LU Updating of unemployment
(LUUPDATE)

Retirements are computed, and new entries to the labour force are added to the pool of unemployed.

4.LU.1 LF:= LU + LZ + LG + SUM(L)

4.LU.2 L:= L x (1-RET)

4.LU.3 AMAN1,2,3:= AMAN1,2,3 x (1-RET)

4.LU.4 LU:= LU x (1-RET)

4.LU.5 LU:= LU + ENTRY x LF

4.0 Production Possibility Frontier

In block 4, the following function describes the relationship between labour input and maximum production for a firm under normal profitability conditions:

4.0.1 $QFR(L) = (1-RES) \times QTOP \times (1 - e^{-\frac{TEC}{QTOP} \times L})$

The inverse of this function will also be used:

4.0.2 $RFQ(Q) = \frac{QTOP}{TEC} \times \ln \frac{(1-RES) \times QTOP}{(1-RES) \times QTOP - Q}$

4.1 Determining Change in Production Frontier (PRODFRONT)

Productivity of modern equipment is updated.
Depreciation is accounted for.
A fraction of total investment (LOSS) does not influence production capacity directly but is directed to the "residual slack", and can be used in future expansions only if current slack is low. Productivity has to be updated since old and new equipment differ in quality.

4.1.1 MTEC:= MTEC x (1 + QDMTEC)
(QDMTEC is entered exogenously)

4.1.2 QTOP:=QTOP x (1-RHO)

4.1.3 $$QCHQTOP1:=(1-LOSS) \times \frac{QINV \times INVEFF}{QP}$$
(QINV and INVEFF from investment-financing block)

4.1.4 $$QCHQTOP2:=MIN\left(LOSS \times \frac{QINV \times INVEFF}{QP} \times \frac{RESMAX-RES}{RESMAX}, \frac{RESMAX-RES}{1-RESMAX} \times (QTOP+QCHQTOP1)\right)$$
(The slack RES cannot exceed RESMAX)

4.1.5 QCHQTOP:=QCHQTOP1+QCHQTOP2

4.1.6 $$RES:= \frac{RES \times (QTOP+QCHQTOP1) + QCHQTOP2}{QTOP+QCHQTOP}$$

4.1.7 $$TEC:= \frac{QTOP+QCHQTOP}{\frac{QTOP}{TEC} + \frac{QCHQTOP}{MTEC}}$$

4.1.8 QTOP:= QTOP + QCHQTOP

4.2 Initial Quarterly Production Plan (INITPRODPLAN)

This initial plan is based on the sales forecast, plus the desire to keep the stock at its "optimal" level.

4.2.1 $$QEXPSU := \frac{QEXPS}{QEXPP}$$

4.2.2 $$QPLANQ := MAX\left\{0, QEXPSU + \frac{OPTSTO - STO}{4 \times TMSTO}\right\}$$

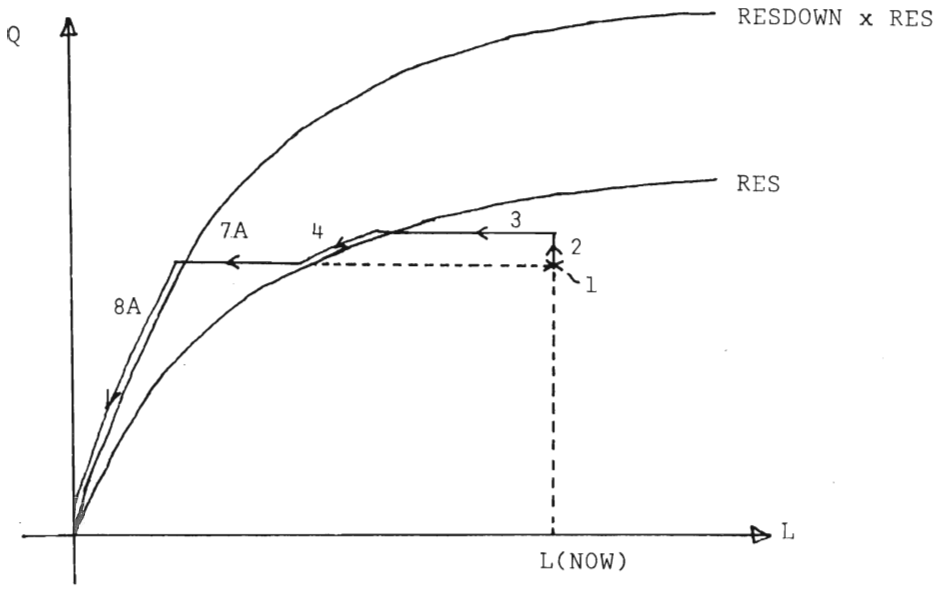
4.3 Search for Target Satisfaction (TARGSEARCH)

This block describes how a firm varies its combination of labour input and production level to satisfy its profit margin requirement (QTARGM). When the target is reached, search is terminated; this means that each section within 4.3 is entered only if the firm has not yet found a satisfactory plan.

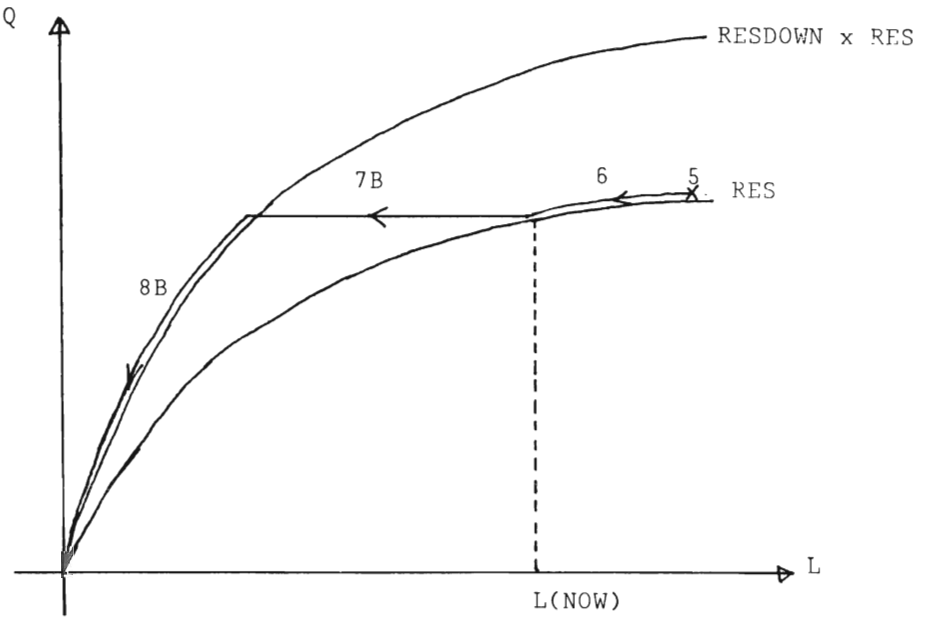
The diagrams and search paths on the next page explain how this search process has been modelled. Note that search will probably terminate within one of the paths, and not at a corner. Two cases can be distinguished, depending on whether the initial plan implies recruitment or not.

Two devices called "SAT" and "SOLVE" are referred to throughout the block; they are described in 4.3.11 and 4.3.12.

The specification in 4.3 holds for each firm, one at a time.



Search path, case A: QPLANQ < QFR(L)



Search path, case B: QPLANQ > QFR(L)

4.3.0 Is the initial plan feasible, and does it imply recruitment?

```
IF QPLANQ ≥ QTOP x (1-RES)
   THEN GOTO 4.3.6
   ELSE IF QPLANQ > QFR(L)
           THEN GOTO 4.3.5
           ELSE CONTINUE
```

4.3.1 Does the initial plan give satisfaction at "1" in the diagram?:

```
IF SAT(QPLANQ,L)
   THEN QPLANL:=L
        GOTO 4.3.10
```

4.3.2 Increase production with same labour force. Raise until production frontier or stock limit is reached (path 2).

```
Q2:=MIN(QFR(L),QEXPSU + MAXSTO - STO)
IF SAT(Q2,L)
   THEN QPLANQ:= L x (QEXPW/4) / (1-QTARGM) x QEXPP

        QPLANL:=L
        GOTO 4.3.10
   ELSE IF Q2=QFR(L)
           THEN GOTO 4.3.4
           ELSE CONTINUE
```

4.3.3 Cut down labour force, still producing up to the stock limit (path 3).

```
IF SAT(Q2,RFQ(Q2))
    THEN QPLANQ:=Q2
         QPLANL:= (1-QTARGM)xQ2xQEXPP / QEXPW/4
         GOTO 4.3.10
```

4.3.4 Reduce production down to QPLANQ, with corresponding decrease in labour force (path 4).

```
IF SAT (QPLANQ,RFQ(QPLANQ))
   THEN QPLANQ,QPLANL:=SOLVE
        GOTO 4.3.10
   ELSE Q7:=QPLANQ
        GOTO 4.3.7
```

4.3.5 With an initial plan implying recruitment, will the profit target be reached?

```
IF SAT(QPLANQ, RFQ(QPLANQ))
   THEN QPLANL:= RFQ(QPLANQ)
        GOTO 4.3.10
```

4.3.6 First step in search when initial plan implies recruitment (path 6).

```
IF SAT(QFR(L),L)
   THEN QPLANQ,QPLANL:=SOLVE
        GOTO 4.3.10
   ELSE Q7:=QFR(L)
```

4.3.7 Keep production at the level Q7 (as it resulted from 4.3.4 or 4.3.6), but reduce the slack RES and thereby the labour force. RESDOWN is an exogenous constant (path 7), telling how much slack can be reduced during a single quarter.

IF SAT(Q7,RFQ($\frac{1-RES}{1-RESDOWNxRES}$ x Q7))

THEN QPLANQ:=Q7

QPLANL:= $\frac{(1-QTARGM)xQ7xQEXPP}{QEXPW/4}$

RES:=1- $\frac{Q7x(1-RES)}{QFR(QPLANL)}$

GOTO 4.3.10

ELSE RES:=RESDOWNxRES

4.3.8 With the new, lower, slack from 4.3.7, try to reach target by reducing production and labour force (path 8).

IF SAT(0,0)
THEN QPLANQ,QPLANL:=SOLVE
GOTO 4.3.10

4.3.9 No plan could be found that satisfies profit target. The firm is eliminated from the model, and the labour force is added to the pool of unemployed.

LU:=LU+L
NULLIFY this firm

4.3.10 QPLANQ and QPLANL have now been decided. The AMAN vector, describing the 2-quarter lag of firings, is updated. (AMAN1 can be fired this quarter).

LAYOFF:=MAX(L-QPLANL,0)
AMAN1:=MIN(LAYOFF,AMAN2)
AMAN2:=MIN(LAYOFF-AMAN1,AMAN3)
AMAN3:=LAYOFF-AMAN1-AMAN2

4.3.11 "SAT": This device is used to find out if a certain combination Q/L of planned production and labour force will satisfy profit targets.

IF L > 0

THEN MARGIN:= $1 - \frac{L \times (QEXPW/4)}{Q \times QEXPP}$

ELSE (L=0) MARGIN:= $1 - \frac{QEXPW/4}{(1-RES) \times TEC \times QEXPP}$

(The case L=0 is used in 4.3.8)

IF MARGIN ≥ QTARGM

THEN SAT:= TRUE

ELSE SAT:= FALSE

4.3.12 "SOLVE": This device solves the equation:

$$1 - \frac{QPLANL \times (QEXPW/4)}{QFR(QPLANL) \times QEXPP} = QTARGM$$

for QPLANL, with an error less than 0.1 %. Once QPLANL is found, QPLANQ is also calculated as

QPLANQ:= QFR(QPLANL)

(See the program for details on how the equation is solved, using the Newton-Raphson iteration method).

4.3.12 SOLVE in detail

The equation is

$$1 - \frac{QPLANL \times (QEXPW/4)}{(1-RES) \times QTOP \times \left\{1 - e^{-\frac{TEC}{QTOP} \times QPLANL}\right\} \times QEXPP} = QTAR$$

Substitute $y = \frac{TEC}{QTOP} \times QPLANL$

$$1 - \frac{\frac{QTOP}{TEC} \times y \times (QEXPW/4)}{(1-RES) \times QTOP \times (1-e^{-y}) \times QEXPP} = QTARGM$$

$$1-e^{-y} = \frac{QEXPW}{(1-QTARGM) \times (1-RES) \times TEC \times QEXPP \times 4} \times y$$

With a substitution this gives

$$1-e^{-y}=b.y$$

or $$f(y) = b.y + e^{-y} - 1 = 0$$

with $$f'(y) = b - e^{-y}$$

(b>0 must hold when we enter SOLVE, else no solution can be found).

We want to use Newton-Raphson's formula

$$y := y - \frac{f(y)}{f'(y)}$$

with the starting value $y_o := 1/b$, which is surely greater than the exact root, and gives convergence with all f/f' positive.

Example of one-firm SOLVE:

```
     ∇ SOLVE
[1]    Y←÷B←QEXPW÷(1-QTARGA)×(1-RES)×TEC×QEXPP×4
[2]  LOOP:→LOOP+D<0.001×Y←Y-D←((B×Y)+(*-Y)-1)÷(B-(*-Y))
[3]    QPLANQ←QFR QPLANL←Y×QTOP÷TEC
     ∇
```

For b $\geq$ 1, this algorithm gives the correct result y = 0. The possibility of b $\leq$ 0 must be checked, however.

The algorithm is easily modified to the case where it should be applied to several equations simultaneously.

5. LABOUR MARKET
(LABOUR MARKET)

5.1 Updating of unemployment
(LUUPDATE)

(This block has been moved to block 4).

5.2 Service sector labour market
(ZLABOUR)

Service sector takes the labour it wants from the pool of unemployed. Wage increase in service sector is equal to average wage increase in industry last quarter. Offering price is calculated.

5.2.1 TECZ:= TECZ x (1 + ODTECZ)
(QDTECZ is entered exogenously)

5.2.2 QCHLZ is calculated to use last quarter's surplus (or deficit) profit (compared with targets) to increase (or diminish) labour force. Notice that QCHLZ also includes substitutes for the retired.

$$QCHLZ := \frac{(QMZ-QTARGMZ)\times QPZ\times TECZ\times LZ}{QWZ/4} + RET\times LZ$$

(QTARGMZ is entered exogenously)
(If QCHLZ > LU we put QCHLZ=LU)

5.2.3 LZ:=LZ+QCHLZ-RETxLZ

5.2.4 LU:=LU-QCHLZ
Notice that if QCHLZ < 0, this means that people are fired from service sector.

5.2.5 QWZ:=QWZx(1+QDWIND)

5.2.6 QQZ:= TECZ x LZ

5.2.7 Offering price is calculated to make QMZ=QTARGMZ
QPRELPZ:=QPZx(1+QDWIND-QDTECZ)

5.3 Government sector labour market
(GLABOUR)

Government sector takes the labour it wants from the pool of unemployed. Wage increase is equal to average wage increase in industry last quarter. As government services are provided free, there are no prices or profit margins.

5.3.1 QCHLG:=LGxRET+REALCHLG
(REALCHLG is entered exogenously)
(If QCHLG > LU we put QCHLG=LU)

5.3.2 LG:=LG+QCHLG-RETxLG

5.3.3 LU:=LU-QCHLG
Notice that if QCHLG < 0, this means that people are fired from government sector.

5.3.4 QWG:=QWGx(1+QDWIND)

5.4 Industry sector labour market (INDLABOUR)

This block consists of three parts:

- Labour search
- Labour update
- Revision of production plans

They are all further specified below.

5.4.1 Labour search (LABOUR SEARCH INPUT; CONFRONT; LABOUR SEARCH OUTPUT)

Describes the sequence of actions that determine the labour force in every firm for the next quarter.

In LABOUR SEARCH INPUT, (5.4.1.0) some help variables are introduced.

In CONFRONT (5.4.1.1 - 5.4.1.11) the actual interaction for new labour takes place.

Firms are ranked in order of the planned relative change in recruitment. Each firm is allowed to "attack" another firm, chosen at random (the probability for a given firm to be chosen is proportional to its size). The desired change in new employment (CHL) is continuously changed. Firms strive to make CHL equal to zero. Firms that achieve this objective refrain from further raiding of other firms. This procedure is repeated NITER times (NITER is an exogenouosly given number).

In LABOUR SEARCH OUTPUT (5.4.1.12 - 5.4.1.13), results are summarized and layoff lags accommodated.

5.4.1.0 Help variables and initial wage offering:

CHL:= QPLANL - L
WW:= QW + IOTA x (QEXPW - QW)
LL:= L concatenated to LU (The pool of unemployed will take part in the interactions)

5.4.1.1 Rank firms in decreasing order after CHL/L.

5.4.1.2 Repeat 5.4.1.3 - 5.4.1.10 NITER times (one time representing one attack from each firm).

5.4.1.3 Repeat 5.4.1.4 - 5.4.1.11 NTOT times (one time representing an attack from one firm).

5.4.1.4 Select the firm that is to perform the next attack (from the ordering in 5.4.1.1). Denote it by I.

5.4.1.5 IF CHL(I) $\leq$ 0 THEN go to 5.4.1.10 (in this case the firm does not want any more labour).

5.4.1.6 Choose a firm to attack. Denote the firm being attacked by II. (The selection is done at random by a function called CHOOSE. The probability for a certain firm to be choosen is the size of its labour force, divided by the sum of the labour forces in all firms plus the number of unemployed).

5.4.1.7 We now check whether the attacked object really was a firm (II $\leq$ NTOT), or whether it was the unemployed (II=NTOT+1) (cf comment to 5.4.1.0).
IF II $\leq$ NTOT
THEN go to 5.4.1.8
ELSE go to 5.4.1.9

5.4.1.8 We now check whether the attack was a success (i.e. whether the wage of the attacking firm was high enough) or not.

```
IF WW(I) ⩾ WW(II)*(1+GAMMA)
   THEN WW(II):=WW(II)+KSISUCCx(WW(I)-WW(II))
        go to 5.4.1.9
   ELSE WW(I):=WW(I)+KSIFAILx(WW(II)*(1+GAMMA)-WW(I))
        go to 5.4.1.10
```

5.4.1.9 If we come to this statement, the attack was a success, and labour is moved from firm II to firm I. If the "attacked firm" was the unemployed, (i.e. II>NTOT) the attack is always a success.
(In the program 5.4.1.9 is a function called TAKE L FROM)

```
CHLNOW:=MIN(THETA*LL(II),CHL(I))
LL(I):=CHL(I)+CHLNOW
CHL(I):=CHL(I)-CHLNOW
LL(II):=LL(II)-CHLNOW
IF II ⩽ NTOT
   THEN CHL(II):=CHL(II)+CHLNOW
```

5.4.1.10 One attack is completed, go to 5.4.1.3.

5.4.1.11 All firms have had the opportunity to attack once, go to 5.4.1.2.

(Labour market interactions are now completed).

5.4.1.12 Summarize results; abandon help variables:

```
LU:= Last component in LL
QCHL:= LL - L
QCHW:= WW - QW
```

5.4.1.13 People who leave one firm for another are subtracted from the layoff-lagging vector AMAN in their first firm.

```
EXIT:= MAX(0,-QCHL)
IF EXIT > AMAN1 + AMAN2
   THEN AMAN3:= AMAN3 - (EXIT-AMAN1-AMAN2)
   (but AMAN3 ≥ 0 must hold)
IF EXIT > AMAN1
   THEN AMAN2:= AMAN2 - (EXIT - AMAN1)
   (but AMAN2 ≥ 0 must hold)
IF EXIT > 0
   THEN AMAN1:= AMAN1 - EXIT
   (but AMAN1 ≥ 0 must hold)
```

5.4.2 Labour update
(LABOUR UPDATE)

Layoff is accomodated. Wage increase in the industry is computed. Labour force and wage is updated for each firm, as described in the previous block.

5.4.2.1 Layoffs; AMAN1 is a limit on how many people a firm can fire this quarter.

```
SACK:= MIN(AMAN1, MAX(0,L + QCHL - QPLANL))
QCHL:= QCHL - SACK
AMAN1:= AMAN1 - SACK
LU:= LU + SUM(SACK)
```

5.4.2.2 Wage average and trend:

$$OLDQW := \frac{SUM(L \times QW)}{SUM(L)}$$

$$NEWQW := \frac{SUM\{(L+QCHL) \times (QW+QCHW)\}}{SUM\{L+QCHL\}}$$

$$QDWIND := \frac{NEWQW}{OLDQW} - 1$$

5.4.2.3 Update labour force and wage:

$$L := L + QCHL$$

$$QDW := \frac{QCHW}{QW}$$

$$QW := QW + QCHW$$

5.4.2.4 Unemployment:

$$CHRU := \frac{LU}{LU + LZ + LG + SUM(L)} - RU$$

$$RU := RU + CHRU$$

5.4.3 Revision of Production Plans (PLANQREVISE)

If a firm has lost too much of its labour force, or could not meet recruitment plans, its production plan must be reduced. The new level of production assigned to the variable QQ is determined in this block. Optimum sales volume is computed.

5.4.3.1 QPLANQ:= MIN(QPLANQ, QFR(L))
(QFR is the production frontier as described in block 4.0)

5.4.3.2 $QDQ := \frac{QPLANQ}{QQ} - 1$

5.4.3.3 $QQ := QQ \times (1 + QDQ)$

5.4.3.4 $QOPTSU := MAX\left\{0, QEXPSU \times \frac{QQ}{QEXPSU + \frac{OPTSTO-STO}{4 \times TMSTO}}\right\}$

6. EXPORT MARKETS
(EXPORT)

Export share and supply, price and sales in foreign markets are determined.

6.1.1 IF $QPDOM \geqslant QPFOR$

THEN $X := X - X \times \frac{1}{4 \times TMX} \times \frac{QPDOM - QPFOR}{QPFOR}$

ELSE $X := X + (1-X) \times \frac{1}{4 \times TMX} \times \frac{QPFOR - QPDOM}{QPDOM}$

This formula can make $X > 1$ or $X < 0$. If this happens, X is put equal to one (or to zero).

6.1.2 $QSUFOR := X \times QOPTSU$

6.1.3 $QPFOR := (1 + QDPFOR) * QPFOR$
(QDPFOR is entered exogenously).

6.1.4 $QSFOR := QSUFOR * QPFOR$

7 Domestic Product Market
(DOMESTIC MARKET)

This block describes the interaction between firms and households, resulting in domestic prices and sales volumes for a quarter (service sector is also treated). It consists of the following parts:

1. Market Entrance
2. Household Initialisation
3. Market Confrontation
4. Computation of Household Expenditures
5. Computation of Total Buyings
6. Price Adjustments
7. Adjustment to Minimum Stock
8. Domestic Result
9. Updating of Households' Data

Computationally, blocks 4, 5, 6 are sub-blocks to "Market Confrontation".

Functionally, blocks 1, 6, 7, 8 describe the behaviour of firms. Blocks 2, 4, 9 form an integrated model of household behaviour and can be studied separately.

Block 3 is the link between firms and households. Block 5 is included to adjust demand to import competition and to handle the firms' investments.

The following abbreviations denote household expenditure categories:

NDUR - Services and non-durable goods.

Z - Service (subset of NDUR).

DUR - Durable goods.

MKT - All NDUR and DUR, with the exception of the service sector.

SAV - Household saving.

7.1 Market Entrance
(MARKET ENTRANCE)

Each firm computes its optimum sales volume. When determining an initial offering price, firms plan as if prices in domestic and foreign markets will develop similarily.

7.1.1 QOPTSUDOM:= (1-X) x QOPTSU

7.1.2 $$QPRELPDOM := QPDOM \times \frac{SUM\left\{QOPTSUDOM \times \frac{QEXPP}{QP}\right\}}{SUM(QOPTSUDOM)}$$

(The average is from firms to markets, giving one preliminary price for each market)

7.2 Household Initialisation
(HOUSEHOLD INIT)

7.2.1 Disposable income per household

$$QDI := \left\{ QMZ \times QSZ + LZ \times \frac{QWZ}{4} + LG \times \frac{QWG}{4} + SUM\left(L \times \frac{QW}{4}\right) \right\} / NH + WH \times \frac{RI}{4}$$

7.2.2 "Essential" consumption volume (NDUR,DUR)

CVE(I):= ALFA1(I) + ALFA2(I) x CVA(I)
(CVA, "addicted" volume, is updated each quarter in 7.9.4).

7.3 Market Confrontation
(MARKET CONFRONT)

(This market specification subroutine is provisional. We should 1) Have a more sophisticated termination criterion than simply a fixed number of iterations or 2) Let each iteration correspond to a period of time within the quarter, having the cumulated lapse of time terminate iterations at the end of a quarter).

Adjust import shares IMP. Form the vector PT of trial prices. Let firms and households interact a pre-specified number of times.

7.3.1 IF QPDOM ≥ QPFOR

$$\text{THEN IMP:= IMP} + \frac{1 - \text{IMP}}{4 \times \text{TMIMP}} \times \frac{\text{QPDOM} - \text{QPFOR}}{\text{QPFOR}}$$

$$\text{ELSE IMP:= IMP} - \frac{\text{IMP}}{4 \times \text{TMIMP}} \times \frac{\text{QPFOR} - \text{QPDOM}}{\text{QPDOM}}$$

This formula can make $X > 1$ or $X < 0$.
If this happens, X is put equal to one (or to zero).

7.3.2 PT(MKT):= QPRELPDOM
PT(Z):= QPRELPZ

7.3.3 Perform 7.3.3 - 7.3.5 MARKET-ITER times:

7.3.4 Compute household expenditures (see 7.4)

7.3.5 Compute total buyings (see 7.5)

7.3.6 (Not in the last iteration)
Adjust prices (see 7.6)

7.4 Computation of Household Expenditures
(COMPUTE EXPENDITURES)

This block describes how households react to a set of trial offering prices in respective expenditure categories. It will interact with firms several times in an iterative manner. The expenditure categories correspond to the firms' markets and the service sector.
Prices are called PT (trial) and QPH (last quarter's final prices).
QDI and CVE come from block 7.2.

All variables have an order of magnitude referring to one household, not to the aggregate.

7.4.1 Preliminary Consumer Price Index (CPI), based on new prices in all expenditure categories:

$$QPRELCPI := \frac{SUM(QC(I))}{SUM\left\{\frac{QC(I)}{PT(I)}\right\}} \quad x)$$

$$CHDCPI := \frac{QPRELCPI}{QCPI} - 1 - QDCPI$$

7.4.2 Essential nondurables consumption.

$$QSPE(NDUR) := CVE(NDUR) \times PT(NDUR)$$

7.4.3 Essential consumption of durable goods:

$$SWAP := ALFA3 \times \left(\frac{CHRI}{4} - CHDCPI\right) + ALFA4 \times CHRU$$

$$QSPE(DUR) := \frac{PT(DUR) \times CVE(DUR)}{RHODUR} -$$

$$- \frac{PT(DUR)}{QPH(DUR)} \times STODUR - QDI \times SWAP$$

---

x) Experiments will also be made with the following formula:

$$QPRELCPI := \frac{SUM\{CVA(I) \times PT(I)\}}{SUM(CVA(I))}$$

7.4.4 Essential level of saving:

QSPE(SAV):= (WHRAxQDI-WH)+QDIxSWAP
(WHRA is updated in 7.9.4)

7.4.5 Adjustment to income constraint
("I" denotes NDUR,DUR,SAV)

$$QSP(I) := BETA1(I) \times QSPE(I) +$$

$$+\left\{BETA2(I) + \frac{BETA3(I)}{QDI/QPRELCPI}\right\} \times \left\{QDI - \right.$$

$$\left. - SUM(BETA1(I) \times QSPE(I))\right\}$$

where all $BETA1 \geq 0$
$SUM(BETA2)=1$
$SUM(BETA3)=0$

7.4.6 For all non-saving categories, $QSP \geq 0$ is enforced. Thus at this stage $SUM(QSP) > QDI$ might hold. This is accomodated in the block "Household Update", where savings are recomputed as a residual.

7.5 Computation of total buyings
(COMPUTE BUYING)

Sum over households to obtain total spending for each expenditure category (= market). Add firms' investment to demand in durables sector (fixed sum of money, no matter what the price is).
Adjust for import fraction and convert from money to volume.

7.5.1 QTSP:= SUM(QSP)
(Sum over households, not over categories)

7.5.2 QTSP(DUR):= QTSP(DUR) + SUM(QINVLAG)
(Sum over all firms).

7.5.3 QTBUY:= (1-IMP) x QTSP/PT

7.6 Price Adjustments
(PRICE ADJUST)

This block describes how firms (in each iteration) adjust their prices, once households have responded to a set of prices with provisional expenditures.

The common goals of the firms in a market is to keep prices (sales sum) up and the stock at OPTSTO.

7.6.1 IF QTBUY < SUM(QOPTSUDOM)

$$\text{THEN PT:= PT} - \frac{\text{MAXDP x PT}}{4 \text{ x (MARKET ITER-1)}}$$

$$\text{ELSE PT:= PT} + \frac{\text{MAXDP x PT}}{4 \text{ x (MARKET ITER-1)}}$$

where MAXDP is an exogenous fraction.

7.7 Adjustment to Minimum Stock
(MINSTO ADJUST)

Market interactions may result in a demand that would lower stocks below minimum levels. In that case, purchasing is reduced in this block. (Equations 7.7.1-7.7.4 hold for markets, not for individual firms. 7.7.2 - 7.7.3 also hold for service).

7.7.1 $QMAXTSUDOM := MAX\{0, SUM[QQ + (STO-MINSTO) - QSUFOR]\}$

7.7.2 $REDUCE := MIN\ (1, \frac{QMAXTSUDOM}{QTBUY})$

(For service, $REDUCE := MIN\ (1, \frac{QQZ}{QTBUY})$

7.7.3 QSP:= QSP x REDUCE

7.7.4 QTBUY:= QTBUY x REDUCE

7.7.5 QINVLAG:= QINVLAG x REDUCE(DUR)
(Holds for each firm).

7.8 Domestic Result
(DOMESTIC RESULT)

Domestic price is updated in each market (cf. QPH in 7.9.5 which also contains the service sector price).

Total change in stock level is computed for each market. If demand was so small that the maximum (total) stock level is exceeded, the excess quantity is assumed wasted.

7.8.1 $QDPDOM := \frac{PT(MKT)}{QPDOM} - 1$

7.8.2 QPDOM:= PT(MKT)

7.8.3 QPZ:= PT(Z)

7.8.4 QCHTSTO:= MIN(SUM(MAXSTO-STO), SUM(QQ-QSUFOR)-QTBUY)

7.8.5 QSZ:= QTBUY(Z) x QPZ

7.9 Updating of Households' Data
(HOUSEHOLD UPDATE)

This block adjusts household variables after firm-households interactions, resulting in a set of prices and a final household expenditure pattern. Trial prices (PT) are then made final (QPH).

7.9.1 Nondurables consumption
QC(NDUR):= QSP(NDUR)

7.9.2 Durables consumption and update

$STODUR := \frac{PT(DUR)}{QPH(DUR)} \times STODUR + QSP(DUR)$

QC(DUR):= RHODUR x STODUR

STODUR:= (1-RHODUR) x STODUR

7.9.3 Saving
QSP(SAV):= QSAVH:= QDI - SUM{QSP(NDUR,DUR)}
WH:= WH + QSAVH

7.9.4 Addicted levels

(I denotes NDUR and DUR)

$$CVA(I) := SMOOTH(I) \times CVA(I) + (1-SMOOTH(I)) \times \frac{QC(I)}{PT(I)}$$

$$WHRA := SMOOTH(SAV) \times WHRA + (1-SMOOTH(SAV)) \times \frac{WH}{QDI} \quad xx)$$

7.9.5 Prices

QPH := PT

OLDQCPI := QCPI

$$QCPI := \frac{SUM(QC(I))}{SUM\left\{\frac{QC(I)}{QPH(I)}\right\}} \quad x)$$

QDCPI := (QCPI - OLDQCPI)/OLDQCPI

---

x) See note to 7.4.1

xx) In a first phase of the project, SMOOTH(SAV)=1 will be used. This will have the effect of a fixed (exogenous) WHRA.

8. INVENTORY SYSTEM
(STOSYSTEM)

8.1 Distributing change in inventories over firms
(FIRMSTO)

Change in inventories industry by industry (from block 7) is distributed over individual firms in each industry. Thereafter domestic sales are calculated as a residual.

8.1.1 Some firms might end up with inventories outside the prespecified limits. We adjust for that:

```
IF STO > MAXSTO
   THEN QCHTSTO:=QCHTSTO+STO-MAXSTO
        STO:=MAXSTO
   ELSE IF  STO < MINSTO
            THEN QCHTSTO:=QCHTSTO+STO-MINSTO
                 STO:=MINSTO
```

8.1.2 The rest of QCHTSTO is distributed over the firms.

IF QCHTSTO > 0

THEN $STO := STO + \frac{MAXSTO-STO}{SUM(MAXSTO-STO)} \times QCHTSTO$

ELSE $STO := STO + \frac{MINSTO-STO}{SUM(MINSTO-STO)} \times QCHTSTO$

8.1.3 Domestic sales are calculated.

QSUDOM:= QQ-QSUFOR-QCHSTO

QSDOM:= QSUDOM x QPDOM

(Where QCHSTO for each firm is the sum of the changes in inventories made in 8.1.1 and 8.1.2.)

8.2 Reference Inventory Levels

The levels MINSTO, MAXSTO, OPTSTO are computed based on last quarter's sales as follows:

8.2.1 MINSTO:= SMALL x $(4 \times \frac{QS}{QP})$

8.2.2 MAXSTO:= BIG x $(4 \times \frac{QS}{QP})$

8.2.3 OPTSTO:= MINSTO + BETA x (MAXSTO - MINSTO)

(In the computer program, these levels are not implemented as variables but as value-returning sub-routines).

9.1 Calculating final prices, sales and profits (FINALQPQSQM)

We have the values of prices and sales in foreign and domestic markets, and calculate total sales and average prices. This enables us to determine this quarter's profits.

9.1.1 QSU:= QSUFOR + QSUDOM

9.1.2 QDS:= $\frac{QSFOR + QSDOM}{QS} - 1$

9.1.3 QS:= QSFOR + QSDOM

9.1.4 QDP:= $\frac{QS/QSU}{QP} - 1$

9.1.5 QP:= QS/QSU

9.1.6 QM:= $1 - \frac{L \times (QW/4)}{QS}$

9.1.7 QMZ:= $1 - \frac{LZ \times (QWZ/4)}{QSZ}$

9.2 Quarterly Cumulation
(QUARTERLY CUM)

Production, sales, wage sum, and labour force are cumulated. An up-till-now margin is computed.

9.2.1 CUMQ:= CUMQ + QQ

9.2.2 CUMS:= CUMS + QS

9.2.3 CUMSU:= CUMSU + QSU

9.2.4 $CUMWS := CUMWS + L \times \frac{QW}{4}$

9.2.5 $CUML := \frac{(NRS-1) \times CUML + L}{NRS}$

9.2.6 $CUMM := 1 - \frac{CUMWS}{CUMS}$

10. Investment Financing (provisional)
(INVFIN)

Update book value of production equipment, and calculate this quarter's rate of return. New borrowing depends on inflation and on current rate of interest.
Investment has a one-quarter delivery lag. Profits and new borrowing are used for investment, except for an amount RW x 4 x QCHS used to keep working capital at a certain fraction RW of sales.

10.1 K1:=K1x(1-RHO+QDPDOM(DUR))+QINVx(1-RHO)

10.2 $QRR := 4 \times \frac{QM \times QS - RHO \times K1}{K1 + K2 + STO \times QP}$

10.3 $QCHS := QS \times \frac{QDS}{1 + QDS}$

10.4 $QCHK2 := RW \times 4 \times QCHS$

10.5 $K2 := K2 + QCHK2$

10.6 $QCHBW := BW \times (ALFABW + BETABW \times (\frac{QRR}{4} + QDPDOM(DUR) - \frac{RI}{4}))$

10.7 $BW := BW + QCHBW$

10.8 $NW := K1 + K2 + STO \times QP - BW$

10.9 $QINV := QINVLAG$

10.10 $QINVLAG := MAX\left\{0, QM \times QS - QCHK2 + QCHBW - \frac{RI}{4} \times BW\right\}$

10.11 $INVEFF := \frac{QTOP \times QP}{K1}$

11. Yearly Update
(YEARLY UPDATE)

Yearly production, price, wage, sales, and margin are computed, based on cumulation in block "Quarterly Cum".

11.1 $DQ := \frac{CUMQ}{Q} - 1$

$Q := Q \times (1 + DQ)$

11.2 $DP := \frac{CUMS/CUMSU}{P} - 1$

$P := P \times (1 + DP)$

11.3 $DW := \frac{CUMWS/CUML}{W} - 1$

$W := W \times (1 + DW)$

11.4 $DS := \frac{CUMS}{S} - 1$

$S := S \times (1 + DS)$

11.5 $CHM := CUMM - M$

$M := M + CHM$

Listing of Variables and Parameters

The following pages give a description of all variables and parameters occurring in the pseudo-code (and hence in the computer program). Variables and parameters described in the textual documentation, but not yet included in the computer program, are explained in the main text when they are first introduced.

Exogenous Variables:

The following variables are treated as exogenous, as the model now stands (see the following pages for an explanation of each variable):

Related to foreign markets: QDPFOR

Related to technological progress: QDMTEC, QDTECZ

Related to expectations: EXPXDP, EXPXDS, EXPXDW

Related to public sector: REALCHLG, RI

Others: ENTRY; TARGMZ

ALFABW - *CONSTANT USED IN 'INVFIN' TO DETERMINE FIRMS' CHANGE IN BORROWING.*

ALFA1 - *CONSTANTS USED IN 'HOUSEHOLD INIT' TO DETERMINE 'ESSENTIAL' CONSUMPTION VOLUME FOR EACH EXPENDITURE CATEGORY.*

ALFA2 - *CONSTANTS USED IN 'HOUSEHOLD INIT' TO DETERMINE 'ESSENTIAL' CONSUMPTION VOLUME FOR EACH EXPENDITURE CATEGORY.*

ALFA3 - *CONSTANT USED IN 'COMPUTE EXPENDITURES' TO DETERMINE THE SHORT-TERM SWAP BETWEEN SAVINGS AND EXPENDITURES ON DURABLES.*

ALFA4 - *CONSTANT USED IN 'COMPUTE EXPENDITURES' TO DETERMINE THE SHORT-TERM SWAP BETWEEN SAVINGS AND EXPENDITURES ON DURABLES.*

AMAN - *FOR EACH FIRM, A THREE-COMPONENT VECTOR ACCOMODATING THE TWO-QUARTER LAG OF LAYOFFS. THE FIRST COMPONENT HOLDS THE NUMBER OF PEOPLE THAT CAN BE FIRED THIS QUARTER, ETC.*

BETA - *CONSTANTS USED TO COMPUTE OPTIMUM INVENTORY LEVELS IN RELATION TO 'MINSTO' AND 'MAXSTO'. SAME FOR ALL FIRMS WITHIN A MARKET.*

BETA1 - *CONSTANTS USED IN 'COMPUTE EXPENDITURES' TO ADJUST EXPENDITURES IN DIFFERENT CATEGORIES TO THE INCOME CONSTRAINT. ALL BETA1* ≥ 0

BETA2 - *CONSTANTS USED IN 'COMPUTE EXPENDITURES' TO ADJUST EXPENDITURES IN DIFFERENT CATEGORIES TO THE INCOME CONSTRAINT. SUM(BETA2)=1.*

BETA3 - *CONSTANTS USED IN 'COMPUTE EXPENDITURES' TO ADJUST EXPENDITURES IN DIFFERENT CATEGORIES TO THE INCOME CONSTRAINT. SUM(BETA3)=0.*

BIG - *ON EACH MARKET, THE FRACTION OF YEARLY SALES THAT FIRMS CONSIDER AS INVENTORY MAXIMUM.*

BW - *A FIRM'S TOTAL BORROWING. UPDATED IN 'INVFIN'.*

ATTEMPTED RISE IN CONSUMER PRICE INDEX BETWEEN QUARTERS (A FRACTION). COMPUTED IN 'COMPUTE EXPENDITURES' EACH TIME HOUSEHOLDS MEET AN OFFERING PRICE VECTOR 'PT'.

CHL - *EACH FIRM'S CHANGE IN LABOUR FORCE. A HELP VARIABLE USED WITHIN 'LABOUR SEARCH' TO ACCOMODATE MARKET INTERACTIONS.*

CHM - *FOR EACH FIRM, ITS CHANGE IN PROFIT MARGIN FROM ONE YEAR TO ANOTHER (A DIFFERENCE BETWEEN FRACTIONS). COMPUTED IN 'YEARLY UPDATE'.*

CHPU - *QUARTERLY CHANGE IN RATE OF UNEMPLOYMENT (A DIFFERENCE BETWEEN FRACTIONS). COMPUTED IN 'LABOUR UPDATE'.*

CUML - *FOR EACH FIRM, A CUMULATION OVER THE YEAR OF THE NUMBER OF EMPLOYED. UPDATED IN 'QUARTERLY CUM'.*

CUMM - *FOR EACH FIRM, A CUMULATION OVER THE YEAR OF ITS PROFIT MARGIN. UPDATED IN 'QUARTERLY CUM'.*

CUMQ - *FOR EACH FIRM, A CUMULATION OVER THE YEAR OF ITS PRODUCTION VOLUME. UPDATED IN 'QUARTERLY CUM'.*

CUMS - *FOR EACH FIRM, A CUMULATION OVER THE YEAR OF ITS SALES VALUE. UPDATED IN 'QUARTERLY CUM'.*

CUMSQ - *FOR EACH FIRM, A CUMULATION OVER THE YEAR OF ITS SALES VOLUME. UPDATED IN 'QUARTERLY CUM'.*

CUMWS - *FOR EACH FIRM, A CUMULATION OVER THE YEAR OF ITS WAGE SUM. UPDATED IN 'QUARTERLY CUM'.*

CVA - *A HOUSEHOLD'S 'ADDICTED' CONSUMPTION VOLUME IN EACH EXPENDITURE CATEGORY (UNITS PER QUARTER). UPDATED IN 'HOUSEHOLD UPDATE'.*

CVE - *A HOUSEHOLD'S 'ESSENTIAL' CONSUMPTION IN EACH EXPENDITURE CATEGORY (UNITS PER QUARTER). COMPUTED IN 'HOUSEHOLD INIT'.*

DISTR - A HELP VARIABLE USED IN 'FIRMSTO' TO DISTRIBUTE INVENTORY ADJUSTMENTS AMONG FIRMS.

DP - FOR EACH FIRM, ITS YEARLY CHANGE IN SALES PRICE (A FRACTION). COMPUTED IN 'YEARLY UPDATE'.

DQ - FOR EACH FIRM, ITS YEARLY CHANGE IN PRODUCTION VOLUME (A FRACTION). COMPUTED IN 'YEARLY UPDATE'.

DS - FOR EACH FIRM, ITS YEARLY CHANGE IN SALES VALUE (A FRACTION). COMPUTED IN 'YEARLY UPDATE'.

DUR - A VECTOR INDEX, GIVING 'DURABLES'/'INDUSTRIAL INVESTMENT GOODS' DATA FROM A VECTOR.

DW - FOR EACH FIRM, ITS YEARLY WAGE CHANGE (A FRACTION). COMPUTED IN 'YEARLY UPDATE'.

ENTRY - A PARAMETER REGULATING THE INFLOW OF NEW PERSONS TO THE LABOUR MARKET (QUARTERLY FRACTION OF THE TOTAL LABOUR FORCE). SOFAR EXOGENOUS AND CONSTANT.

EPS - A CONSTANT FORCING FIRMS TO SHARPEN THEIR PROFIT-MARGIN TARGETS AS COMPARED WITH HISTORICAL DATA.

EXIT - FOR EACH FIRM, DISCREPANCY BETWEEN ACTUAL AND PLANNED LABOUR FORCE (AFTER MARKET INTERACTIONS). HELP VARIABLE USED IN 'LABOUR SEARCH' TO ACCOMODATE 'AMAN' LAYOFF LAG.

EXPDP - EACH FIRM'S EXPECTED CHANGE IN SALES PRICE FOR A YEAR (A FRACTION). COMPUTED IN 'YEARLY EXP'.

EXPDS - EACH FIRM'S EXPECTED CHANGE IN SALES FOR A YEAR (A FRACTION). COMPUTED IN 'YEARLY EXP'.

EXPDW - EACH FIRM'S EXPECTED WAGE CHANGE FOR A YEAR (A FRACTION). COMPUTED IN 'YEARLY EXP'.

EXPIDP - EACH FIRM'S 'INTERNALLY' EXPECTED CHANGE IN SALES PRICE FOR A YEAR (A FRACTION). UPDATED IN 'YEARLY EXP'.

EXPIDS - EACH FIRM'S 'INTERNALLY' EXPECTED CHANGE IN SALES FOR A YEAR (A FRACTION). UPDATED IN 'YEARLY EXP'.

EXPIDW - EACH FIRM'S 'INTERNALLY' EXPECTED CHANGE IN WAGE FOR A YEAR (A FRACTION). UPDATED IN 'YEARLY EXP'.

EXPXDP - IN EACH MARKET, THE 'EXTERNALLY' EXPECTED CHANGE IN SALES PRICE FOR A YEAR (A FRACTION). ENTERED EXOGENOUSLY.

EXPXDS - IN EACH MARKET, THE 'EXTERNALLY' EXPECTED CHANGE IN SALES FOR A YEAR (A FRACTION). ENTERED EXOGENOUSLY.

EXPXDW - IN EACH MARKET, THE 'EXTERNALLY' EXPECTED CHANGE IN WAGE FOR A YEAR (A FRACTION). ENTERED EXOGENOUSLY.

E1 - A CONSTANT USED IN 'YEARLY EXP' TO UPDATE 'INTERNAL' EXPECTATIONS ON PRICES, SALES, AND WAGES.

E2 - A CONSTANT USED IN 'YEARLY EXP' TO UPDATE 'INTERNAL' EXPECTATIONS ON PRICES, SALES, AND WAGES.

FIP - A CONSTANT DESCRIBING HOW FIRMS TRADE OFF ONLY JUST EXPERIENCED PRICE CHANGE AGAINST LONGER-TERM EXPECTATIONS. USED IN 'QUARTERLY EXP'.

FIS - A CONSTANT DESCRIBING HOW FIRMS TRADE OFF ONLY JUST EXPERIENCED SALES VALUE CHANGE AGAINST LONGER-TERM EXPECTATIONS. USED IN 'QUARTERLY EXP'.

FIW - A CONSTANT DESCRIBING HOW FIRMS TRADE OFF ONLY JUST EXPERIENCED WAGE CHANGE AGAINST LONGER-TERM EXPECTATIONS. USED IN 'QUARTERLY EXP'.

GAMMA - A CONSTANT TELLING HOW BIG WAGE INCREASE IS NEEDED FOR A PERSON THAT HE SHOULD LEAVE HIS JOB FOR A NEW ONE. USED IN 'LABOUR SEARCH'.

IMP - IMPORT SHARE IN EACH MARKET. UPDATED IN 'MARKET CONFRONT'.

INVEFF - *FOR EACH FIRM, ITS INVESTMENT EFFECIENCY (INCREASE IN QUARTERLY PRODUCTION VALUE, DIVIDED BY INVESTMENT). COMPUTED IN 'INVFIN'.*

IOTA - *A CONSTANT USED BY FIRMS TO FORM THEIR INITIAL WAGE OFFER IN 'LABOUR SEARCH'.*

KSIFAIL - *A CONSTANT, USED IN 'LABOUR SEARCH', WHICH TELLS BY HOW MUCH A FIRM RAISES ITS OWN WAGE LEVEL AFTER IT HAS PERFORMED AN UNSUCCESSFUL ATTACK.*

KSISUCC - *A CONSTANT, USED IN 'LABOUR SEARCH', WHICH TELLS BY HOW MUCH AN ATTACKED FIRM RAISES ITS WAGE LEVEL AFTER IT HAS LOST PART OF ITS LABOUR FORCE.*

K1 - *FOR EACH FIRM, THE BOOK VALUE OF ITS PRODUCTION EQUIPMENT. UPDATED IN 'INVFIN'.*

K2 - *FOR EACH FIRM, ITS CURRENT ASSETS. UPDATED IN 'INVFIN'.*

L - *FOR EACH FIRM, ITS LABOUR FORCE. UPDATED IN 'LUUPDATE' (RETIREMENTS) AND IN 'LABOUR UPDATE' (OTHER CHANGES).*

LAYOFF - *FOR EACH FIRM, DISCREPANCY BETWEEN ACTUAL AND PLANNED LABOUR FORCE (BEFORE MARKET INTERACTIONS). HELP VARIABLE USED IN 'TARGET SEARCH' TO ACCOMODATE 'AMAN' LAYOFF LAG.*

LF - *TOTAL LABOUR FORCE IN THE ECONOMY. UPDATED IN 'LUUPDATE'.*

LG - *GOVERNMENT LABOUR FORCE. UPDATED IN 'GLABOUR'.*

LL - *EACH FIRM'S LABOUR FORCE. A HELP VARIABLE USED WITHIN 'LABOUR SEARCH' TO ACCOMODATE THE MARKET INTERACTIONS.*

LOSS - *A CONSTANT, TELLING HOW MUCH OF FIRMS' INVESTMENTS THAT ARE DIRECTED TO THE STRUCTURAL SLACK.*

LU - *NUMBER OF PEOPLE UNEMPLOYED. UPDATED IN 'LUUPDATE' AND AT VARIOUS PLACES WITHIN BLOCK 'LABOUR MARKET'.*

LZ - *SERVICE SECTOR LABOUR FORCE. UPDATED IN 'ZLABOUR'.*

M - *FOR EACH FIRM, ITS YEARLY PROFIT MARGIN (A FRACTION). COMPUTED IN 'YEARLY UPDATE'.*

MARKETITER - *NUMBER OF ITERATIONS ON DOMESTIC PRODUCT MARKET. USED IN 'MARKET CONFRONT'.*

MAXDP - *A FRACTION WHICH DETERMINES MAXIMUM YEARLY DEVIATION IN DOMESTIC PRICES FROM WHAT FIRMS EXPECT. USED IN 'ADJUST PRICES' TO ACCOMODATE SUPPLY-DEMAND INTERACTIONS.*

MAXSTO - *FOR EACH FIRM, ITS 'MAXIMUM' INVENTORY LEVEL (VOLUME TERMS). COMPUTATION IS DESCRIBED WITHIN BLOCK 'STOSYSTEM'.*

MHIST - *FOR EACH FIRM, AN AVERAGE OF PAST PROFIT MARGINS (A FRACTION). UPDATED IN 'YEARLY TARG'.*

MINSTO - *FOR EACH FIRM, ITS 'MINIMUM' INVENTORY LEVEL (VOLUME TERMS). COMPUTATION IS DESCRIBED WITHIN BLOCK 'STOSYSTEM'.*

MKT - *INDEX VARIABLE, EXTRACTING FROM 'EXPENDITURE CATEGORY' VECTORS DATA THAT APPLY TO INDUSTRIAL MARKETS.*

MTEC - *ON EACH MARKET, TECHNOLOGY FACTOR OF MODERN EQUIPMENT (POTENTIALLY PRODUCED UNITS PER PERSON AND QUARTER). UPDATED IN 'PRODFRONT'.*

NDUR - *INDEX VARIABLE, EXTRACTING FROM 'EXPENDITURE CATEGORY' VECTORS DATA THAT APPLY TO NON-DURABLE CONSUMPTION CATEGORIES.*

NH - *NUMBER OF HOUSEHOLDS - A CONSTANT, AS THE MODEL NOW STANDS.*

NITER - *NUMBER OF ITERATIONS ON THE LABOUR MARKET EACH QUARTER. USED IN 'LABOUR SEARCH'.*

NW - *FOR EACH FIRM, ITS NET VALUE AS THE RESIDUAL BETWEEN TOTAL ASSETS AND BORROWING. COMPUTED IN 'INVFIN'.*

OPTSTO - *FOR EACH FIRM, ITS 'OPTIMUM' INVENTORY LEVEL (VOLUME TERMS). COMPUTATION IS DESCRIBED WITHIN BLOCK 'STOSYSTEM'.*

ORDER - VECTOR, TELLING IN WHICH SEQUENCE FIRMS ARE ALLOWED TO MAKE ATTACKS ON THE LABOUR MARKET (BIG RELATIVE RECRUITMENT PLAN GOES FIRST).

P - FOR EACH FIRM, ITS YEARLY AVERAGE SALES PRICE. UPDATED IN 'YEARLY UPDATE'.

PRIMCHSTO - A HELP VARIABLE USED IN 'FIRMSTO' TO DISTRIBUTE INVENTORY ADJUSTMENTS AMONG FIRMS.

PROPCHSTO - A HELP VARIABLE USED IN 'FIRMSTO' TO DISTRIBUTE INVENTORY ADJUSTMENTS AMONG FIRMS.

PT - ON EACH MARKET, FIRMS' COMMON OFFERING PRICE TO HOUSEHOLDS IN ONE ITERATION. FIRST COMPUTED IN 'MARKET CONFRONT'; LATER UPDATED IN 'ADJUST PRICES'.

Q - FOR EACH FIRM, ITS TOTAL PRODUCTION FOR A YEAR (VOLUME). UPDATED IN 'YEARLY UPDATE'.

QC - A HOUSEHOLD'S CONSUMPTION IN EACH OF THE EXPENDITURE CATEGORIES (VALUE PER QUARTER). COMPUTED IN 'HOUSEHOLD UPDATE'.

QCHBW - FOR EACH FIRM, ITS QUARTERLY CHANGE IN BORROWING. COMPUTED IN 'INVFIN'.

QCHK2 - FOR EACH FIRM, ITS QUARTERLY CHANGE IN CURRENT ASSETS. HELP VARIABLE USED IN 'INVFIN'.

QCHL - FOR EACH FIRM, ITS QUARTERLY LABOUR FORCE CHANGE DUE TO LABOUR MARKET INTERACTIONS (RETIREMENTS ARE NOT INCLUDED). COMPUTED LAST IN 'LABOUR SEARCH'; UPDATED IN 'LABOUR UPDATE' IF LAYOFFS OCCUR.

QCHLG - NUMBER OF NEW PERSONS IN GOVERNMENT SECTOR LABOUR FORCE EACH QUARTER (INCLUDING REPLACEMENTS FOR RETIREMENTS).

QCHLZ - NUMBER OF NEW PERSONS IN SERVICE SECTOR LABOUR FORCE EACH QUARTER (INCLUDING REPLACEMENTS FOR RETIREMENTS).

QCHQTOP - FOR EACH FIRM, QUARTERLY CHANGE IN PRODUCTION CAPACITY 'QTOP' DUE TO INVESTMENTS. COMPUTED IN 'PRODFRONT'.

QCHQTOP1 - PRODUCTION CAPACITY INCREASE THAT CAN BE USED REGARDLESS OF SLACK CONSIDERATIONS. COMPUTED IN 'PRODFRONT'.

QCHQTOP2 - THAT PART OF A PRODUCTION CAPACITY INCREASE WHICH IS DIRECTED TO THE FIRM'S SLACK. COMPUTED IN 'PRODFRONT'.

QCHS - FOR EACH FIRM, ITS QUARTERLY CHANGE IN SALES (ABSOLUTE VALUE TERMS). HELP VARIABLE IN 'INVFIN'.

QCHTSTO - ON EACH MARKET, TOTAL QUARTERLY CHANGE IN INVENTORY TO BE DISTRIBUTED BETWEEN FIRMS. COMPUTED IN 'DOMESTIC RESULT'.

QCHW - FOR EACH FIRM, ITS QUARTERLY WAGE CHANGE IN ABSOLUTE TERMS. COMPUTED LAST IN 'LABOUR SEARCH'.

QCPI - CONSUMER PRICE INDEX, UPDATED IN 'HOUSEHOLD UPDATE'.

QDCPI - QUARTERLY CHANGE IN CONSUMER PRICE INDEX (A FRACTION). COMPUTED IN 'HOUSEHOLD UPDATE'.

QDI - A HOUSEHOLD'S DISPOSABLE INCOME FOR ONE QUARTER. COMPUTED IN 'HOUSEHOLD INIT'.

QDMTEC - ON EACH MARKET, THE RATE OF TECHNOLOGY UPGRADE FOR PRODUCTION EQUIPMENT (A FRACTION ON QUARTERLY BASIS). ENTERED EXOGENOUSLY.

QDP - FOR EACH FIRM, ITS QUARTERLY INCREASE IN SALES PRICE (A FRACTION). COMPUTED IN 'FINALQPQSQM'.

QDPDOM - ON EACH MARKET, THE QUARTERLY INCREASE IN DOMESTIC PRICE (A FRACTION). COMPUTED IN 'DOMESTIC RESULT'.

QDPFOR - ON EACH MARKET, THE QUARTERLY INCREASE IN FOREIGN PRICE (A FRACTION). EXOGENOUSLY ENTERED IN 'EXPORT'.

QDQ - FOR EACH FIRM, ITS QUARTERLY INCREASE IN PRODUCTION VOLUME (A FRACTION). COMPUTED IN 'PLANQREVISE'.

QDS - FOR EACH FIRM, ITS QUARTERLY INCREASE IN SALES VALUE (A FRACTION). COMPUTED IN 'FINALQPQSQM'.

QDTECZ - *QUARTERLY UPGRADE OF TECHNOLOGY FACTOR FOR THE SERVICE SECTOR (A FRACTION). EXOGENOUSLY ENTERED IN 'ZLABOUR'.*

QDW - *FOR EACH FIRM, ITS QUARTERLY WAGE INCREASE (A FRACTION). COMPUTED IN 'LABOUR UPDATE'.*

QDWIND - *AVERAGE WAGE INCREASE IN THE INDUSTRY DURING ONE QUARTER (A FRACTION). COMPUTED IN 'LABOUR UPDATE'.*

QEXPDP - *FOR EACH FIRM, ITS EXPECTATION ON PRICE INCREASE FOR THE NEXT QUARTER (A FRACTION). HELP VARIABLE USED IN 'QUARTERLY EXP'.*

QEXPDS - *FOR EACH FIRM, ITS EXPECTATION ON SALES VALUE INCREASE FOR THE NEXT QUARTER (A FRACTION). HELP VARIABLE USED IN 'QUARTERLY EXP'.*

QEXPDW - *FOR EACH FIRM, ITS EXPECTATION ON WAGE INCREASE FOR THE NEXT QUARTER (A FRACTION). HELP VARIABLE USED IN 'QUARTERLY EXP'.*

QEXPP - *FOR EACH FIRM, ITS EXPECTED SALES PRICE FOR THE NEXT QUARTER. COMPUTED IN 'QUARTERLY EXP'.*

QEXPS - *FOR EACH FIRM, ITS EXPECTED SALES VALUE FOR THE NEXT QUARTER. COMPUTED IN 'QUARTERLY EXP'.*

QEXPW - *FOR EACH FIRM, ITS EXPECTED WAGE LEVEL FOR THE NEXT QUARTER (EXPRESSED ON A YEARLY BASIS). COMPUTED IN 'QUARTERLY EXP'.*

QFR - *FOR EACH FIRM, ITS PRODUCTION POSSIBILITY FRONTIER (VOLUME PER QUARTER) AS A FUNCTION OF ITS LABOUR FORCE. COMPUTATION IS DESCRIBED WITHIN BLOCK 'PRODPLAN'.*

QINV - *FOR EACH FIRM, ITS QUARTERLY INVESTMENT (VALUE TERMS). COMPUTED IN 'INVFIN'.*

QINVLAG - *FOR EACH FIRM, ITS INVESTMENT FOR THE NEXT QUARTER (VALUE TERMS). COMPUTED IN 'INVFIN'.*

QM - *FOR EACH FIRM, ITS PROFIT MARGIN DURING A QUARTER (A FRACTION). COMPUTED IN 'INVFIN'.*

QMAXTSUDOM - FOR EACH MARKET, MAXIMUM SALES VOLUME FOR A QUARTER DUE TO 'MINSTO' CONSIDERATIONS. HELP VARIABLE USED WITHIN 'MINSTO ADJUST'.

QMZ - PROFIT MARGIN IN THE SERVICE SECTOR DURING A QUARTER (A FRACTION). COMPUTED IN 'FINALQPQSQM'.

QOPTSU - FOR EACH FIRM, ITS OPTIMUM SOLD VOLUME DURING A QUARTER. COMPUTED IN 'PLANQREVISE'.

QOPTSUDOM - OPTIMUM SOLD VOLUME ON THE DOMESTIC MARKET (UNITS PER QUARTER). COMPUTED FOR EACH FIRM IN 'MARKET ENTRANCE'.

QP - FOR EACH FIRM, ITS SALES PRICE DURING A QUARTER (AN AVERAGE BETWEEN FOREIGN AND DOMESTIC PRICE). UPDATED IN 'FINALQPQSQM'.

QPDOM - ON EACH MARKET, THE DOMESTIC PRICE DURING ONE QUARTER. UPDATED IN 'DOMESTIC RESULT'.

QPFOR - ON EACH MARKET, THE FOREIGN PRICE DURING ONE QUARTER. UPDATED IN 'EXPORT'.

QPH - DOMESTIC PRICE IN EACH EXPENDITURE CATEGORY AS HOUSEHOLDS SEE THEM. UPDATED IN 'HOUSEHOLD UPDATE'.

QPLANL - FOR EACH FIRM, ITS PLANNED LABOUR FORCE FOR A QUARTER. COMPUTED IN 'TARGET SEARCH'.

QPLANQ - FOR EACH FIRM, ITS PLANNED PRODUCTION VOLUME DURING A QUARTER. COMPUTED IN 'INITPRODPLAN'; REVISED IN 'TARGET SEARCH' AND IN 'PLANQREVISE'.

QPRELCPI - PRELIMINARY CONSUMER PRICE INDEX. COMPUTED IN 'COMPUTE EXPENDITURES' EACH TIME HOUSEHOLDS MEET AN OFFERING PRICE VECTOR 'PT'.

QPRELPDOM - ON EACH MARKET, THE FIRMS' INITIAL OFFERING PRICE TO HOUSEHOLDS. COMPUTED IN 'MARKET ENTRANCE'.

QPRELPZ - PRELIMINARY PRICE IN THE SERVICE SECTOR DURING THE QUARTER TO COME. COMPUTED IN 'ZLABOUR'.

QPZ - PRICE IN THE SERVICE SECTOR DURING ONE QUARTER. COMPUTED IN 'DOMESTIC RESULT'.

QQ - PRODUCTION FOR A FIRM (UNITS PER QUARTER). COMPUTED IN 'PLANQREVISE'.

QQZ - (POTENTIAL) PRODUCTION IN THE SERVICE SECTOR DURING ONE QUARTER (VOLUME). COMPUTED IN 'ZLABOUR'.

QRR - FOR EACH FIRM, ITS RATE OF RETURN (A FRACTION ON A YEARLY BASIS). COMPUTED IN 'INVFIN' EACH QUARTER.

QS - FOR EACH FIRM, ITS SALES VALUE DURING ONE QUARTER. COMPUTED IN 'FINALOPQSQM'.

QSAVH - HOUSEHOLD SAVINGS (PER QUARTER AND HOUSEHOLD). COMPUTED IN 'HOUSEHOLD UPDATE' AS A RESIDUAL.

QSDOM - FOR EACH FIRM, ITS DOMESTIC SALES VALUE DURING ONE QUARTER. COMPUTED IN 'FIRMSTO'.

QSFOR - FOR EACH FIRM, ITS FOREIGN SALES VALUE DURING ONE QUARTER. COMPUTED IN 'EXPORT'.

QSP - HOUSEHOLD PURCHASING IN EACH EXPENDITURE CATEGORY (VALUE PER QUARTER). COMPUTED IN 'COMPUTE EXPENDITURES' IN EACH ITERATION ON THE DOMESTIC MARKET.

QSPE - 'ESSENTIAL' HOUSEHOLD PURCHASING IN EACH EXPENDITURE CATEGORY (VALUE PER QUARTER). HELP VARIABLE USED WITHIN 'COMPUTE EXPENDITURES'

QSU - FOR EACH FIRM, ITS SALES VOLUME DURING ONE QUARTER. COMPUTED IN 'FINALOPQSQM'.

QSUDOM - FOR EACH FIRM, ITS DOMESTIC SALES VOLUME DURING ONE QUARTER. COMPUTED IN 'FIRMSTO'.

QSUFOR - FOR EACH FIRM, ITS FOREIGN SALES VOLUME DURING ONE QUARTER. COMPUTED IN 'EXPORT'.

QSZ - QUARTERLY SALES VALUE IN THE SERVICE SECTOR. COMPUTED IN 'DOMESTIC RESULT'.

QTARGM - FOR EACH FIRM, ITS PROFIT-MARGIN TARGET FOR A QUARTER (A FRACTION). COMPUTED IN 'QUARTERLY TARG'.

QTBUY - TOTAL BUYING IN EACH EXPENDITURE CATEGORY (UNITS PER QUARTER). COMPUTED IN 'COMPUTE BUYING' IN EACH ITERATION ON THE DOMESTIC MARKET.

QTOP - POTENTIAL OUTPUT FOR A FIRM (UNITS PER QUARTER) AT ZERO SLACK AND INFINITE LABOUR FORCE. UPDATED IN 'PRODFRONT'.

QTSP - AGGREGATE HOUSEHOLD PURCHASING IN EACH EXPENDITURE CATEGORY (VALUE PER QUARTER). HELP VARIABLE USED WITHIN 'COMPUTE BUYING'.

QW - FOR EACH FIRM, ITS WAGE LEVEL (EXPRESSED ON A YEARLY BASIS) DURING ONE QUARTER. UPDATED IN 'LABOUR UPDATE'.

QWG - GOVERNMENT WAGE LEVEL (EXPRESSED ON A YEARLY BASIS) DURING ONE QUARTER. UPDATED IN 'GLABOUR'.

QWZ - SERVICE SECTOR WAGE LEVEL (EXPRESSED ON A YEARLY BASIS) DURING ONE QUARTER. UPDATED IN 'ZLABOUR'.

Q2 - FOR EACH FIRM, MAX PRODUCTION FOR A QUARTER REGARDING SALES PLAN AND INVENTORY MAXIMUM. HELP VARIABLE USED WITHIN 'TARGET SEARCH'.

Q3 - FOR EACH FIRM, MAX PRODUCTION FOR A QUARTER REGARDING ACTUAL LABOUR FORCE AND SLACK LIMITATIONS. HELP VARIABLE USED IN 'TARGET SEARCH'.

Q7 - FOR EACH FIRM, A QUARTERLY PRODUCTION LEVEL, BELOW WHICH STRUCTURAL SLACK IS REALIZED. HELP VARIABLE USED WITHIN 'TARGET SEARCH'.

R - A CONSTANT IMPLYING HOW MUCH FIRMS RELY ON EXTERNAL INFORMATION WHEN THEY FORM EXPECTATIONS (IN 'YEARLY EXP')

REALCHLG - NET CHANGE IN GOVERNMENT EMPLOYMENT (PERSONS PER QUARTER). ENTERED EXOGENOUSLY IN 'GLABOUR'.

REDUCE - FOR EACH EXPENDITURE CATEGORY, A FRACTION BY WHICH EXPENDITURES MUST BE REDUCED DUE TO LIMITED SUPPLY. HELP VARIABLE USED WITHIN 'MINSTO ADJUST'.

RES - *STRUCTURAL SLACK FOR A FIRM (FRACTION). UPDATED IN 'PRODFRONT' AND (UNDER TARGET PRESSURE ONLY) IN 'TARGET SEARCH'.*

RESDOWN - *A CONSTANT TELLING BY HOW MUCH FIRMS CAN REDUCE THEIR SLACK DURING ONE QUARTER.*

RESMAX - *A CONSTANT TELLING MAXIMUM SLACK ANY FIRM CAN POSSIBLY HAVE.*

RET - *RETIREMENT RATE ON THE LABOUR MARKET (A FRACTION ON QUARTERLY BASIS).*

RFQ - *FOR EACH FIRM, THE MINIMUM LABOUR FORCE NEEDED AS A FUNCTION OF DESIRED PRODUCTION (VOLUME PER QUARTER). THE COMPUTATION IS DESCRIBED WITHIN BLOCK 'PRODPLAN'; THIS IS THE INVERSE FUNCTION TO 'OFF(L)'.*

RHO - *DEPRECIATION RATE OF PRODUCTION EQUIPMENT (A FRACTION ON QUARTERLY BASIS).*

RHODUR - *DEPRECIATION RATE OF CONSUMER DURABLE GOODS (A FRACTION ON QUARTERLY BASIS).*

RI - *RATE OF INTEREST, EXPRESSED ON A YEARLY BASIS. ENTERED EXOGENOUSLY.*

RU - *RATE OF UNEMPLOYMENT (A FRACTION). UPDATED IN 'LABOUR UPDATE'.*

RW - *A CONSTANT GIVING FIRMS' DESIRED AMOUNT OF WORKING CAPITAL AS A FRACTION OF SALES.*

S - *FOR EACH FIRM, ITS SALES VALUE DURING ONE YEAR. UPDATED IN 'YEARLY UPDATE'.*

SACK - *FOR EACH FIRM, NUMBER OF PEOPLE FIRED DURING A QUARTER. HELP VARIABLE WITHIN 'LABOUR UPDATE'.*

SAV - *INDEXING VARIABLE, GIVING SAVINGS COMPONENT OF HOUSEHOLD EXPENDITURE VECTORS.*

SMALL - *ON EACH MARKET, THE FRACTION OF YEARLY SALES THAT FIRMS CONSIDER AS INVENTORY MINIMUM.*

SMOOTH - *CONSTANT USED BY HOUSEHOLDS TO (EACH QUARTER) TIME-SMOOTH THEIR ADDICTED CONSUMPTION LEVELS AND SAVINGS RATIO.*

SMP - CONSTANT USED BY FIRMS TO (EACH YEAR) TIME-SMOOTH THEIR PRICE EXPERIENCES.

SMS - CONSTANT USED BY FIRMS TO (EACH YEAR) TIME-SMOOTH THEIR SALES EXPERIENCES.

SMT - CONSTANT USED BY FIRMS TO (EACH YEAR) TIME-SMOOTH THEIR PROFIT-MARGIN HISTORY.

SMW - CONSTANT USED BY FIRMS TO (EACH YEAR) TIME-SMOOTH THEIR WAGE EXPERIENCES.

STO - FOR EACH FIRM, ITS CURRENT INVENTORY LEVEL (VOLUME TERMS). UPDATED IN 'FIRMSTO'.

STODUR - EACH HOUSEHOLD'S STOCK OF DURABLE GOODS (VALUE TERMS). UPDATED IN 'HOUSEHOLD UPDATE'.

SWAP - A FACTOR DETERMINING THE SHORT-TERM TRADE-OFF BETWEEN SAVINGS AND EXPENDITURES ON CONSUMER DURABLES. COMPUTED IN 'COMPUTE EXPENDITURES'.

TARGM - FOR EACH FIRM, ITS PROFIT-MARGIN TARGET FOR ONE YEAR (A FRACTION). COMPUTED IN 'YEARLY TARG'.

TARGMZ - PROFIT-MARGIN TARGET IN THE SERVICE SECTOR (A FRACTION). ENTERED EXOGENOUSLY.

TEC - TECHNOLOGY FACTOR FOR A FIRM (UNITS PER MAN AND QUARTER). UPDATED IN 'PRODFRONT'.

TECZ - TECHNOLOGY FACTOR FOR THE SERVICE SECTOR (POTENTIALLY PRODUCED VOLUME PER MAN AND QUARTER). UPDATED IN 'ZLABOUR'.

THETA - MAXIMUM FRACTION OF A FIRM'S LABOUR FORCE THAT IT CAN LOOSE AT ONE LABOUR MARKET ATTACK. USED IN 'LABOUR SEARCH'.

TMIMP - FOR EACH MARKET, THE TIME CONSTANT TO ADJUST IMPORT SHARE.

TMSTO - TIME CONSTANT FOR FIRMS WHEN ADJUSTING INVENTORY DISCREPANCY (YEARS). USED IN 'INITPRODPLAN' AND IN 'PLANQREVISE'.

TMX - TIME CONSTANT FOR FIRMS WHEN ADJUSTING EXPORT SHARE IN 'EXPORT' (YEARS; COMMON TO ALL FIRMS ON A MARKET).

W - *FOR EACH FIRM, ITS AVERAGE WAGE DURING ONE YEAR. COMPUTED IN 'YEARLY UPDATE'.*

WH - *EACH HOUSEHOLD'S WEALTH (CURRENT VALUE OF ITS BANK DEPOSITS). UPDATED IN 'HOUSEHOLD UPDATE'.*

WHRA - *EACH HOUSEHOLD'S ADDICTED WEALTH RATIO (QUOTIENT BETWEEN BANK DEPOSITS AND QUARTERLY DISPOSABLE INCOME). UPDATED IN 'HOUSEHOLD UPDATE'.*

WW - *EACH FIRM'S WAGE. A HELP VARIABLE USED WITHIN 'LABOUR SEARCH' TO ACCOMODATE MARKET INTERACTIONS.*

X - *FOR EACH FIRM, ITS EXPORT SHARE (FRACTION OF SOLD VOLUME). UPDATED IN 'EXPORT'.*

Z - *INDEXING VARIABLE, EXTRACTING SERVICE SECTOR DATA FROM A EXPENDITURE CATEGORY VECTOR.*

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