MULTILEVEL COMPUTER MODEL OF WORLD DEVELOPMENT SYSTEM

User Oriented Descriptions

A SERIES: PART II. THE FOOD ANALYSIS MODEL

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THE FOOD ANALYSIS SUBMODEL

ABSTRACT

The Food Analysis Submodel is intended to provide an estimation of the food situation for the next 50 years. It consists of a population, an economic, a land use and a food production submodel as well as a pricing mechanism. By choosing appropriate scenaria it is possible to analyze the effects of population policies and investment shifts to the agricultural sector.

I. MATHEMATICS OF THE MODEL

The M.P. Food Model uses an extensive list of variables and parameters which is given below:

A. Notation

1. Population Submodel

POP	:	Population number
AP(I), I = 1,...,86	:	Age group of the I - year-olds
FERTO	:	Initial fertility coefficient
FERT	:	Fertility coefficient
KONTR	:	Start of equilibrium birth control
INT	:	Transition period to reach equilibrium fertility coefficient
FERTE	:	Fertility coefficient that leads to population equilibrium
EO	:	Sensitivity of babies to protein deficiency
EU	:	Sensitivity of old people to protein deficiency
EA	:	Time constant that indicates the years that pass until E(a) - EU drops to 37% of EO - EU (see model equations)
XO	:	Minimum daily protein consumption per capita below which there is no survival

TL	:	Time delay in the effect of protein deficiency
PPCSAV(I), I = 1,...,15	:	Array used to compute lagged daily per capita protein consumption
PRONOR	:	Level of daily per capita protein consumption below which starvation occurs
PROPCI	:	Daily per capita protein consumption
PTPCR	:	Protein per capita produced regionally
PRODST	:	Protein distribution factor
PROPCN	:	Lagged daily per capita protein consumption
PROFAC	:	Factor indicating food supply situation
AMPFO	:	Mortality multiplier for babies
AMPF(I), I = 1,...,86	:	Mortality multiplier, by age category
BAB	:	Number of babies
TOT	:	Number of deaths
AMORT	:	Mortality coefficient
AMO	:	Normalized probability that a baby dies
AM(I), I = 1,...,86	:	Normalized age-specific probability to die, by age category
TOT15	:	Accumulative sum of children that died
CBR	:	Crude birth rate
CGR	:	Population growth rate
CDR	:	Crude death rate

2. Economic Submodel

A(I,J), I,J = 1,2	:	Input-Output matrix
AINV(I,J) I,J = 1,2	:	Inverse of (I - A), I denoting the 2 • 2 identity matrix

CNA	:	Capital stock, non-agricultural sector
QNA	:	Capital per output ratio, non-agricultural sector
YNA	:	Gross regional product, non-agricultural sector
CA	:	Capital stock, agricultural sector
QA	:	Capital per output ratio, agricultural sector
YA	:	Agricultural production (dollar value)
YAX	:	Agricultural production (dollar value) computed within the economic model
SYSYNA	:	Ratio of Y to YNA
Z(I), I = 1,2	:	Gross output, by sector
U(I), I = 1,2	:	Intermediate demand, by sector
UA	:	Intermediate demand, from agriculture
UAFK	:	Coefficient relating UA to expenditures on fertilizers etc.
UAF	:	Expenditures on fertilizer and related productive factors
SUAF	:	Increased expenditures on fertilizer etc.
I	:	Total investment
GI	:	Investment coefficient
IAS	:	Additional investment shifted to the agricultural sector
IAKS	:	Shift of investment to the agricultural sector, coefficient
IAK	:	Investment in agricultural sector, coefficient
IA	:	Investment in agricultural sector
K1	:	Fraction of additional investment to agricultural capital stock
INA	:	Investment in non-agricultural sector

IR	:	Regional investment
IRK	:	Regional investment, coefficient
IMN	:	Imports of investment capital needed
IAP	:	Investment in non-land agricultural capital stock
IAPK	:	Investment in agricultural production, coefficient
IALV	:	Investment in livestock development
IALVK	:	Investment in livestock development, coefficient
IALD	:	Investment in land development
C	:	Consumption
GC	:	Consumption, coefficient
G	:	Governmental expenditures
GG	:	Governmental expenditures, coefficient
M	:	Imports
GM	:	Imports, coefficient
MA	:	Imports, agricultural
MAK	:	Agricultural imports, coefficient
MI	:	Imports, investment
MC	:	Imports for consumption

3. Land Use Model

CLGR	:	Cultivated grain land
CLNG	:	Cultivated non-grain land
TA	:	Intercept of linear equation relating grain land to non-grain land
TB	:	Slope of linear equation relating grain land to non-grain land
CLWR	:	Ratio of maximum cultivable land to maximum total land
CLM	:	Maximum cultivable land
TLM	:	Maximum total land
CL	:	Cultivated land
CLW	:	Total cultivable land withdrawn

TLW	:	Total land withdrawn for urbanization etc.
GLM	:	Maximum grazing land
CLR	:	Cultivable land remaining that is not yet cultivated
TLWR	:	Ratio of withdrawn land to maximum total land
TLWM	:	Land withdrawal multiplier
TLAW	:	Annual withdrawal of land for urbanization etc.
TLWPCB	:	Per capita land withdrawal
CLAW	:	Annual withdrawal of cultivable land for urbanization etc.
GLW	:	Grazing land withdrawn
GL	:	Grazing land
TLLS	:	Total land for livestock support
FCLR	:	Ratio of remaining cultivable land to total cultivable land
CLD	:	Cultivated land developed
CLDGR	:	Development of grain land
CLDNG	:	Development of non-grain land
CLWGR	:	Annual grain land withdrawn

4. Food Production and Distribution Submodel

YNAPC	:	Non-agricultural product per capita
CAPH	:	Capital per hectare
PTFC	:	Productivity coefficient from CAPH
PMCI	:	Productivity coefficient from YNAPC
FA	:	Grain production saturation level
ZPHG	:	Per hectare use of fertilizer etc.
GRPH	:	Grain production per hectare
FC	:	Slope of grain production function at minimum level
FD	:	Intercept of linear equation relating GRGP to NGGP

FE	:	Slope of linear equation relating GRGP to NGGP
GRGP	:	Gross production of grain crops
NGGP	:	Gross production of non-grain crops
SLVMA	:	Maximum possible livestock due to carrying capacity
SLVA	:	Total livestock in animal units
SLVAR	:	Animal use ratio
XLVPLM	:	Livestock price-land multiplier
PXLVP(I), I = 1,...,9	:	Base price of livestock, by category
LVPL(I), I = 1,...,9	:	Development capital cost per livestock unit , by category
SLV(I), I = 1,...,9	:	Livestock numbers, by category
SLVK(I), I = 1,...,9	:	Livestock adjustment coefficient, by category
ALVI(I), I = 1,...,9	:	Annual livestock development, by category
UALV(I), I = 1,...,9	:	Investment in livestock development, by category
SLVMK(I), I = 1,...,12	:	Meat from livestock coefficient, by category
FGP(I), I = 1,...,26	:	Gross regional food production, by category
SLVV	:	Gross regional meat production
AWFM	:	Additional marine fish production
FWCM	:	Catch of marine fish
FWMM	:	Maximum catch of marine fish
FWPM	:	Maximum land under pond culture
AWFMK	:	Growth rate of marine fish production
AUFWP	:	Additional land under pond culture
UFWP	:	Land under pond culture
UFWPK	:	Factor relating pond fish to land under pond fish culture
WB	:	Fish pond growth rate

FWCP	:	Pond fish production
FWCT	:	Gross fish production
FWCNTK	:	Meat from fish, coefficient
FWT	:	Total meat from fish
NGGPK(I), I = 1,...,8	:	Disaggregation coefficients of non-grain crops
GRGPK(I), I = 1,...,5	:	Disaggregation coefficients of grain crops
SPFTK(I), I = 1,...,26	:	Withdrawal for seed, by category, coefficent
SFT(I), I = 1,...,26	:	Total seed, by category
FTS(I), I = 1,...,26	:	Gross food supply, by type
LSFTK(I), I = 1,...,26	:	Coefficients for livestock food withdrawal, by type
LSFT(I), I = 1,...,26	:	Livestock food, by type
FFTK(I), I = 1,...,26	:	Food supply coefficients, by type
FTG(I), I = 1,...,26	:	Gross human food supply, by type
FTN(I), I = 1,...,26	:	Net human food supply, by type
XHMLF(I) I = 1,...,26	:	Coefficients of food losses, by type
FSRPC(I), I = 1,...,26	:	Regionally produced food per capita, by type
CLK(I), I = 1,...,26	:	Calorie content coefficients, by type
PTK(I), I = 1, ...,26	:	Protein content coefficients, by type
VCLPCR(I), I = 1,...,26	:	Calories per capita, by type
VPTPCR(I), I = 1,...,26	:	Protein per capita, by type
CLPCR	:	Total calories per capita produced regionally

PTPCR	:	Total protein per captia produced regionally
PTAPCR	:	Animal protein per capita produced regionally
PTAR	:	Total regional animal protein
PTR	:	Total regional protein
YPC	:	Gross regional product per capita
PTNM	:	Protein needs multiplier
PTPCN	:	Protein per capita consumption need
PTPCB	:	Protein per capita consumption, base value
SPTPC	:	Surplus protein per capita
DPTPC	:	Protein deficit per capita
PTPCSN	:	Ratio of protein supply to needs
PTN	:	Regional protein needs
DPT	:	Regional protein deficit
SPT	:	Regional protein surplus
PTPCDR	:	Regional daily per capita protein supply

5. Pricing Mechanism

TPF	:	Total fertilizer and related productive factors
PXPF	:	Price of fertilizer
PXK	:	Price coefficient
PXLVK	:	Meat price coefficient
PXLV	:	Base price of meat
PXLVP	:	Adjusted meat price
PXGR	:	Grain price
PXNG	:	Price of non-grain crops
PXFS	:	Price of fish
GRV	:	Dollar value of grain production
NGV	:	Dollar value of non-grain production
LVV	:	Dollar value of livestock production
FSV	:	Dollar value of fish production

YAPC	:	Gross agricultural product per capita
CCLDH	:	Per hectare capital cost of land development
PXPTM	:	Price of protein imports
FDMV	:	Dollar value of food imports
FDMAR	:	Ratio of food imports to agricultural product
FDMYR	:	Ratio of food imports to gross regional product
FDMMR	:	Ratio of food imports to total imports
FDXV	:	Dollar value of food exports
FDXAR	:	Ratio of food exports to gross regional agricultural product
FDXYR	:	Ratio of food exports to gross regional product
FDX9YR	:	Ratio of FDXV9 to gross regional product
FDX9AR	:	Ratio of FDXV9 to gross regional agricultural product
FDXV9	:	Value of food exported from region 1 to region 9
PTX9	:	Protein exported from region 1 to region 9
PTX9RR	:	Ratio of PTX9 to total regional protein
PTX9SR	:	Ratio of PTX9 to regional protein surplus
ENZ	:	Energy required for plant food production
ENZPLK	:	Energy requirements coefficient
ENZFR	:	Ratio of energy production to energy requirements in plant food production
RPXPF	:	Growth rate of fertilizer price
RPXPK	:	Growth rate of price coefficient PXK
RPXPTM	:	Growth rate of protein price

B. Model Equations

1. Population Model

$$POP_t = \sum_{I=1}^{86} AP_t(I)$$

$$FERT_t = \begin{cases} FERTO & t < KONTR \\ FERT_{t-1} - (FERTO - FERTE) \cdot FK_t, & KONTR \leq t \leq KONTR + INT \\ FERTE & t > KONTR + INT \end{cases}$$

$$FK_t = \begin{cases} 0.7/INT, & KONTR \leq t < KONTR + 2 \cdot INT/7 \\ 1.4/INT, & KONTR + 2 \cdot INT/7 \leq t < KONTR + 5 \cdot INT/7 \\ 0.7/INT, & KONTR + 5 \cdot INT/7 \leq t \leq KONTR + INT \end{cases}$$

$$PPCSAV_t(I) = PPCSAV_{t-1}(I + 1) \ , \quad I = 1,\ldots,14$$

$$PPCSAV_t(TL) = PTPCR_t \cdot PRODST \cdot 1000/365$$

$$PROPCN_t = PPCSAV_t(1)$$

$$PROFAC_t = (PRONOR - XO)/(PROPCN_t - XO) - 1.0$$

$$AMPFO_t = PROFAC_t \cdot EO + 1.0$$

$$AMPF_t(I) = PROFAC_t \cdot [(EO - EU) \cdot \exp(-I/EA) + EU] + 1.0 \qquad I=1,\ldots,85$$

$$AMPF_t(86) = PROFAC_t \cdot EU + 1.0$$

$$BAB_t = \sum_{I=1}^{86} AP_t(I) \cdot AF(I) \cdot FERT_t$$

$$TOT_t = 0.5 \cdot BAB_t \cdot AMO \cdot AMORT \cdot AMPFO_t + \sum_{I=1}^{86} AP_t(I) \cdot AM(I) \cdot AMORT \cdot AMPF_t(I)$$

$$TOT15_t = 0.5 \cdot BAB_t \cdot AMO \cdot AMORT \cdot AMPFO + \sum_{I=1}^{15} AP_t(I) \cdot AM(I) \cdot AMORT \cdot AMPF_t(I)$$

$$CBR_t = BAB_t/POP_t$$

$$CDR_t = TOT_t/POP_t$$

$$CGR_t = CBR_t - CDR_t$$

$$AP_{t+1}(1) = BAB_t \cdot (1.0 - 0.5 \cdot AMO \cdot AMPFO_t \cdot AMORT)$$

$$AP_{t+1}(I) = AP_t(I - 1) \cdot (1 - AMORT \cdot AM(I - 1) \cdot AMPF_t(I - 1)), \quad I = 2,\ldots,85$$

$$AP_{t+1}(86) = AP_t(86) \cdot (1 - AMORT \cdot AM(86) \cdot AMPF_t(86)) + AP_t(85) \cdot (1 - AMORT \cdot AM(85) \cdot AMPF_t(85))$$

2. Economic Model

$$CNA_t = CNA_{t-1} \cdot (1 - DNA) + INA_t$$

$$CA_t = CA_{t-1} \cdot (1 - DA) + IA_t$$

$$CDA_t = CA_t \cdot DA$$

$$CDNA_t = CNA_t \cdot DNA$$

$$YNA_t = CNA_t / QNA$$

$$YAX_t = CA_t / QA$$

$$Y_t = YNA_t + YA_t$$

$$Z_t(I) = AINV(I,1) \cdot YA_t + AINV(I,2) \cdot YNA_t \quad , \; I = 1,2$$

$$U_t(I) = A(I,1) \cdot Z_t(1) + A(I,2) \cdot Z_t(2) \quad , \quad I = 1,2$$

$$UA_t = A(2,1) \cdot Z_t(2)$$

$$UAF_t = UA_t \cdot UAFK$$

$$I_{t+1} = GI \cdot YNA_t \cdot SYSYNA_t$$

$$SYSYNA_{t+1} = Y_t \; / \; YNA_t$$

$$IAS_t = (IAKS_t - IAK) \cdot I_t \geq 0.0$$

$$IAKS_t = \text{from time-series}$$

$$IA_t = IAK \cdot I_t + K1 \cdot IAS_t$$

$$SUAF_t = UAF_t + (1 - K1) \cdot IAS_t$$

$$INA_t = I_t - IA_t - (1 - K1) \cdot IAS_t$$

$$IR_t = I_t \cdot IRK$$

$$IMN_t = I_t - IR_t$$

$$IAP_t = IAPK \cdot IA_t$$

$$IALV_t = IALVK \cdot IA_t$$

$$IALD_t = IA_t - IAP_t - IALV_t$$

$$C_t = GC \cdot Y_t$$

$$G_t = GG \cdot Y_t$$

$$M_t = GM \cdot Y_t$$

$$MA_t = MAK \cdot M_t$$

$$MI_t = \max(M_t - MA_t \ , \ IMN_t)$$

$$MC_t = M_t - MA_t - MI_t \geq 0.0$$

3. Land Use Model

$$CLGR_{t+1} = CLGR_t + CLDGR_t - CLWGR_t \geq CLGR_t$$

$$TLWR_t = TLW_t/TLM$$

$$TLWM_t = f(TLWR_t)$$

$$TLAW_t = CGR_t \cdot POP_t \cdot TLWM_t \cdot TLWPCB$$

$$CLAW_t = TLAW_t \cdot CLM/TLM$$

$$CLW_t = TLW_t \cdot CLM/TLM$$

$$GLW_t = TLW_t - CLW_t$$

$$GL_t = GLM - GLW_t$$

$$TLLS_t = GL_t + CLR_t$$

$$TLW_{t+1} = TLW_t + TLAW_t$$

$$FCLR_t = CLR_t/(CLM - CLW_t)$$

$$CLD_t = IALD_t/CCLDH_t$$

$$CLDNG_t = CLD_t \cdot CLNG_t/CL_t$$

$$CLDGR_t = CLD_t \cdot CLGR_t/CL_t$$

$$CLWGR_t = CLAW_t \cdot CLGR_t/CL_t$$

$$CLNG_t = TA + TB \cdot CLGR_t$$

$$CL_t = CLGR_t + CLNG_t$$

$$CLR_t = CLM - CL_t - CLW_t \geq 0.0$$

4. Food Production and Distribution

$$YNAPC_t = YNA_t/POP_t$$

$$CAPH_t = CA_t/CL_t$$

$$PTFC_t = f(CAPH_t)$$

$$PMCI_t = f(YNAPC_t)$$

$$FA_t = PTFC_t + PMCI_t + 1.5$$

$$TPF_t = SUAF_t/PXPF_t$$

$$ZPHG_t = (TPF_t \cdot GZPHK/CLGR_t) \cdot 1000$$

$$GRPH_t = FA_t - (FA_t - FB) \cdot \exp(-FC \cdot ZPHG_t/(FA_t - FB))$$

$$GRGP_t = CLGR_t \cdot GRPH_t$$

$$NGGP_t = FD + FE \cdot GRGP_t$$

$$SLVMA_t = RLLVS \cdot TLLS_t$$

$$SLVA_t = \sum_{I=2,4,5,9} SLV_t(I) \cdot SLVK(I)$$

$$SLVAR_t = SLVA_t/SLVMA_t$$

$$XLVPLM_t = f(SLVAR_t)$$

$$LVPL_t(I) = PXLVP(I) \cdot XLVPLM_t \quad , I = 1,...,9$$

$$UALV_t(I) = IALV_t \cdot SLV_t(I) \cdot SLVK(I)/SLVA_t \quad , I = 1,...,9$$

$$ALVI_t(I) = UALV_t(I)/LVPL_t(I) \quad , I = 1,...,9$$

$$SLV_{t+1} = SLV_t(I) + ALVI_t(I) \quad , \quad I = 1,...,9$$

$$FGP_t(I) = \begin{cases} SLV_t(I) \cdot SLVMK(I)/1000.0 & , I = 1,...,8 \\ SLV_t(9) \cdot SLVMK(I)/1000.0 & , I = 9,...,12 \end{cases}$$

$$SLVV_t = \sum_{I=1}^{5} FGP_t(I)$$

$$AWFM_t = FWCM_t \cdot AWFMK$$

$$AUFWP_t = UFWP_t \cdot WB$$

$$FWCP_t = UFWP_t \cdot UFWPK$$

$$UFWP_{t+1} = UFWP_t + AUFWP_t \leq FWPM$$

$$FWCM_{t+1} = FWCM_t + AWFM_t \leq FWMM$$

$$FWCT_t = FWCM_t + FWCP_t$$

$$FWT_t = FWCT_t \cdot FWCNTK$$

$$FGP_t(13) = FWT_t$$

$$FGP_t(13 + I) = NGGP_t \cdot NGGPK(I) \quad , I = 1,...,8$$

$$FGP_t(21 + I) = GRGP_t \cdot GRGPK(I) \quad , I = 1,...,5$$

$$SFT_t(I) = FGP_t(I) \cdot SPFTK(I) \quad , \qquad I = 1,\ldots,26$$

$$FTS_t(I) = FGP_t(I) \cdot (1 - SPFTK(I)), \qquad I = 1,\ldots,26$$

$$LSFT_t(I) = LSFTK(I) \cdot FTS_t(I) \quad , \qquad I = 1,\ldots,26$$

$$FTG_t(I) = FFTK(I) \cdot FTS_t(I) \quad , \qquad I = 1,\ldots,26$$

$$FTN_t(I) = FTG_t(I) \cdot (1 - XHMLF(I)) \quad , \qquad I = 1,\ldots,26$$

$$FSRPC_t(I) = FTN_t(I) \cdot 1000/POP_t \quad , \qquad I = 1,\ldots,26$$

$$VCLPCR_t(I) = FSRPC_t(I) \cdot CLK(I) \quad , \qquad I = 1,\ldots,26$$

$$VPTPCR_t(I) = FSRPC_t(I) \cdot PTK(I)/100.0 \quad , \qquad I = 1,\ldots,26$$

$$PTAPCR_t = \sum_{I=1}^{13} VPTPCR_t(I)$$

$$PTPCR_t = \sum_{I=1}^{26} VPTPCR_t(I)$$

$$CLPCR_t = \sum_{I=1}^{26} VCLPCR_t(I)$$

$$PTAR_t = PTAPCR_t \cdot POP_t/1000$$

$$PTR_t = PTPCR_t \cdot POP_t/1000$$

$$YPC_t = Y_t/POP_t$$

$$PTNM_t = f(YPC_t)$$

$$PTPCN_t = PTPCB \cdot PTNM_t$$

$$SPTPC_t = \max(PTPCR_t - PTPCN_t, 0.0)$$

$$DPTPC_t = \max(PTPCN_t - PTPCR_t, 0.0)$$

$$PTPCSN_t = PTPCR_t/PTPCN_t$$

$$PTN_t = PTPCN_t \cdot POP_t/1000.0$$

$$DPT_t = DPTPC_t \cdot POP_t/1000.0$$

$$SPT_t = SPTPC_t \cdot POP_t/1000.0$$

$$PTPCDR_t = PTPCR_t/365$$

5. Pricing Mechanism

$$PXLVP_t = PXLV \cdot PXLVK \cdot PXK_t$$

$$GRV_t = GRGP_t \cdot PXGR \cdot PXK_t$$

$$NGV_t = NGGP_t \cdot PXNG \cdot PXK_t$$

$$LVV_t = SLVV_t \cdot PXLVP_t$$

$$FSV_t = FWT_t \cdot PXFS_t \cdot PXK_t$$

$$YA_t = GRV_t + NGV_t + LVV_t + FSV_t$$

$$YAPC_t = YA_t/POP_t$$

$$CCLDH_t = f(FCLR_t)$$

$$PXPTM_t = PXPTM_{t-1} \cdot (1 + RPXPTM)$$

$$PXK_t = PXK_{t-1} \cdot (1 + RPXPK)$$

$$PXPF_t = PXPF_{t-1} \cdot (1 + RPXPF)$$

$$FDMV_t = DPT_t \cdot PXPTM_t$$

$$FDMAR_t = FDMV_t/YA_t$$

$$FDMYR_t = FDMV_t/Y_t$$

$$FDMMR_t = FDMV_t/M_t$$

$$FDXV_t = YA_t \cdot SPT_t/PTR_t$$

$$FDXAR_t = FDXV_t/YA_t$$

$$FDXYR_t = FDXV_t/Y_t$$

$$FDX9YR_t = FDXV9_t/Y_t$$

$$FDX9AR_t = FDXV9_t/YA_t$$

$$PTX9RR_t = PTX9_t/PTR_t$$

$$PTX9SR_t = PTX9_t/SPT_t$$

$$ENZ_t = TPF_t \cdot ENZPLK$$

$$ENZFR = CLPCR_t \cdot POP_t/ENZ_t/1000$$

II. TERMINAL INPUT AND DATA BASE

A. Requests from the Model

Playing with the model requires the input of some specific parameters from the keyboard. For this purpose the model issues some appropriate statements on the keyboard. Following each request there is an example for the expected input. This example is primarily intended to show the user the format by which the data are to be entered rather than to give a meaningful set of data.

During a session some or all of the following requests may be issued:

"ENTER REGION, E.G. 09"

At this the user of the model should enter the number of the region for which he intends to run the model (see Table 1). (At the moment data are available only for regions 01 and 09, i.e. North America and South East Asia.)

"ENTER SCENARIO NUMBER, E.G. 06"

There are some scenaria that are already implemented, which may be found in Table 2. If you want to run the model for one of these scenaria you have to type in the corresponding number at this request. If you want to specify parameters yourself you must type "99".

"IF YOU WANT TO ENTER SCENARIO WITH THE CARD READER
TYPE '1' AND HIT 'CR' OTHERWISE TYPE '0'"

This provides the possibility of entering scenario 99 either from the card reader or from the keyboard.

"SCENARIO NUMBER NON-EXISTENT--TRY AGAIN"

This message will be issued if you have typed in a non-existing scenario number. Subsequently you will be asked again for a scenario number.

"ENTER EQUIL. CONTROL START/SPAN, E.G. 1985/35"

At this you must enter the year in which fertility control should start, and the number of years after which the equilibrium fertility factor will be reached (for more details see [1]). The format to be used is I4,1X,I2.

"ENTER PRONOR,EO,EU,EA,XO,TL,PRODST, E.G.
44./1.0/0.5/10./0.0/0.0/1.0"

These parameters are used to compute the mortality multiplier due to lack of protein (for more details see [1]). If you do not want to consider lack of protein you must use EO = EU = 0.0. The input format is shown in the above request (i.e. 7 (F3.0,1X)).

"ENTER UAFK,K1,IAPK,IALVK,IAFK, E.G. .14/0.1/0.5/
.05/0.0"

These parameters are used in the economic submodel to compute the distribution of investments in the agricultural sector (for more details see [3]). The input format is again shown in the request (i.e. 7(F3.0,1X)).

"ENTER INVESTMENT SHIFT PARAMETERS, E.G. 0.063/
0.145/0.145/0.145/0.063/0.063"

This time-series which gives the factor of additional investment to the agricultural sector in time-steps of ten years is used to investigate different investment policies. The input format as shown is 6(F5.3,1X).

"ENTER LAND WITHDRAWAL PER CAPITA E.G. 0.001"

This factor is used to calculate the withdrawal of land due to population growth.

"ENTER GZPHK, E.G. 0.666"

This factor is used to calculate the fraction of fertilizer and other productive factors devoted to grain production.

"ENTER RPXPF,RPXPTM,RPXPK, E.G. 0.025/0.025/0.025"

These factors are the growth parameters of the pricing mechanism.

"ENTER NDRU(21)"

The values of NDRU(I), I = 1,21 are used to control the output provided by the model which consist of 11 tables and 10 plots. The array is entered by format (I21).

The terms appearing in the above requests denote the following:

IREG : In the M.P. World Model the world has been regionalized. There are ten regions.

Table 1

Number	Region
01	North America
02	Western Europe
03	Japan
04	Rest of Developed Countries (i.e. Israel, South Africa, Australia, New Zealand)
05	East Europe and USSR
06	Latin America
07	Middle East
08	Main Africa
09	South East Asia
10	China

ISCEN : There are some scenaria with special sets of parameters available (Table 2). If you want to specify your own parameters you must enter 99.

KONTR (EQUILIBRIUM CONTROL START) : Start of the equilibrium policy; must be a multiple of 5, e.g. 1975, 1985, 2000, etc. If you do not want any equilibrium policies specify 2100.

INT (EQUILIBRIUM CONTROL SPAN) : Length of transition interval, i.e. number of years from the start of the equilibrium policy until the equilibrium fertility factor is reached; must be a multiple of 7, e.g. 0,14,35 etc.

PRONOR : Daily amount of per capita protein intake (in grams) below which starvation occurs.

EO : Sensititivity of babies to protein deficiency.

EU : Sensititivity of older people to protein deficiency.

EA : Time constant that indicates the number of years that pass until E(a) - EU drops to 37% of EO - EU, where E(a) is defined as

$$E(a) = (EO - EU) \cdot \exp(-a/EA) + EU$$

("Age specific sensitivity to protein deficiency")

XO : Minimal per capita protein consumption (in grams) per day below which all people die due to a lack of protein.

TL : Time delay in the effect of protein deficiency (in years).

PRODST : Protein distribution factor $0 \leq PRODST \leq 1$ which takes into account inadequacies, and inequities in the distribution system which can occur in less developed regions.

K1	:	Fraction of additional investment to agricultural capital stock.
IAFK	:	Investment in fishery, coefficient
IAPK	:	Investment in agricultural production, coefficient
IALVK	:	Investment in livestock, coefficient
TLWPCB	:	Per capita land withdrawal, base value (in ha).
GZPHK	:	Fraction of fertilizer and other productive factors devoted to grain production, coefficient. This coefficient is used to allocate fertilizers and other productive factors to grain crops.
RPXPF	:	Rate of price increase, fertilizers and productive factors.
RPXPTM	:	Rate of price increase, protein imports.
UAFK	:	Expenditure on fertilizer and related productive factors, coefficient.
RPXPK	:	Ratio of base price increase for calculation of the value of agricultural production.
IAKSA(I), I = 1,6	:	Coefficient for shift of investment to agricultural sector in time-steps of 10 years, i.e. for 1975, 1985, 1995, 2005, 2015 and 2025. This time-series is the main tool to investigate different investment policies. In order to avoid unreasonable changes in food production IAKSA(1) ought to be set equal to IAK.

NDRU(I), I = 1,21	:	In order to get only a selection of the 21 pages of available output you may specify NDRU(I) = 1 to get the I-th page of printout or NDRU(I) = 0 to suppress it.

B. Data Base

In addition to a file which contains the prepared sets of scenario data, the food model uses three files which provide the basic data for the different submodels. You can find the formats that are used to read in the data, and the location of data within the file in the listing of the FORTRAN--program.

The following notations are used for data read from device number 3.

NAME(J), J = 1,12	:	Region label with up to 24 characters
A	:	2 • 2 input-output matrix for two-sector economic model
CA	:	Capital agricultural sector (for 1975 in 10^9 US $)
CNA	:	Capital non-agricultural sector (for 1975 in 10^9 US $)
DA	:	Depreciation rate, agricultural sector
DNA	:	Depreciation rate, non-agricultural sector
Y	:	Gross regional product (1975 in 10^9 US $)
QNA	:	Capital per output ratio, non-agricultural sector
ENZPLK	:	Energy requirements, coefficient
IAK	:	Investment in agricultural sector, coefficient

IRK	:	Investment regional, coefficient
GI	:	Total investment, coefficient
GC	:	Consumption, coefficient
GG	:	Governmental expenditures, coefficient
GM	:	Imports, coefficient
MAK	:	Agricultural imports, coefficient
TLM	:	Maximum total land (in 10^6 ha)
TLW	:	Total land withdrawn for urbanization and economic development (1975 in 10^6 ha)
CLM	:	Maximum cultivable land (1975 in 10^6 ha)
CLGR	:	Cultivated grain land (1975 in 10^6 ha)
TA	:	Subscript of linear equation relating non-grain land to grain land (CLNG = TB · CLGR + TA)
TB	:	Slope of linear equation relating grain land to non-grain land
CCLDH	:	Capital cost for land development per hectare (10^3 US \$/ha) Initial value for 1975
PXLV	:	Base price of meat (10^3 US \$/ton)
PXLVK	:	Meat price coefficient
PXK	:	Price coefficient
PXGR	:	Price of grain (10^3 US \$/ton)
PXNG	:	Price of non-grain (10^3 US \$/ton)
PXFS	:	Price of fish (10^3 US \$/ton)

PXPF : Price of fertilizer and other related productive factors (10^3 US $/ton)

PXPTM : Price of protein imports (10^3 US $/ton)

The following data are read from device number 1:

AP(J), J = 1,86 : Population numbers by one year age groups, initial values for 1975 (in millions of people)

AM(J), J = 1,86 : Age-specific mortality distribution by one year age groups.

AF(J), J = 1,86 : Age-specific fertility by one year age groups

FERTO : Fertility factor for 1975

FERTE : Fertility factor that leads to population equilibrium

AMORT : Mortality factor for 1975

AMO : Mortality factor for babies (1975)

The following data are read from device number 4 :

SLVK(J), J = 1,9 : Coefficients to correct individual categories of livestock for purposes of aggregating to a single base unit, by livestock category

PXLVP(J), J = 1,9 : Livestock price, base value, by category (10^3 US $/individual)

CLK(J), J = 1,26 : Calorie content, coefficient by category (cal/gm)

PTK(J), J = 1,26 : Protein content, coefficient, by category (percentage)

FB	:	Minimum level for grain productivity per ha (metric tons)
FC	:	Slope of grain productivity curve at minimum level
FD	:	Intercept of linear equation relating non-grain yield to grain yield
FE	:	Slope of linear equation relating non-grain yield to grain yield
RLLVS	:	Land livestock support rate
AWFMK	:	Growth rate of marine fish production
WB	:	Fish pond growth rate
UFWPK	:	Relationship between land use and pond fish, factor
FWCM	:	Catch of marine fish (initial value for 1975 in 10^6 tons)
FWCNTK	:	Meat from fish, coefficient
UFWP	:	Land in pond culture (1975 - value in 10^6 ha)
FWPM	:	Maximum fish production in fish ponds (10^6 tons)
FWMM	:	Maximum catch of marine fish (10^6 tons)
NGGPK	:	Coefficients which disaggregate non-grain crop production into 8 categories
GRGPK	:	Coefficients which disaggregate grain crop production into 5 categories
SLV(J), J = 1,9	:	Total livestock by type

SLVMK(J), J = 1,12 : Meat from livestock coefficient, by type (the types of animal food considered are: beef and veal, lamb and mutton, horse meat, other meat, honey, eggs, poultry, edible offal products, milk, cheese and butter)

SPFTK(J), J = 1,26 : Withdrawal for seed, by category, coefficient

LSFTK(J), J = 1,26 : Withdrawal for livestock food, by category, coefficient

FFTK(J), J = 1,26 : Total human food supply, by type, coefficient

XHMLF(J), J = 1,26 : Household and market losses, by type, coefficient

III. OUTPUT

The M.P. Food Model provides quite a voluminous output. The first page shows the region label and the scenario number as well as a reproduction of the input scenario. The variables listed have the following meaning:

PARAMETER: POUL. SECTOR: see section II

PARAMETER: ECON. SECTOR

QNA : Capital per output ratio, non-agricultural sector

IAK : Investment in agricultural sector, coefficient

MAK : Agricultural imports, coefficient

IRK : Investment, regional, coefficient

GI : Total investment, coefficient

GC : Consumption, coefficient

GG : Governmental expenditures, coefficient

GM : Imports, coefficient

PARAMETER: LAND SECTOR

TLM : Maximum total land (in 10^6 ha)

TLW : Total land withdrawn for urbanization and economic development (initial value for 1975, in 10^6 ha)

CLM : Maximum cultivable land (in 10^6 ha)

TA : Subscript of linear equation relating grain land to non-grain land

TB : Slope of linear equation relating grain land to non-grain land

CLGR : Cultivated grain land (initial value for 1975, in 10^6 ha)

PARAMETER: FOOD SECTOR

FB : Minimum level for grain productivity per ha (treated constant for each region)

FC : Slope of grain productivity curve at minimum level

FD : Intercept of linear equation in which production of non-grain crops per ha is calculated as a function of the production of grain crops

FE : Slope of linear equation in which non-grain production is calculated as a function of the grain crops production

RLLVS : Land livestock support rate

AWFMK : Growth rate of marine fish production

WB : Fish pond growth rate

UFWPK : Relationship between land use and pond fish

FWCM : Catch of marine fish (in 10^6 tons)

FWCNTK : Meat from fish, coefficient

UFWP : Land in pond culture (in 10^6 ha)

SLV : Total livestock, by type; the types of livestock considered are cattle, pigs, sheep and goats, horses, other large animals (mules, asses, buffaloes and camels), bees, chickens, all poultry and dairy animals. Livestock numbers are in million of individuals (only for bees there is the honey production in thousands of metric tons). For more details see [2].

SLVK : Coefficient to correct individual categories of livestock for purposes of aggregating to a single base unit, by livestock category.

PARAMETER: PRICE SECTOR

PXLV : Base price of meat (10^3 US $)

PXLVK : Meat price coefficient

PXK : Price coefficient (initial value for 1975)

PXGR : Price of grain crops (10^3 US $)

PXNG : Price of non-grain crops (10^3 US $)

PXFS : Price of fish (10^3 US $)

PXPF : Price for fertilizer and other related productive factors (initial value for 1975), (10^3 US $/ton)

After that you can produce an output of up to 21 pages consisting of 11 tables and 10 plots, which will be described subsequently. The output is controlled by the array NDRU(I), I = 1,21 which you have to enter from the keyboard at the corresponding request from the program (see section II). As described before you have to set NDRU(I) equal to 1 if you want to get the I-th page and equal to 0 if you want to suppress it.

Page 1: Population Indicators

This page contains 9 time-series for the years 1975-2025 concerning the population sector. The different columns are entitled as follows:

POP : Total population number (in millions)

BAB : Number of babies (in millions)

TOT : Number of deaths (in millions)

FERT : Fertility factor (not to be mixed up with crude birth rate)

MORT : Mortality factor (not to be mixed up with crude death rate)

CBR : Crude birth rate

CDR : Crude death rate

CGR : Population growth rate

TOT15 : Number of dead children (i.e. accumulated number of dead children up to an age of 15 years)

Page 2: Capital

This page provides time-series of some relevant economic indicators. Units are 10^9 US $:

CA	:	Capital stock, agricultural sector
CNA	:	Capital stock, non-agricultural sector
Y	:	Gross regional product
YA	:	Gross regional product, agricultural sector, computed within the pricing mechanism using the output of the food-production submodel
YAX	:	Gross regional product, agricultural sector, computed within the economic submodel. The values of YAX have been retained so that they can be compared with YA, but they do not have any effect on the computations of the model
YNA	:	Gross regional product, non-agricultural sector
YPC	:	Regional product, per capita (10^3 US $/ha)

Page 3: Investment

In order to investigate different investment policies several investment indicators are shown on this page. Again units are billions of US $:

I	:	Total investment
IA	:	Investment, agricultural sector
INA	:	Investment, non-agricultural sector
IR	:	Regional investment
IMN	:	Imports of investment capital needed

IAP : Investment in non-land agricultural capital stock

IALV : Investment in livestock development

IALD : Investment in land development.

Page 4: Land Indicators

This page presents the output from the land-use submodel. Units are millions of hectares:

CLGR : Cultivated grain land

CLNG : Land cultivated with non-grain crops

CL : Cultivated land (= grain land + non-grain land)

CLD : Cultivated land developed annually

CLW : Total cultivable land withdrawn

CLR : Cultivable land remaining

TLLS : Total land for livestock support

FCLR : Fraction of cultivable land remaining to total cultivable land

CCLDH : Capital cost for land development per ha (10^3 US $/ha)

Page 5: Agricultural Production

SUAF : Total expenditures on fertilizer an related productive factors (units are billions of US $)

PXPF : Price of productive factors (10^3 US $/ton)

ZPHG : Use of fertilizer and related productive factors (kg/ha)

GRPH : Grain production per ha (ton/ha)

GRGP : Gross production, grain crops (10^6 tons)

NGGP	:	Gross production, non-grain crops (10^6 tons)
ENZ	:	Energy required for plant food production (10^{12} cal)
ENZFR	:	Ratio of energy in produced food to that required for plant food production.

Page 6: Yield

In order to investigate the effects of increased fertilizer usage this page provides some details on yield indicators:

YNAPC	:	Regional product, non-agricultural, per capita (10^3 $/cap.)
PMCI	:	Productivity coefficient from infra-structure
CAPH	:	Agricultural capital per ha (10^3 US $/ha)
PTFC	:	Productivity coefficient from capital investment
FA	:	Saturation level for grain production (ton/ha)
ZPHG, GRGP	:	see description of page 5

Page 7: Livestock and Fish

This page shows some figures on livestock and fish production:

FWT	:	Meat from fish (10^6 tons)
SLVA	:	Total livestock number (corrected to a single base unit) in million of individuals

SLVMA : Total livestock supportable on available grazing land in million of individuals

SLVAR : Ratio of total livestock to maximum livestock supportable

LVPLM : Livestock, price-land multiplier, which is a function of SLVAR

IALV : Investment in livestock development (10^9 US $)

Page 8: Protein Indicators

In order to analyze the regional food situation some protein indicators have been defined:

PTR : Regional protein production (10^6 tons)

PTPCR : Annual protein per capita produced regionally (kg/cap.)

DPT : Regional protein deficit (10^6 tons)

DPTPC : Per capita protein deficit (kg/cap.)

PTN : Regional protein needs (10^6 tons)

PTAR : Animal protein produced regionally (10^6 tons)

PTAPCR : Animal protein per capita, regional (kg/cap.)

PTPCSN : Ratio of protein per capita supply to needs

PTPCDR : Regional daily protein per capita (kg/day)

SPT : Regional protein surplus (10^6 tons)

Page 9: Pricing

This page shows the dollar values of food production:

PXLVP	:	Adjusted price of meat (10^3 US $/ton)
GRV	:	Dollar value, grain production (10^9 US $)
NGV	:	Dollar value, non-grain production (10^9 US $)
SLVV	:	Total meat production from livestock (10^6 tons)
LVV	:	Dollar value, livestock production (10^9 US $)
FSV	:	Dollar value, fish production (10^9 US $)

Page 10: Imports

FDMV	:	Dollar value of food imports (10^9 US $)
FDMAR	:	Ratio of food imports to agricultural production
FDMYR	:	Ratio of food imports to total GRP
FDMMR	:	Ratio of food imports to total imports
M	:	Total imports (10^9 US $)
PXPTM	:	Price of protein imports (10^3 US $/ton)

Page 11: Exports

FDXV	:	Dollar value of exports (10^9 US $)
FDXAR	:	Ratio of food exports to agricultural production
FDXYR	:	Ratio of food exports to total GRP
FDX9AR	:	Ratio of food exported from region 1 to region 9 to agricultural production (not implemented)

FDX9YR : Ratio of food exported from region 1 to region 9 to total GRP (not implemented)

PTX9RR : Ratio of protein exported from region 1 to region 9 to total protein produced regionally (not implemented)

PTX9SR : Ratio of protein exported from region 1 to region 9 to regional protein surplus (not implemented)

The following ten pages are graphical representations of the above tables. Therefore, they will not be discussed in detail:

Page 12: Plot of population indicators (POP,BAB,TOT,TOT15)

Page 13: Plot of population growth indicators (CBR,CDR,CGR)

Page 14: Plot of economic indicators (Y,YA,YAX,YNA)

Page 15: Plot of investment indicators (I,IA,INA,IR,IMN)

Page 16: Plot of land indicators (CLD,CL,CLGR,CLW,CLR)

Page 17: Plot of food production (FWT,SLVA,GRGP,NGGP)

Plot 18: Plot of protein indicators (PTN,PTR,DPT,SPT)

Page 19: Plot of protein per capita (PTPCR,PTA,PTR,DPTPC,PTPCN)

Page 20: Plot of imports (FDMAR,FDMYR,FDMMR)

Page 21: Plot of exports (FDXAR,FDXYR)

IV. BATCH VERSION OF THE M.P. FOOD MODEL

To use the facilities provided by the TH Vienna a batch version of the M.P. Food Model has been implemented on CYBER 74. In this batch version a few additional features have been incorporated which are described below.

In order to treat the investment shift to the agricultural sector appropriately a mechanism has been built that adjusts the scenario variable IAKS in such a way that no starvation occurs, but also no surplus protein is produced. This mechanism can be especially helpful when investigating the impact of population policies.

Economic aid or a food aid program may be specified exogenously by means of the time-series AIDF and AIDT (11 data points for each time-series).

Last but not least, MAXIYR is not fixed (= 2025) but may be set equal to 2075 for studying the long-term behaviour of the model.

Due to these changes in the program the data base is also slightly different from that already described. The whole data base (together with the scenario data) is read from device number 1. The actual location of the data may be found from the program listing and the examples that are given at the end of this section.

There are two additional parameters NFLAG and NPER which denote the following:

NFLAG: Control parameter, IF

NFLAG = 1 : IAKS is determined so that after a period of NPER years no starvation occurs (if possible; IAKSA is subject to IAK $\leq$ IAKS $\leq$ 1). A time-series for IAKSA must not be given.

NFLAG = 0 : IAKS is calculated according to the time-series IAKSA. The program assumes that the time increments of IAKSA are 10 years. So the number of data points depends on MAXIYR (e.g. 6 data points for MAXIYR = 2025).

NPER : This parameter denotes the length of the period over which IAKS is optimized in the sense that no protein deficit or surplus occurs after that period, provided a value of IAKS can be found that obeys to IAK $\leq$ IAKS $\leq$ 1.

Assuming that the computations start at year t_o this is done by solving the equation

$$PTPCN_{t_o+NPER} - PTPCR_{t_o+NPER} = 0$$

numerically. This yields a value $IAKS_{t_o+NPER}$. The values $IAKS_{t_o+I}$ I = 1,...,NPER-1 are determined by means of linear interpolation between $IAKS_{t_o}$ and $IAKS_{t_o+NPER}$. After that the computations consider the interval t_o + NPER to t_o + 2 · NPER etc.

The values for AIDT and AIDF are read by format (11F6.2). They correspond to 5 year or 10 year increments for MAXIYR = 2025 or MAXIYR = 2075 respectively.

The output of the model provides now an additional page that will be printed if NDRU(12) = 1. The actual printing of the provided plots can be controlled by means of NDRU(I), I = 13,...,22 (see Chapter III).

EXAMPLE 1. Sample set of data for the batch version of the Food Model (without optimizing IAKS)

```
2075
SOUTH EAST ASIA
A      0.2024230 0.0691948 0.0550028 0.2898180
ECO      39.4990   225.4960    0.0555    0.02857  170.76    2.50000   12.2214
ECO    0.1449970 0.30       0.1285930 0.7599790 0.9999985 0.1249960 0.1739960
LAND     565.0       2.44     278.0      171.844 - 48.6982    0.79695   0.3305
PRICE  1.5         1.0         1.0        0.115     0.09        0.9       0.15      2.7
 AP 75   50.66438  45.88050  43.54782  41.51517  39.84339  38.48023  37.13423  35.96400
 AP 75   34.93629  33.15854  31.30316  30.17845  30.02734  29.35849  27.98729  27.23886
 AP 75   25.33131  25.64915  25.67342  25.71103  25.24819  24.32276  23.22588  22.31420
 AP 75   21.61863  17.73292  17.99158  17.22476  17.76306  17.51119  18.36975  18.85101
 AP 75   18.77454  18.18074  17.12072  15.75250  14.54278  13.59599  12.90198  12.45226
 AP 75   12.19406  11.94071  11.64775  11.31735  10.95154  10.56893  10.23689   9.96967
 AP 75    9.76389   9.61609   9.50203   9.33719   9.10376   8.80633   8.44937   8.05185
 AP 75    7.68807   7.35145   7.02560   6.73972   6.44360   6.05648   5.70278   5.34879
 AP 75    4.99314   4.64309   4.31201   3.99457   3.63866   3.37167   3.08877   2.82888
 AP 75    2.57899   2.34129   2.12004   1.94084   1.72248   1.50297   1.28788   1.08173
 AP 75    0.89212   0.73437   0.60655   0.50324   0.41981   1.56969
 AM       0.02491   0.00951   0.00866   0.00725   0.00536   0.00345   0.00198   0.00102
 AM       0.00058   0.00061   0.00096   0.00108   0.00123   0.00129   0.00129   0.00127
 AM       0.00126   0.00129   0.00134   0.00142   0.00151   0.00159   0.00165   0.00170
 AM       0.00174   0.00177   0.00182   0.00188   0.00196   0.00205   0.00214   0.00222
 AM       0.00229   0.00234   0.00239   0.00243   0.00249   0.00256   0.00264   0.00273
 AM       0.00284   0.00296   0.00310   0.00324   0.00340   0.00360   0.00385   0.00415
 AM       0.00451   0.00492   0.00534   0.00573   0.00609   0.00640   0.00670   0.00711
 AM       0.00776   0.00866   0.00982   0.01119   0.01252   0.01357   0.01429   0.01467
 AM       0.01479   0.01493   0.01540   0.01627   0.01752   0.01915   0.02106   0.02316
 AM       0.02544   0.02789   0.03047   0.03298   0.03523   0.03717   0.03861   0.04025
 AM       0.04204   0.04474   0.04846   0.05319   0.06250   0.06919
 AF       0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000
 AF       0.00000   0.00000   0.00006   0.00027   0.00070   0.00140   0.00250   0.00413
 AF       0.00645   0.00978   0.01448   0.02090   0.02916   0.03883   0.04870   0.05674
 AF       0.06099   0.06154   0.06000   0.05750   0.05485   0.05246   0.05017   0.04769
 AF       0.04499   0.04209   0.03893   0.03527   0.03108   0.02667   0.02235   0.01835
 AF       0.01479   0.01172   0.00915   0.00706   0.00540   0.00409   0.00305   0.00223
  AF      0.00157   0.00102   0.00059   0.00029   0.00009   0.00000   0.00000   0.000
 AF       0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000
 AF       0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000
 AF       0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000
  AF      0.00000   0.00000   0.00000   0.00000   0.00000   0.00000
          2.95424   1.37543   2.80414   0.04003
SLVK        0.64999   0.19999   0.09999   1.00000   1.00000   0.00000   0.00999
SLVK        0.00999   1.00000
PXLVP       0.12499   0.04299   0.01499   0.09999   0.08099   0.00050   0.00050
PXLVP       0.00050   0.08099
CLK         2.50      4.36      2.88      0.94      1.64      2.90      1.30
CLK         1.63      1.43      0.65      3.00      7.16      1.32      3.50
CLK         3.60      3.48      3.60      3.49      3.87      0.92      0.22
CLK         3.45      0.59      2.75      0.00      0.00
PTK        17.70     11.90     15.60     20.00     15.20      0.00     20.00
```

```
PTK          12.40      16.00       3.50      18.00       0.60      18.80      12.20
PTK           9.50       9.70       6.70      11.80       0.00       1.80       1.70
PTK          23.10       0.70      19.00       0.00       0.00
VARIOUS       0.91998    0.02389  -66.19730    1.71991   87.71290    0.07099    0.01000
VARIOUS       2.07410   13.09010    0.44997    0.00110    2.000     16.3008
NGGPK         0.64360    0.13880    0.00640    0.06300    0.03530    0.07010    0.00750
NGGPK         0.0351
GRGPK         0.10000    0.06380    0.10890    0.69960    0.02770
SLV         266.258     33.1152   200.238      3.13495  100.654      1.49997  612,859
SLV         537.000    327.711
SLVMK         4.337     35.658      3.500      0.337      0.20       1.0        0.875
SLVMK         1.560      0.630    117.100      5.0        1.50
SPFTK         0.0        0.0        0.0        0.0        0.0        0.0        0.0
SPFTK         0.1        0.0        0.0        0.0        0.0        0.0        0.20
SPFTK         0.2        0.2        0.2        0.2        0.1        0.1        0.1
SPFTK         0.1        0.1        0.1        0.1        0.1
LSFTK         0.0        0.0        0.0        0.0        0.0        0.0        0.0
LSFTK         0.0        0.0        0.0        0.0        0.0        0.0        0.0
LSFTK         0.0        0.1        0.2        0.2        0.0        0.2        0.0
LSFTK         0.1        0.1        0.0        0.1        0.2
FFTK          0.85       0.85       0.85       0.85       0.85       0.85       0.85
FFTK          0.85       0.85       0.85       0.85       0.85       0.8        0.8
FFTK          0.7        0.5        0.7        0.6        0.8        0.8        0.8
FFTK          0.8        0.8        0.2        0.2        0.1
XHMLF         0.2        0.2        0.2        0.2        0.2        0.2        0.2
XHMLF         0.2        0.2        0.2        0.2        0.2        0.3        0.3
XHMLF         0.3        0.3        0.3        0.3        0.3        0.3        0.3
XHMLF         0.3        0.3        0.3        0.2        0.2
99 0 1
09
 99  1995  35     44.0      1.0       0.25      10.0       25.0      0.0        0.7   SEA
          0.500     0.000     0.5       0.05      0.002     0.667     0.020     0.024 SEA
        0.1539     0.025
IAKSA   0.144997 0.300     0.300     0.300     0.300     0.300     0.300     0.300
0.300     0.300     0.300     0.300     0.300
                                                                          TECHN.AID
                                                                          FOOD AID
111111111111
```

EXAMPLE 2. Sample set of data for the batch version of the Food Model (optimizing IAKS as described in IV)

```
2075
SOUTH EAST ASIA
A       0.2024230 0.0691948 0.0554020 0.2808180
ECO       39.4990   225.4960    2.0555    0.02857  170.76    2.50000    12.2214
ECO    0.1449970 0.30        0.1265930 0.7599790 0.2999985 0.1249960 0.1739960
LAND     565.0        2.44     278.0      171.844 - 48.6982     0.79695   0.3305
PRICE  1.5          1.0          1.0        0.115      0.09        0.9        0.15        2.7
 AP 75    50.66438  45.88050  43.54782  41.51517  39.84339  38.48023  37.13423  35.96400
 AP 75    34.93629  33.15854  31.30316  30.17645  30.02734  29.35849  27.98729  27.23886
 AP 75    26.33131  25.64915  25.67342  25.71103  25.24819  24.32276  23.22588  22.31420
 AP 75    21.61863  17.73092  17.99158  17.22478  17.26306  17.51119  18.36975  18.85101
 AP 75    18.77454  18.18274  17.12070  15.75250  14.54278  13.59599  12.90198  12.45220
 AP 75    12.19406  11.94071  11.64775  11.31735  10.95154  10.56893  10.23689   9.96967
 AP 75     9.76369   9.61609   9.50203   9.33719   9.10376   8.80633   8.44937   8.05105
 AP 75     7.68827   7.35145   7.02560   6.73972   6.44360   6.05648   5.70278   5.34879
 AP 75     4.99314   4.64309   4.31201   3.99457   3.63866   3.37167   3.08877   2.82888
 AP 75     2.57899   2.34129   2.12004   1.94084   1.72248   1.50297   1.28788   1.08173
 AP 75     0.89212   0.73437   0.60655   0.50324   0.41981   1.56969
 AM        0.02491   0.00951   0.00866   0.00725   0.00536   0.00345   0.00198   0.00102
 AM        0.00058   0.00061   0.00086   0.00108   0.00123   0.00129   0.00129   0.00127
 AM        0.00126   0.00129   0.00134   0.00142   0.00151   0.00159   0.00165   0.00172
 AM        0.00174   0.00177   0.00182   0.00188   0.00196   0.00205   0.00214   0.00222
 AM        0.00229   0.00234   0.00239   0.00243   0.00249   0.00256   0.00264   0.00273
 AM        0.00284   0.00296   0.00310   0.00324   0.00340   0.00360   0.00385   0.00415
 AM        0.00451   0.00492   0.00554   0.00573   0.00609   0.00640   0.00670   0.00711
 AM        0.00776   0.00866   0.00982   0.01119   0.01252   0.01357   0.01429   0.01467
 AM        0.01479   0.01493   0.01540   0.01627   0.01752   0.01915   0.02106   0.02316
 AM        0.02544   0.02789   0.03047   0.03298   0.03523   0.03717   0.03881   0.04025
 AM        0.04204   0.04474   0.04846   0.05319   0.06250   0.06919
 AF        0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000
 AF        0.00000   0.00000   0.00006   0.00027   0.00070   0.00140   0.00250   0.00413
 AF        0.00645   0.00978   0.01448   0.02090   0.02916   0.03883   0.04870   0.05674
 AF        0.06099   0.06154   0.06000   0.05750   0.05485   0.05246   0.05017   0.04769
 AF        0.04499   0.04209   0.03893   0.03527   0.03108   0.02667   0.02235   0.01835
 AF        0.01479   0.01172   0.00915   0.00706   0.00540   0.00409   0.00305   0.00223
  AF       0.00157   0.00102   0.00059   0.00029   0.00009   0.00000   0.00000   0.000
 AF        0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000
 AF        0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000
 AF        0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000   0.00000
  AF       0.00000   0.00000   0.00000   0.00000   0.00000   0.00000
           2.95424   1.37543   2.80414   0.04003
SLVK          0.64999    0.19999    0.09999    1.00000    1.00000    0.00000    0.00999
SLVK          0.00999    1.00000
PXLVP         0.12499    0.04299    0.01499    0.09999    0.08099    0.00050    0.00050
PXLVP         0.00050    0.08099
CLK           2.50       4.38       2.88       0.94       1.64       2.90       1.30
CLK           1.63       1.43       0.65       3.00       7.16       1.32       3.50
CLK           3.60       3.48       3.60       3.49       3.87       0.92       0.22
CLK           3.45       0.59       2.75       0.00       0.00
PTK          17.70      11.90      15.60      20.00      15.20       0.00      20.20
```

```
PTK          12.40      16.00       3.50      18.00       0.60      18.80      12.20
PTK           9.50       9.70       6.70      11.80       0.00       1.80       1.70
PTK          23.10       8.70      19.00       0.00       0.00
VARIOUS       0.91998    0.02389 -66.19730    1.71991   87.71290    0.07099    0.01000
VARIOUS       2.27410   13.29010    0.44997    0.00110   2.000     16.3008
NGGPK         0.64360    0.13880    0.00640    0.06300    0.03530    0.07010    0.00750
NGGPK         0.0351
GRGPK         0.10000    0.06380    0.10890    0.69960    0.02770
SLV         266.258     33.1152   200.238     3.13495  100.654      1.49997  612.859
SLV         537.000    327.711
SLVMK         4.337     35.658      3.500      0.337      0.20       1.0        0.875
SLVMK         1.560      0.630    117.100      5.0        1.50
SPFTK         0.0        0.0        0.0        0.0        0.0        0.0        0.0
SPFTK         0.1        0.0        0.0        0.0        0.0        0.0        0.20
SPFTK         0.2        0.2        0.2        0.2        0.1        0.1        0.1
SPFTK         0.1        0.1        0.1        0.1        0.1
LSFTK         0.0        0.0        0.0        0.0        0.0        0.0        0.0
LSFTK         0.0        0.0        0.0        0.0        0.0        0.0        0.0
LSFTK         0.0        0.1        0.2        0.2        0.0        0.2        0.0
LSFTK         0.1        0.1        0.0        0.1        0.2
FFTK          0.85       0.85       0.85       0.85       0.85       0.85       0.85
FFTK          0.85       0.85       0.85       0.85       0.85       0.8        0.8
FFTK          0.7        0.5        0.7        0.6        0.8        0.8        0.8
FFTK          0.8        0.8        0.2        0.2        0.1
XHMLF         0.2        0.2        0.2        0.2        0.2        0.2        0.2
XHMLF         0.2        0.2        0.2        0.2        0.2        0.3        0.3
XHMLF         0.3        0.3        0.3        0.3        0.3        0.3        0.3
XHMLF         0.3        0.3        0.3        0.2        0.2
99 1 5
09
 99  1995  35     44.0      1.0       0.25      10.0       25.0      0.0       0.7   SE
          0.500     0.000     0.5       0.05      0.002     0.667     0.020     0.024 SE
        0.1539    0.025
                                                                                TECHN.AID
                                                                                FOOD AID
111111111111
```

EXAMPLE 3. Set of prepared scenaria to be used under DOS

```
09
01  2100  00    44.0      1.0      0.25     10.0     25.0     0.0      0.7   SEA
      0.500     0.000     0.5      0.05     0.002    0.667    0.025    0.025 SEA
     .15390     0.0
      0.144997  0.144997  0.144997 0.144997 0.144997 0.144997
02  2100  00    44.0      1.0      0.25     10.0     25.0     0.0      0.7   SEA
      0.500     0.000     0.5      0.05     0.002    0.667    0.025    0.025 SEA
     .15390     0.0
      0.144997  0.300     0.300    0.300    0.300    0.300
03  1995  35    44.0      1.0      0.25     10.0     25.0     0.0      0.7   SEA
      0.500     0.000     0.5      0.05     0.002    0.667    0.025    0.025 SEA
     .15390     0.0
      0.144997  0.145     0.145    0.145    0.145    0.145
04  1975  35    44.0      1.0      0.25     10.0     25.0     0.0      0.7   SEA
      0.500     0.000     0.5      0.05     0.002    0.667    0.025    0.025 SEA
     .15390     0.0
      0.144997  0.145     0.145    0.145    0.145    0.145
05  1975  35    44.0      1.0      0.25     10.0     25.0     0.0      0.7   SEA
      0.500     0.000     0.5      0.05     0.002    0.667    0.025    0.025 SEA
     .15390     0.0
      0.144997  0.300     0.300    0.300    0.300    0.300
06  1995  35    44.0      1.0      0.25     10.0     25.0     0.0      0.7   SEA
      0.500     0.000     0.5      0.05     0.002    0.667    0.025    0.025 SEA
     .15390     0.0
      0.144997  0.145     0.145    0.145    0.145    0.145
07  1985  35    44.0      1.0      0.25     10.0     25.0     0.0      0.7   SE
      0.500     0.000     0.5      0.05     0.002    0.667    0.025    0.025 SEA
     .15390     0.0
      0.144997  0.500     0.500    0.300    0.300    0.145
08  1985  35    44.0      1.0      0.25     10.0     25.0     0.0      0.7   SE
      0.500     0.000     0.5      0.05     0.002    0.667    0.025    0.025 SEA
     .15390     0.0
      0.144997  0.145     0.145    0.145    0.145    0.145
09  1985  35    44.0      1.0      0.25     10.0     25.0     0.0      0.7   SE
      0.500     0.000     0.5      0.05     0.002    0.667    0.025    0.025 SEA
     .15390     0.0
      0.144997  0.145     0.145    0.145    0.145    0.145
```

LISTING 1. Batch version of the Food Model used at TH Vienna

```
      PROGRAM MRFOOD(INPUT,OUTPUT,TAPE1=INPUT,TAPE9=OUTPUT)
C     MAIN
      REAL IALV,IALD,NGGP,M,IAFK,IAFV,IAKSA,INA,MA
      REAL IAKSO,IAKSU,INV,IAS,IAP,IMN,IR,IAKSN
       REAL IAKS,K1,IAPK,IALVK,MAK,MC,IAK,IRK,IA,LSFTK,NGGPK
      DIMENSION A(2,2),NAME(12),AP(86),AF(86),AM(86),SLVK(9),PXLVP(9),
     1CLK(26),PTK(26),SPFTK(26),LSFTK(26),FFTK(26),NGGPK(8),GRGPK(5),
     2SLV(9),SLVMK(12),XHMLF(26),PPCSAV(15)
      DIMENSION IAKSA(12)
      DIMENSION DRUPOP(9,101),DRUEC1(11,101),DRUEC2(8,101),DRULAN(9,101)
     1,DRUFO1(10,101),DRUFO2(7,101),DRUFO3(6,101),DRUFO4(10,101),
     2DRUPR1(6,101),DRUPR2(6,101),DRUPR3(7,101)
      DIMENSION OLD(155),AIDT(11),AIDF(11)
      COMMON /DRUCK/ DRUPOP,DRUEC1,DRUEC2,DRULAN,DRUFO1,
     1DRUFO2,DRUFO3,DRUFO4,DRUPR1,DRUPR2,DRUPR3,NAME
      COMMON /AI/ ISTAT, IYR,IREG,ISCEN
      COMMON /AR/ PTPCR,CLPCR,PTPCB,PTAPCR,POP,CGR,IALD,CCLDH,Y,YA,YNA,C
     1A,CL,CLGR,TLLS,FCLR,IALV,TPF,SUAF,PXPF,GRGP,NGGP,SLVV,FWT,M,SPT,PT
     2R,ENZPLK,ENZFR ,ENZ,SAVV,IAFK,IAFV,YPC,DPTPC
      COMMON /POPI/ KONTR,INT
      COMMON /POPR/ PRONOR,EO,EU,EA,X0,TL,CBR,CDR,FERT,AMORT,TOT,TOT15,
     1PRODST,FERTE,FERT0,AM0,AP,AF,AM
      COMMON /ECON/ MA,UAFK,IAKS,K1,IAPK,IALVK,MAK,YAX,MC,A,DA,DNA,QNA,
     1IAK,IRK,GI,GC,GG,GM,IA,CNA,INA,INV,IAS,IAP,IMN,IR,TAIDR,AID
      COMMON /LAND1/ TLWPCR,TLM,TLW,CLM,TA,TB
      COMMON /LAND0/ CLNG,CLD,CLW
      COMMON /FDI/ GZPHK,FB,FD,FE,FC,RLLVS,AWFMK,WB,UFWPK,UFWP,FWCM,FWCN
     1TK,SLVK,PXLVP,CLK,PTK,SPFTK,LSFTK,FFTK,NGGPK,GRGPK,SLV,SLVMK,XHMLF
     2,FWPM,FWMM
      COMMON /FOO/ DPT,PTN
      COMMON /PRI/ RPXPF,RPXPTM,PXLV,PXLVK,PXK,PXGR,PXNG,PXFS,RPXPK,PXPT
     1M
      COMMON /PRO/ FDMV,FDMAR,FDMYR,FDMMR,FDXV,FDXAR,FDXYR,FDX9YR,FDX9AR
     1,PTX9RR,PTX9SR
      COMMON /OPTIM/ PPCSAV,CAX,SYSYNA,CLR,NFLAG
      COMMON /OLD/ OLD
      COMMON /AID/ AIDF,AIDT,MAXIYR
C
C
      ISTAT = 1975
      READ(1,8003) MAXIYR
      K = (MAXIYR - ISTAT)/10 + 1
      READ(1,1500) (NAME(J),J=1,12)
      READ(1,1025) A
      READ(1,1025) CA,CNA,DA,DNA,Y,QNA,ENZPLK
      READ(1,1025) IAK,IRK,GI,GC,GG,GM,MAK
      READ(1,1025) TLM,TLW,CLM,CLGR,TA,TB,CCLDH
      READ(1,1025) PXLV,PXLVK,PXK,PXGR,PXNG,PXFS,PXPF,PXPTM
C
      READ(1,6000) (AP(J),J=1,86)
      READ(1,6000) (AM(J),J=1,86)
      READ(1,6000) (AF(J),J=1,86)
      READ(1,6000) FERT0,FERTE,AMORT,AM0
C
      READ(1,7000) (SLVK(J),J=1,9)
      READ(1,7200) (PXLVP(J),J=1,9)
      READ(1,7200) (CLK(J),J=1,26)
```

```
PROGRAM MPFOOD     74/74   OPT=1                          FTN 4.4+R401        75/

      READ(1,7000) (PTK(J),J=1,26)
      READ(1,7002) FB,FC,FD,FE,RLLVS,AWFMK,WB,UFWPK,FWCM,FWCNTK,UFWP,FWP
     1M,FWMM
      READ(1,7000) (NGGPK(J),J=1,8)
      READ(1,7000) (GRGPK(J),J=1,5)
      READ(1,7004) (SLV(J),J=1,9)
      READ(1,7000) (SLVMK(J),J=1,12)
      READ(1,7000) (SFFTK(J),J=1,26)
      READ(1,7000) (LSFTK(J),J=1,26)
      READ(1,7000) (FFTK(J),J=1,26)
      READ(1,7000) (XHMLF(J),J=1,26)
C
 1    READ(1,1050 ) ISCEN,NFLAG,NPER
      READ(1,1050) IREG
      READ(1,1090) NSC,KONTR,INT,PRONOR,EO,EU,EA,X0,TL,PRODST
      READ(1,1100) K1,IAFK,IAPK,IALVK,TLWPCB,GZPHK,RPXPF,RPXPTM
      READ(1,1100) UAFK,RPXPK
      IF(NFLAG.EQ.1) GO TO 92
      READ(1,1100) (IAKSA(JJ),JJ=1,K)
 92   READ(1,1030) (AIDT(JJ),JJ=1,11)
      READ(1,1030) (AIDF(JJ),JJ=1,11)
      PTPCB = PRONOR*365.0/(1000.0*PRODST)
      IAKS=IAK
      IYR = 0
      CALL ECO
      CALL LAND
      CALL PRICE
      WRITE(9,5001) (NAME(J), J=1,12) , ISCEN
      WRITE(9,2000)
      WRITE(9,2100)
      WRITE(9,2200) KONTR,INT,PRONOR,EO,EU,EA,X0,TL,PRODST
      WRITE(9,2010)
      WRITE(9,2110)
      WRITE(9,2210) QNA,IAK,MAK,IRK,GI,GC,GG,GM,IAPK
      WRITE(9,2120)
      WRITE(9,2210) UAFK,     K1,IALVK
      IF (NFLAG .EQ. 1) GO TO 93
      WRITE(9,2111)
      WRITE(9,2210) (IAKSA(JJ),JJ=1,K)
 93   WRITE(9,2115)
      DO 95 I=1,2
      WRITE(9,2210) (A(I,J),J=1,2)
 95   CONTINUE
      WRITE(9,2030)
      WRITE(9,2170)
      WRITE(9,2210) TLM,TLW,CLM,TA,TB,CLGR,TLWPCB
      WRITE(9,2020)
      WRITE(9,2130)
      WRITE(9,2210) FB,FC,FD,FE,RLLVS,AWFMK,WB,UFWPK
      WRITE(9,2140)
      WRITE(9,2210)  FWCM,FWCNTK,UFWP,GZPHK
      WRITE(9,2135)
      WRITE(9,2136)
      WRITE(9,2210) (SLV(J),J=1,9)
      WRITE(9,2137)
      WRITE(9,2136)
      WRITE(9,2210) (SLVK(J),J=1,9)
```

```
PROGRAM MPFOOD     74/74   OPT=1                                  FTN 4.4+R401

      WRITE(9,2040)
      WRITE(9,2150)
      WRITE(9,2210) PXLV,PXLVK,PXK,PXGR,PXNG,PXFS,PXPF
      WRITE(9,2160)
      WRITE(9,1270) RPXPF,RPXPTM,RPXPK
C
C
      IF(NFLAG .EQ. 1) GO TO 8040
      JMAX = MAXIYR - ISTAT + 1
      KK = JMAX/10
      DO 100 K = 1,KK
      DIFF = IAKSA(K+1) - IAKSA(K)
      DO 100 J = 1,10
      IYR = ISTAT -1+J+(K-1)*10
      IAKS = IAKSA(K) + DIFF*(J-1)/10.0
      CALL POPUL
      CALL LAND
      TPF= SUAF/PXPF
      CALL FOOD
      CALL PRICE
      CALL ECO
  100 CONTINUE
      IAKS = IAKSA(6)
      GO TO 9800
 8040 IYR = ISTAT
 8050 IF(IYR .GT. MAXIYR) GO TO 120
      IAKSO = IAKS +0.05*NPER
      IAKSO = AMIN1(IAKSO,1.0)
      IAKSU = IAKS - 0.05*NPER
      IAKSU = AMAX1(IAKSU,IAK)
      NFLAG = 0
      CALL SET
 9000 IAKSN = (IAKSO + IAKSU)/2.0
      DIF = IAKSO - IAKSU
      IF(DIF .GT. 1.E-6) GO TO 9050
      NFLAG = 1
 9050 IEND = IYR + NPER -1
      IEND = MIN0(IEND,MAXIYR)
      I1 = IYR
      DIF1=(IAKSN-IAKS)/NPER
      XIAKS = IAKS
      DO 9100 J= I1,IEND
      IAKS = XIAKS + DIF1*(IYR-I1+1)
      CALL POPUL
      CALL LAND
      TPF = SUAF/PXPF
      CALL FOOD
      CALL PRICE
      CALL ECO
      IYR = IYR + 1
 9100 CONTINUE
      IF(NFLAG .EQ. 1) GO TO 9700
      IF (DPTPC .GT. 0.0) GO TO 9500
      IAKSO = IAKSN
      GO TO 9600
 9500 IAKSU = IAKSN
 9600 CALL RESET
```

```
PROGRAM MPFOOD     74/74   OPT=1                          FTN 4.4+R401      7

      GO TO 9320
 9700 GO TO 8050
 9800 CONTINUE
      IYR = MAXIYR
      CALL POPUL
      CALL LAND
      TPF = SUAF/PXPF
      CALL FOOD
      CALL PRICE
      CALL ECO
  120 CONTINUE
      CALL DRUCK(MAXIYR)
C
C
 1025 FORMAT(6X,7F10.7,F4.2)
 1030 FORMAT(11F6.2)
 1050 FORMAT(3I2)
 1090 FORMAT(1X,I2,2X,I4,2X,I2,7(3X,F6.3))
 1100 FORMAT(7X,7(F9.3),F6.3,3X)
 1270 FORMAT(1H ,20X,3F12.6)
 1500 FORMAT(12A2)
 2000 FORMAT(1H0,  " PARAMETER : POPUL.SECTOR ")
 2010 FORMAT(1H0,  " PARAMETER : ECON. SECTOR ")
 2020 FORMAT(1H0,  " PARAMETER : FOOD  SECTOR ")
 2030 FORMAT(1H0,  " PARAMETER : LAND  SECTOR ")
 2040 FORMAT(1H0,  " PARAMETER : PRICE SECTOR ")
 2100 FORMAT(1H0,  "                              KONTR          INT         PRONO
     1R         EO          EU          EA          X0          TL
     2 PRODST   ")
 2110 FORMAT(1H0,  "                               QNA          IAK          MAK
     1          IRK          GI          GC          GG          GM
     2  IAPK    ")
 2111 FORMAT(1H0,20X,4X,"IAKS (1)",4X,"IAKS (2)",4X,"IAKS (3)",4X,"IAKS
     1(4)",4X,"IAKS (5)",4X,"IAKS (6)")
 2115 FORMAT(1H0, "                           INPUT-OUTPUT MATRIX        ")
 2120 FORMAT(1H0,  "                           UAFK          K1          IALV
     1K    ")
 2130 FORMAT(1H0,  "                            FB          FC          FD
     1          FE         HLLVS        AFWMK          WB         UFWPK    ")
 2135 FORMAT(1H0, 20X,"     SLV          SLV          SLV          SLV          SLV
     1    SLV          SLV          SLV          SLV          SLV    ")
 2136 FORMAT(1H ,20X,"   CATTLE        PIGS       SHPGTS       HORSES
     1  MABC         HONEY       POULTR        MPOUL        CBSG    ")
 2137 FORMAT(1H0,20X,"    SLVK         SLVK         SLVK         SLVK         SLVK
     1  SLVK         SLVK         SLVK         SLVK         SLVK    ")
 2140 FORMAT(1H0,  "                           FWCM         FWCNTK         UFW
     1P         GZPHK            ")
 2150 FORMAT(1H0,  "                           PXLV         PXLVK          PXK
     1         PXGR         PXNG         PXFS          PXPF          ")
 2160 FORMAT(1H0,  "                           RPXPF        RPXPTM         RPX
     1PK   ")
 2170 FORMAT(1H0,  "                            TLM          TLW          CLM
     1          TA          TB         CLGR        TLWPCB   ")
 2200 FORMAT(1H ,20X,4X,I4,9X,I2,5X,7F12.6)
 2210 FORMAT(1H ,20X,9F12.6)
 5001 FORMAT(1H1,12A2,37X,13HSCENARIO RUN  , I2)
 6000 FORMAT(8X,8F9.5)
```

```
PROGRAM MPFOOD      74/74   OPT=1                          FTN 4.4+

 7000 FORMAT(10X,7F10.5)
 8002 FORMAT(1H1)
 8003 FORMAT(I4)
C
      STOP
      END
```

ROUTINE RESET 74/74 OPT=1 FTN 4.4+R401 75

```
      SUBROUTINE RESET
      REAL IALV,IALD,NGGP,M,IAFK,IAFV,INA,MA
      REAL INV,IAS,IAP,IMN,IR
      REAL IAKS,K1,IAPK,IALVK,MAK,MC,IAK,IRK,IA,LSFTK,NGGPK
      COMMON /A1/ ISTAT, IYR,IREG,ISCEN
      COMMON /AR/ PTPCR,CLPCR,PTPCB,PTAPCR,POP,CGR,IALD,CCLDH,Y,YA,YNA,C
     1A,CL,CLGR,TLLS,FCLR,IALV,TPF,SUAF,PXPF,GRGP,NGGP,SLVV,FWT,M,SPT,PT
     2R,ENZPLK,ENZFR ,ENZ,SAVV,IAFK,IAFV,YPC,DPTPC
      COMMON /POPR/ PRONOR,EO,EU,EA,X0,TL,CBR,CDR,FERT,AMORT,TOT,TOT15,
     1PRODST,FERTE,FERTD,AM0,AP,AF,AM
      COMMON /ECON/ MA,UAFK,IAKS,K1,IAPK,IALVK,MAK,YAX,MC,A,DA,DNA,QNA,
     1IAK,IRK,GI,GC,GG,GM,IA,CNA,INA,INV,IAS,IAP,IMN,IR,TAIDR,AID
      COMMON /LAND1/ TLWPCB,TLM,TLW,CLM,TA,TB
      COMMON /LAND0/ CLNG,CLD,CLW
      COMMON /FDI/ GZPHK,FB,FD,FE,FC,RLLVS,AWFMK,WB,UFWPK,UFWP,FWCM,FWCN
     1TK,SLVK,PXLVP,CLK,PTK,SPFTK,LSFTK,FFTK,NGGPK,GRGPK,SLV,SLVMK,XHMLF
     2,FWPM,FWMM
      COMMON /PRI/ RPXPF,RPXPTM,PXLV,PXLVK,PXK,PXGR,PXNG,PXFS,RPXPK,PXPT
     1M
      COMMON /OPTIM/ PPCSAV,CAX,SYSYNA,CLR,NFLAG
      COMMON /OLD/ OLD
      DIMENSION A(2,2),AP(86),AF(86),AM(86),SLVK( 9),PXLVP(9),
     1CLK(26),PTK(26),SPFTK(26),LSFTK(26),FFTK(26),NGGPK(8),GRGPK(5),
     2SLV(9),SLVMK(12),XHMLF(26),PPCSAV(15)
      DIMENSION OLD(155)
      IYR = OLD(1)
      FERT = OLD (2)
      DO 10 I=1,86
      I1 = I + 2
10    AP(I) = OLD(I1)
      DO 20 I=1,15
      I1 = I + 88
20    PPCSAV(I) = OLD(I1)
      YA = OLD(104)
      YNA = OLD(105)
      IA = OLD(106)
      INA = OLD(107)
      CAX = OLD(108)
      CNA = OLD(109)
      SYSYNA = OLD (110)
      TLW = OLD(111)
      CLR = OLD(112)
      CCLDH = OLD(113)
      CL = OLD(114)
      CLNG = OLD(115)
      CLGR = OLD(116)
      DO 30 I = 1,9
      I1 = I + 116
30    SLV(I) = OLD(I1)
      FWCM = OLD(126)
      UFWP = OLD(127)
      PTPCR = OLD(128)
      PXK = OLD(129)
      PXPTM = OLD(130)
      PXPF = OLD(131)
      INV = OLD(132)
      IR = OLD(133)
```

SUBROUTINE RESET 74/74 OPT=1 FTN 4.4+R401

```
      IMN = OLD(134)
      IAP = OLD(135)
      IALV = OLD(136)
      IALD = OLD(137)
      IAS = OLD(138)
      CLD = OLD(139)
      FCLR = OLD(140)
      TLLS = OLD(141)
      CLW = OLD(142)
      Y = OLD(143)
      YAX = OLD(144)
      AID = OLD(145)
      TAIDR = OLD(146)
      ENZ = OLD(147)
      ENZFR = OLD(148)
      IAMS = OLD(149)
      SUAF = OLD(150)
      CA=OLD(151)
      RETURN
      END
```

SUBROUTINE SET 74/74 OPT=1 FTN 4.4+R401 7

```
      SUBROUTINE SET
      REAL IALV,IALD,NGGP,M,IAFK,IAFV,INA,MA
      REAL INV,IAS,IAP,IMN,IR
       REAL IAKS,K1,IAPK,IALVK,MAK,MC,IAK,IRK,IA,LSFTK,NGGPK
      COMMON /AI/ ISTAT, IYR,IREG,ISCEN
      COMMON /AR/ PTPCR,CLPCR,PTPCB,PTAPCR,POP,CGR,IALD,CCLDH,Y,YA,YNA,C
     1A,CL,CLGR,TLLS,FCLR,IALV,TPS,SUAF,PXPF,GRGP,NGGP,SLVV,FWT,M,SPT,PT
     2R,ENZPLK,ENZFR ,ENZ,SAVV,IAFK,IAFV,YPC,DPTPC
      COMMON /POPR/ PRONOR,EC,EU,EA,XC,TL,CBR,CDR,FERT,AMORT,TOT,TOT15,
     1PRODST,FERTE,FERTO,AMO,AP,AF,AM
      COMMON /ECON/ MA,UAFK,IAKS,K1,IAPK,IALVK,MAK,YAX,MC,A,DA,DNA,QNA,
     1IAK,IRK,GI,GC,GG,GM,IA,CNA,INA,INV,IAS,IAP,IMN,IR,TAIDR,AID
      COMMON /LANDI/ TLWPCB,TLM,TLW,CLM,TA,TB
      COMMON /LANDO/ CLNG,CLD,CLW
      COMMON /FDI/ GZPHK,FB,FD,FE,FC,RLLVS,AWFMK,WB,UFWPK,UFWP,FWCM,FWCN
     1TK,SLVK,PXLVP,CLK,PTK,SPFTK,LSFTK,FFTK,NGGPK,GRGPK,SLV,SLVMK,XHMLF
     2,FWPM,FWMM
      COMMON /PRI/ RPXPF,RPXPTM,PXLV,PXLVK,PXK,PXGR,PXNG,PXFS,RPXPK,PXPT
     1M
      COMMON /OPTIM/ PPCSAV,CAX,SYSYNA,CLR,NFLAG
      COMMON /OLD/ OLD
      DIMENSION A(2,2),AP(86),AF(86),AM(86),SLVK( 9),PXLVP(9),
     1CLK(26),PTK(26),SPFTK(26),LSFTK(26),FFTK(26),NGGPK(8),GRGPK(5),
     2SLV(9),SLVMK(12),XHMLF(26),PPCSAV(15)
      DIMENSION OLD(155)
      OLD(1) = IYR
      OLD(2) = FERT
      DO 10 I=1,86
      I1 = I+2
   10 OLD(I1) = AP(I)
      DO 20 I=1,15
      I1 = I+88
   20 OLD(I1) = PPCSAV(I)
      OLD(104) = YA
      OLD(105) = YNA
      OLD(106) = IA
      OLD(107) = INA
      OLD(108) = CAX
      OLD(109) = CNA
      OLD(110) = SYSYNA
      OLD(111) = TLW
      OLD(112) = CLR
      OLD(113) = CCLDH
      OLD(114) = CL
      OLD(115) = CLNG
      OLD(116) = CLGR
      DO 30 I=1,9
      I1 = I + 116
   30 OLD(I1) = SLV(I)
      OLD(126) = FWCM
      OLD(127) = UFWP
      OLD(128) = PTPCR
      OLD(129) = PXK
      OLD(130) = PXPTM
      OLD(131) = PXPF
      OLD(132) = INV
      OLD(133) = IR
```

```
      OLD(134) = IMN
      OLD(135) = IAP
      OLD(136) = IALV
      OLD(137) = IALD
      OLD(138) = IAS
      OLD(139) = CLD
      OLD(140) = FCLR
      OLD(141) = TLLS
      OLD(142) = CLW
      OLD(143) = Y
      OLD(144) = YAX
      OLD(145) = AID
      OLD(146) = TAIDR
      OLD(147) = ENZ
      OLD(148) = ENZFR
      OLD(149) = IAKS
      OLD(150) = SUAF
      OLD(151) = CA
      RETURN
      END
```

```
SUBROUTINE POPUL      74/74   OPT=1                    FTN 4.4+R401      75/
      SUBROUTINE POPUL
      REAL IALV,IALD,NGGP,M,IAFK,IAFV,IAKSA
      DIMENSION AP(86),AF(86),AM(86),AMPF(86),PPCSAV(15)
      DIMENSION DRUPOP(9,101),DRUEC1(11,101),DRUEC2(8,101),DRULAN(9,101)
     1,DRUFO1(10,101),DRUFC2(7,101),DRUFO3(6,101),DRUFO4(10,101),
     2DRUPR1(6,101),DRUPR2(6,101),DRUPR3(7,101),NAME(12)
      COMMON /DRUCK/ DRUPOP,DRUEC1,DRUEC2,DRULAN,DRUFO1,
     1DRUFO2,DRUFO3,DRUFO4,DRUPR1,DRUPR2,DRUPR3,NAME
      COMMON /POPI/ KONTR,INT
      COMMON /POPR/ PRONOR,EO,EU,EA,X0,TL,CBR,CDR,FERT,AMORT,TOT,TOT15,
     1PRODST,FERTE,FERT0,AMP,AP,AF,AM
      COMMON /AI/ ISTAT, IYR,IREG,ISCEN
      COMMON /AR/ PTPCR,CLPCR,PTPCB,PTAPCR,POP,CGR,IALD,CCLDH,Y,YA,YNA,C
     1A,CL,CLGR,TLIS,FCLR,IALV,TPF,SUAF,PXPF,GRGP,NGGP,SLVV,FWT,M,SPT,PT
     2R,ENZPLK,ENZFR ,ENZ,SAVV,IAFK,IAFV,YPC,DPTPC
      COMMON /OPTIM/ PPCSAV,CAX,SYSYNA,CLR,NFLAG
C
C     INITIALISATION
C
      POP = 0.0
      DO 35 J=1,86
      POP = POP + AP(J)
   35 CONTINUE
C
C     START
C
      IF(IYR .EQ. ISTAT) FERT = FERT0
      IF(IYR-KONTR) 100,40,40
   40 IF(INT) 80,80,45
   45 FK = 0.7/INT
      IF(IYR-KONTR-INT)50,80,80
   50 IF(IYR-KONTR-5*INT/7) 60,75,75
   60 IF(IYR-KONTR-2*INT/7) 75,70,70
   70 FK=FK*2.0
   75 FERT = FERT  - (FERT0-FERTE)*FK
      GO TO 100
   80 FERT = FERTE
  100 CONTINUE
C
C     MORTALITY MULTIPLIER
C
      IF(EO+EU+EA+X0+TL .EQ. 0) GO TO 160
      IF(IYR .NE. ISTAT) GO TO 130
      DO 120 I=1,15
      PPCSAV(I) = PRONOR
  120 CONTINUE
      GO TO 160
  130 PROPCI = PTPCR*PRODST*1000.0/365.0
      PROPCN = PPCSAV(1)
      IMAX = TL+0.5
      IF(IMAX .LE. 0 ) IMAX = 1
      IF(IMAX-1) 142,142,135
  135 DO 140 I=2,IMAX
      J=I-1
      PPCSAV(J)=PPCSAV(I)
  140 CONTINUE
  142 PPCSAV(IMAX) = PROPCI
```

```
E POPUL      74/74   OPT=1                    FTN 4.4+R401      75/08/11

      IF(PRONOR .LE. PROPCN) GO TO 160
      IF (PROPCN .LE. X0+0.5) GO TO 143
      PROFAC = (PRONOR-X0)/(PROPCN-X0)-1.0
      GO TO 144
  143 PROFAC = 40.0
  144 AMPF0 = PROFAC*E0 + 1.0
      AMPF(86) = PROFAC*EU + 1.0
      DO 150 I=1,85
      E = EU
      IF(E0 .EQ. EU .OR. EA .EQ. 0) GO TO 145
      E =  (E0 - EU)*EXP(-I/EA) + EU
  145 AMPF(I) = PROFAC*E + 1.0
  150 CONTINUE
      GO TO 180
  160 DO 170 I=1,86
      AMPF(I) = 1.0
  170 CONTINUE
      AMPF0 = 1.0
  180 CONTINUE
      BAB = 0.0
      DO 190 I=1,86
      BAB = BAB + AP(I)*AF(I)*FERT
  190 CONTINUE
      TOT = 0.5*BAB*AM0  *AMORT*AMPF0
      DO 200 I=1,15
      TOT = TOT + AP(I)*AM(I)*AMORT*AMPF(I)
  200 CONTINUE
      TOT15 = TOT
      DO 205 I=16,86
      TOT = TOT + AP(I)*AM(I)*AMORT*AMPF(I)
  205 CONTINUE
      AP(86) = AP(85)*(1.0 - AMORT*AM(85)*AMPF(85)) + AP(86)*(1.0 - AMOR
     1T*AM(86)*AMPF(86))
      DO 210 I=1,84
      J = 86-I
      J1=J-1
      AP(J)=AP(J1)*(1.0 - AMORT*AM(J1)*AMPF(J1))
  210 CONTINUE
      AP(1)=BAB*(1.0 - 0.5*AM0*AMPF0*AMORT)
      CBR = BAB/POP
      CDR = TOT/POP
      CGR = CBR - CDR
      II = IYR - ISTAT + 1
      DRUPOP(1,II) = POP
      DRUPOP(2,II) = BAB
      DRUPOP(3,II) = TOT
      DRUPOP(4,II) = FERT
      DRUPOP(5,II) = AMORT
      DRUPOP(6,II) = CBR
      DRUPOP(7,II) = CDR
      DRUPOP(8,II) = CGR
      DRUPOP(9,II) = TOT15
      POP = 0.0
      DO 220 J = 1,86
  220 POP = POP + AP(J)
  300 CONTINUE
      RETURN
```

```
SUBROUTINE POPUL      74/74    OPT=1                    FTN 4.4+R401

                      END
```

ROUTINE ECO 74/74 OPT=1 FTN 4.4+R401 7

```
      SUBROUTINE ECO
      REAL IALV,IALD,NGGP,M,IAFK,IAFV
      REAL I,IAS,IAKS,IA,IAP,IALVK,IAPK,IMN,INA,IR,K1,MI,MC,MA,MAK,IRK,
     1IAK
      DIMENSION A(2,2),AINV(2,2),Z(2),U(2),PPCSAV(15)
      DIMENSION DRUPOP(9,101),DRUEC1(11,101),DRUEC2(8,101),DRULAN(9,101)
     1,DRUFO1(10,101),DRUFO2(7,101),DRUFO3(6,101),DRUFO4(10,101),
     2DRUPR1(6,101),DRUPR2(6,101),DRUPR3(7,101),NAME(12)
      COMMON /DRUCK/ DRUPOP,DRUEC1,DRUEC2,DRULAN,DRUFO1,
     1DRUFO2,DRUFO3,DRUFO4,DRUPR1,DRUPR2,DRUPR3,NAME
      COMMON /AI/ ISTAT, IYR,IREG,ISCEN
      COMMON /AR/ PTPCR,CLPCR,PTPCB,PTAPCR,POP,CGR,IALD,CCLDH,Y,YA,YNA,C
     1A,CL,CLGR,TLLS,FCLR,IALV,TPF,SUAF,PXPF,GRGP,NGGP,SLVV,FWT,M,SPT,PT
     2R,ENZPLK,ENZFR ,ENZ,SAVV,IAFK,IAFV,YPC,DPTPC
      COMMON /ECON/ MA,UAFK,IAKS,K1,IAPK,IALVK,MAK,YAX,MC,A,DA,DNA,QNA,
     1IAK,IRK,GI,GC,GG,GM,IA,CNA,INA,I,IAS,IAP,IMN,IR,TAIDR,AID
      COMMON /OPTIM/ PPCSAV,CAX,SYSYNA,CLR,NFLAG
C
C     INITIALISATION
      IF(IYR-ISTAT) 10,40,40
   10 DET = (1.0-A(1,1))*(1.0-A(2,2))-A(1,2)*A(2,1)
      AINV(1,1)=(1.0-A(2,2))/DET
      AINV(2,2)=(1.0-A(1,1))/DET
      AINV(1,2)=A(1,2)/DET
      AINV(2,1)=A(2,1)/DET
      YNA = CNA/QNA
      CAX = CA
      YA = Y - YNA
      YAX = YA
      QA = CA/YA
      SYSYNA = Y/YNA
      Z(1)=AINV(1,1)*YA + AINV(1,2)*YNA
      Z(2)=AINV(2,1)*YA + AINV(2,2)*YNA
      U(1)=A(1,1)*Z(1)+A(1,2)*Z(2)
      U(2)=A(2,1)*Z(1)+A(2,2)*Z(2)
      UA = A(2,1)*Z(2)
      SUAF = UA*UAFK
      AID = TAID(ISTAT)
      TAIDR = AID/SUAF
      I = GI*Y
      IA = IAK*I
      INA = I - IA
      IR = IRK*I
      IMN = I - IR
      IAP = IAPK* IA
       IALV = IALVK*IA
       IAFV = IAFK*IA
      IALD = IA - IAP - IALV - IAFV
      M = GM*Y
      GO TO 500
   40 CONTINUE
C
C     START
C
      II = IYR - ISTAT + 1
      DRUEC1(1,II) = CA
      DRUEC1(2,II) = CNA
```

SUBROUTINE ECO 74/74 OPT=1 FTN 4.4+R40

```
      DRUEC1(3,II) = Y
      DRUEC1(4,II) = YA
      DRUEC1(5,II) = YAX
      DRUEC1(6,II) = YNA
      DRUEC1(7,II) = YPC
      DRUEC1( 8,II) = IAS
      DRUEC1( 9,II) = IAKS
      DRUEC1(10,II) = AID
      DRUEC1(11,II) = TAIDR
      DRUEC2(1,II) = I
      DRUEC2(2,II) = IA
      DRUEC2(3,II) = INA
      DRUEC2(4,II) = IR
      DRUEC2(5,II) = IMN
      DRUEC2(6,II) = IAP
      DRUEC2(7,II) = IALV
      DRUEC2(8,II) = IALD
      CAX = CAX*(1.0-DA) + IA
      CA=CAX
      CNA = CNA*(1.0-DNA) + INA
      CDA = CA*DA
      CDNA = CNA*DNA
      YAX = CAX/QA
      YNA = CNA/GNA
      Y = YNA + YA
C
C     GROSS OUTPUT,INTERMEDIATE DEMAND
C
      Z(1)=AINV(1,1)*YA + AINV(1,2)*YNA
      Z(2)=AINV(2,1)*YA + AINV(2,2)*YNA
      U(1)=A(1,1)*Z(1)+A(1,2)*Z(2)
      U(2)=A(2,1)*Z(1)+A(2,2)*Z(2)
      UA = A(2,1)*Z(2)
      UAF = UA*UAFK
C
C     INVESTMENT
C
      I=GI*YNA*SYSYNA
      SYSYNA = Y/YNA
      IAS = (IAKS - IAK)*I
      IAS = AMAX1(IAS,0.0)
      IA = IAK*I + K1*IAS
      SUAF = UAF + (1.0 - K1)*IAS
      AID = TAID(IYR)
      TAIDR = AID/SUAF
      SUAF = SUAF + AID
      INA = I + K1*IAS - IA - IAS
      IR = I*IRK
      IMN = I - IR
      IAP = IAPK*IA
      IALV = IALVK*IA
      IAFV = IAFK*IA
       IALD = IA - IAP - IALV - IAFV
C
C        CONSUMPTION,GOVERMENTAL EXPENDITURES,IMPORTS
C
      C = GC*Y
```

SUBROUTINE ECO 74/74 OPT=1 FTN 4.4+R401

```
      G = GG*Y
      M = GM*Y
      MA = MAK*M
      IF(IMN-M+MA) 70,70,80
   70 MI = M - MA
      GO TO 90
   80 MI = IMN
   90 MC = M - MA -MI
      MC = AMAX1(MC,0.0)
  500 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE LAND
      REAL IALV,IALD,NGGP,M,IAFK,IAFV
      DIMENSION DRUPOP(9,101),DRUEC1(11,101),DRUEC2(8,101),DRULAN(9,101)
     1,DRUFO1(10,101),DRUFO2(7,101),DRUFO3(6,101),DRUFO4(10,101),
     2DRUPR1(6,101),DRUPR2(6,101),DRUPR3(7,101),NAME(12)
      DIMENSION PPCSAV(15)
      COMMON /DRUCK/ DRUPOP,DRUEC1,DRUEC2,DRULAN,DRUFO1,
     1DRUFO2,DRUFO3,DRUFO4,DRUPR1,DRUPR2,DRUPR3,NAME
      COMMON /LANDI/ TLWPCB,TLM,TLW,CLM,TA,TB
      COMMON /LANDO/ CLNG,CLD,CLW
      COMMON /AI/ ISTAT, IYR,IREG,ISCEN
      COMMON /AR/ PTPCR,CLPCR,PTPCB,PTAPCR,POP,CGR,IALD,CCLDH,Y,YA,YNA,C
     1A,CL,CLGR,TLLS,FCLR,IALV,TPF,SUAF,PXPF,GRGP,NGGP,SLVV,FWT,M,SPT,PT
     2R,ENZFLK,ENZFR ,ENZ,SAVV,IAFK,IAFV,YPC,DPTPC
      COMMON /OPTIM/ PPCSAV,CAX,SYSYNA,CLR,NFLAG
C
C     INITIALISATION
C
      IF(IYR-ISTAT) 10,40,40
   10 CLNG=TA+TB*CLGR
      CLWR= CLM/TLM
      CL = CLGR+CLNG
      CLW = TLW*CLWR
      GLM = TLM - CLM
      CLR = CLM - CL - CLW
      GO TO 100
   40 TLWR=TLW/TLM
      II = IYR - ISTAT + 1
      DRULAN(1,II) = CLGR
      DRULAN(2,II) = CLNG
      DRULAN(3,II) = CL
      DRULAN(4,II) = CLD
      DRULAN(5,II) = CLW
      DRULAN(6,II) = CLR
      DRULAN(7,II) = TLLS
      DRULAN(8,II) = FCLR
      DRULAN(9,II) = CCLDH
      TLWM= TLWMF(TLWR)
      TLAW= CGR*POP*TLWM*TLWPCB
      CLAW = TLAW*CLWR
      CLW = TLW*CLWR
      GLW = TLW - CLW
      GL  = GLM - GLW
      TLLS= GL + CLR
      TLW = TLW + TLAW
      FCLR= CLR/(CLM-CLW)
      CLD = IALD/CCLDH
      CLDNG = CLD*CLNG/CL
      CLDGR = CLD*CLGR/CL
      CLWGR = CLAW*CLGR/CL
      CLGR = CLGR + CLDGR - CLWGR
      CLNG = TA + TB*CLGR
      CL = CLGR + CLNG
      CLR = CLM - CL - CLW
      IF(CLR .GT. 0) GO TO 100
      CLR = 0.0
      CLD = 0.0
```

```
      CLGR = CLGR - CLOGR + CLWGR
      CLNG = TA + TB*CLGR
      CL = CLGR + CLNG
  100 CONTINUE
      RETURN
      END
```

FUNCTION TLWMF 74/74 OPT=1 FTN 4.4+R401

```
C
C
      REAL FUNCTION TLWMF(TLWR,IREG)
      IF(0.2-TLWR) 20,10,10
   10 TLWMF = -0.1*TLWR + 1.0
      GO TO 200
  200 IF(0.3-TLWR) 40,30,30
   30 TLWMF = 1.1- 0.6*TLWR
      GO TO 200
   40 IF(0.4-TLWR) 60,50,50
   50 TLWMF = 1.28 - 1.2*TLWR
      GO TO 200
   60 IF(0.5-TLWR) 80,70,70
   70 TLWMF = 1.6 - 2.0*TLWR
      GO TO 200
   80 IF(0.6 - TLWR) 100,90,90
   90 TLWMF = 2.1 - 3.0*TLWR
      GO TO 200
  100 IF(0.65 - TLWR) 120,110,110
  110 TLWMF = 3.9 - 6.0*TLWR
      GO TO 200
  120 TLWMF = 0.0
  200 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE FOOD
      REAL IALV,IALD,NGGP,M,IAFK,IAFV
      REAL LSFTK,NGGPK,LVPL,LSFT
      DIMENSION PPCSAV(15)
      DIMENSION ALVI(9),CLK(26),FFTK(26),FGP(26),FTN(26),FTS(26),
     1    FSKPL(26),GRGPK(5),LSFTK(26),LVPL(9),NGGPK(8),PTK(26),PXLVP(9)
     2   ,SFT(26),SLV(9),SLVK(9),SLVMK(12),SPFTK(26),UALV(9),VCLPCR(26),
     3    VPTPCR(26),XHMLF(26),FTG(26),LSFT(26)
      DIMENSION DRUPOP(9,101),DRUEC1(11,101),DRUEC2(8,101),DRULAN(9,101)
     1,DRUF01(10,101),DRUF02(7,101),DRUF03(6,101),DRUF04(10,101),
     2DRUPR1(6,101),DRUPR2(6,101),DRUPR3(7,101),NAME(12)
      COMMON /DRUCK/ DRUPOP,DRUEC1,DRUEC2,DRULAN,DRUF01,
     1DRUF02,DRUF03,DRUF04,DRUPR1,DRUPR2,DRUPR3,NAME
      COMMON /FDI/ GZPHK,FB,FD,FE,FC,RLLVS,AWFMK,WB,UFWPK,UFWP,FWCM,FWCN
     1TK,SLVK,PXLVP,CLK,PTK,SPFTK,LSFTK,FFTK,NGGPK,GRGPK,SLV,SLVMK,XHMLF
     2,FWPM,FWMM
      COMMON /FDO/ DPT,PTN
      COMMON /AI/ ISTAT, IYR,IREG,ISCEN
      COMMON /AR/ PTPCR,CLPCR,PTPCB,PTAPCR,POP,CGR,IALD,CCLDH,Y,YA,YNA,C
     1A,CL,CLGR,TLLS,FCLR,IALV,TPF,SUAF,PXPF,GRGP,NGGP,SLVV,FWT,M,SPT,PT
     2R,ENZPLK,ENZFR ,ENZ,SAVV,IAFK,IAFV,YPC,DPTPC
      COMMON /OPTIM/ PPCSAV,CAX,SYSYNA,CLR,NFLAG
C
C     INITIALISATION
C
C
C     CROP PRODUCTION
C
      YNAPC = YNA/POP
      CAPH  = CA/CL
      PTFC  = PTFCF(CAPH,IREG)
      PMCI  = PMCIF(YNAPC,IREG)
      FA = PMCI+PTFC+1.5
      ZPHG = TPF*GZPHK/CLGR*1000.0
      TEMP = FA - FB
      GRPH = FA - TEMP*EXP(-FC/TEMP*ZPHG)
      GRGP = CLGR*GRPH
      NGGP = FD+FE*GRGP
C
C     LIVESTOCK PRODUCTION
C
      SLVMA = RLLVS*TLLS
      SLVA  = SLV(2)*SLVK(2)+SLV(4)+SLV(5)+SLV(9)
      SLVAR = SLVA/SLVMA
      XLVPLM = XLVPLF (SLVAR,IREG)
      DO 40 J=1,9
      LVPL(J)= PXLVP(J)*XLVPLM
      UALV(J) = IALV*SLV(J)*SLVK(J)/SLVA
      ALVI(J) = UALV(J)/LVPL(J)
      SLV(J) = SLV(J) + ALVI(J)
   40 CONTINUE
      DO 50 J=1,8
      FGP(J) = SLV(J)*SLVMK(J)/1000.0
   50 CONTINUE
      DO 60 J=9,12
      FGP(J) = SLV(9)*SLVMK(J)/1000.0
   60 CONTINUE
```

SUBROUTINE FOOD 74/74 OPT=1 FTN 4.4+R40

```
      SLVV = 0.0
      DO 70 J=1,5
      SLVV = SLVV + FGP(J)
   70 CONTINUE
      SAVV = FGP(7) + FGP(8) + FGP(9)
C
C     FISH PRODUCTION
C
       IF(IYR .EQ. ISTAT) GO TO 88
      AWFM = FWCM*AWFMK
      AUFWP = UFWP*WB
   88 FWCP = UFWP*UFWPK
      UFWP=AMIN1(UFWP+AUFWP,FWPM)
      FWCM = AMIN1(FWCM+AWFM,FWMM)
      FWCT = FWCM + FWCP
      FWT = FWCT*FWCNTK
      FGP(13)= FWT
C
C     FOOD PRODUCTION
C
      DO 80 J=14,21
      I=J-13
      FGP(J)= NGGP*NGGPK(I)
   80 CONTINUE
      DO 90 J=22,26
      I=J-21
      FGP(J)= GRGP*GRGPK(I)
   90 CONTINUE
      CLPCR = 0.0
      PTPCR = 0.0
      DO 100 J=1,26
      SFT(J) = FGP(J)*SPFTK(J)
      FTS(J) = FGP(J)
      LSFT(J) = LSFTK(J)*FTS(J)
      FTG(J) = FFTK(J)*FTS(J)
      FTN(J) = FTG(J)*(1.0-XHMLF(J))
      FSRPC(J) = FTN(J)*1000.0/POP
      VCLPCR(J)= FSRPC(J)*CLK(J)
      VPTPCR(J)= FSRPC(J)*PTK(J)/100.0
      CLPCR = CLPCR + VCLPCR(J)
      PTPCR = PTPCR + VPTPCR(J)
  100 CONTINUE
      PTAPCR = 0.0
      DO 110 J=1,13
      PTAPCR = PTAPCR + VPTPCR(J)
  110 CONTINUE
      PTAR = PTAPCR*POP/1000.0
C
C     NEEDS
C
      PTR = PTPCR*POP/1000.0
      AID = FAID(IYR)
      PTPCR = (PTR + AID)*1000.0/POP
      FAIDR = AID/PTR
      YPC = Y/POP
      PTNM = PTNMF(YPC,IREG)
      PTPCN = PTPCR*PTNM
```

SUBROUTINE FOOD 74/74 OPT=1 FTN 4.4+R4

```
      SPTPC = AMAX1(PTPCR - PTPCN,0.0)
      DPTPC = AMAX1(PTPCN - PTPCR,0.0)
      PTPCSN = PTPCR/PTPCN
      PTN = PTPCN*POP/1000.0
      DPT = DPTPC*POP/1000.0
      SPT = SPTPC*POP/1000.0
      PTPCDR = PTPCR/365.0
      II = IYR - ISTAT + 1
      DRUFD1(1,II) = SUAF
      DRUFD1(2,II) = PXPF
      DRUFD1(3,II) = ZPHG
      DRUFD1(4,II) = GRPH
      DRUFD1(5,II) = GRGP
      DRUFD1(6,II) = NGGP
      DRUFD1(7,II) = ENZ
      DRUFD1(8,II) = ENZFR
      DRUFD1(9,II) = AID
      DRUFD1(10,II) = FAIDR
      DRUFD2(1,II) = YNAPC
      DRUFD2(2,II) = PMCI
      DRUFD2(3,II) = CAPH
      DRUFD2(4,II) = PTFC
      DRUFD2(5,II) = FA
      DRUFD2(6,II) = ZPHG
      DRUFD2(7,II) = GRPH
      DRUFD3(1,II) = FWT
      DRUFD3(2,II) = SLVA
      DRUFD3(3,II) = SLVMA
      DRUFD3(4,II) = SLVAR
      DRUFD3(5,II) = XLVPLM
      DRUFD3(6,II) = IALV
      DRUFD4(1,II) = PTR
      DRUFD4(2,II) = PTPCR
      DRUFD4(3,II) = DPT
      DRUFD4(4,II) = DPTPC
      DRUFD4(5,II) = PTN
      DRUFD4(6,II) = PTAR
      DRUFD4(7,II) = PTAPCR
      DRUFD4(8,II) = PTPCSN
      DRUFD4(9,II) = PTPCDR
      DRUFD4(10,II) = SPT
  500 CONTINUE
      RETURN
      END
```

FUNCTION PTFCF 74/74 OPT=1 FTN 4.4+R401

```
C
C
      REAL FUNCTION PTFCF(CAPH,IREG)
      PTFCF = 0.2171468*ALOG(CAPH)+1.0
      RETURN
      END
```

FUNCTION PMCIF 74/74 OPT=1 FTN 4.4+R401

```
C
      REAL FUNCTION PMCIF(YNAPC,IREG)
      PMCIF = 0.1737361*ALOG(YNAPC) + 1.4
      RETURN
      END
```

FUNCTION XLVPLF 74/74 OPT=1 FTN 4.4+R40

```
C
C
      REAL FUNCTION XLVPLF(SLVAR,IREG)
      IF(SLVAR - 1.0) 10,10,20
 10   XLVPLF = SLVAR/10.0 + 0.9
      GO TO 30
 20   XLVPLF = EXP(ALOG(2.2)*(2.0*SLVAR - 1.0)) - 1.0
 30   CONTINUE
      RETURN
      END
```

FUNCTION PTNMF 74/74 OPT=1 FTN 4.4+R401

```
C
      REAL FUNCTION PTNMF(YPC,IREG)
      IF(IREG .EQ. 9 ) GO TO 35
      IF(YPC-0.151) 10,10,15
   10 PTNMF = 1.0
      GO TO 40
   15 XHELP = 1.0 - 3.58/(YPC-0.13006)
      IF(XHELP) 20,20,30
   20 PTNMF = 1.0 + (80.0*EXP(XHELP))/44.0
      GO TO 40
   30 PTNMF = 1.0 + 80.0/44.0
      GO TO 40
   35 PTNMF = 1.0
   40 CONTINUE
      RETURN
      END
```

```
UBROUTINE PRICE      74/74   OPT=1                          FTN 4.4+R401      75

      SUBROUTINE PRICE
      REAL IALV,IALD,NGGP,M,IAFK,IAFV
      DIMENSION PPCSAV(15)
      DIMENSION DRUPC1(11,101),DRUEC2(6,101),DRULAN(9,101)
     1,DRUFC1(11,101),DRUFC2(7,101),DRUFC3(6,101),DRUFC4(10,101),
     2DRUPR1(6,101),DRUPR2(6,101),DRUPR3(7,101),NAME(12)
      COMMON /DRUCK/ DRUPOP,DRUEC1,DRUEC2,DRULAN,DRUFC1,
     1DRUFC2,DRUFC3,DRUFC4,DRUPR1,DRUPR2,DRUPR3,NAME
      COMMON /AI/ ISTAT, IYR,IREG,ISCEN
      COMMON /AR/ PTPCR,CLPCR,PTPCB,PTAPCR,POP,CGR,IALD,CCLDH,Y,YA,YNA,C
     1A,CL,CLGR,TLLS,FCLR,IALV,TPF,SUAF,PXPF,GRGP,NGGP,SLVV,FWT,M,SPT,PT
     2R,EN7PLK,EN7PR ,EN7,SAVV,IAFK,IAFV,YPC,DPTPC
      COMMON /PR1/ RPXPF,RPXPTM,PXLV,PXLVK,PXK,PXGR,PXNG,PXFS,RPXPK,PXPT
     1M
      COMMON /PRO/ FDMV,FDMAR,FDMYR,FDMMR,FDXV,FDXAR,FDXYR,FDX9YR,FDX9AR
     1,PTX9RR,PTX9SR
       COMMON /FDO/ DPT,PTN
      COMMON /OPTIM/ PPCSAV,CAX,SYSYNA,CLR,NFLAG
      REAL NGV,LVV
C
C     INITIALISATION
C
      IF(IYR-ISTAT) 10,30,30
   10 TPF = SUAF/PXPF
      GO TO 100
   30 PXLVP = PXLV*PXLVK*PXK
      GRV = GRGP*PXGR*PXK
      NGV = NGGP*PXNG*PXK
      LVV = SLVV*PXLVP
      FSV = FWT*PXFS*PXK
      YA = GRV+NGV+LVV+FSV
      YAPC=YA/POP
      TPF    = SUAF/ PXPF
      IF(FCLR-1.0E-10) 40,40,35
   35 CCLDH = XKCLDH(FCLR,IREG)
      GO TO 50
   40 CCLDH = 1.0E+10
   50 CONTINUE
C
C     IMPORTS
C
      FDMV   = DPT*PXPTM
      FDMAR = FDMV/YA
      FDMYR = FDMV/Y
      FDMMR = FDMV/M
C
C     EXPORTS
C
      FDXV    = YA*SPT/PTR
      FDXAR   = FDXV/YA
      FDXYR   = FDXV/Y
      FDX9YR = FDXV9/Y
      FDX9AR = FDXV9/YA
      PTX9RR = PTX9/PTR
      PTX9SR = 0.0
      IF(SPT .GT. 1.0E-5) PTX9SR = PTX9/SPT
C
```

SUBROUTINE PRICE 74/74 OPT=1 FTN 4.4+R401

```
C       ENERGY
C
        ENZ = TPF*ENZPLK
        ENZFR = CLPCR*POP/ENZ/1000.0
        II = IYR - ISTAT + 1
        DRUPR1(1,II) = PXLVP
        DRUPR1(2,II) = GRV
        DRUPR1(3,II) = NGV
        DRUPR1(4,II) = SLVV
        DRUPR1(5,II) = LVV
        DRUPR1(6,II) = FSV
        DRUPR2(1,II) = FDMV
        DRUPR2(2,II) = FDMAR
        DRUPR2(3,II) = FDMYR
        DRUPR2(4,II) = FDMMR
        DRUPR2(5,II) = M
        DRUPR2(6,II) = PXPTM
        DRUPR3(1,II) = FDXV
        DRUPR3(2,II) = FDXAR
        DRUPR3(3,II) = FDXYR
        DRUPR3(4,II) = FDX9YR
        DRUPR3(5,II) = FDX9AR
        DRUPR3(6,II) = PTX9RR
        DRUPR3(7,II) = PTX9SR
        PXPTM = PXPTM*(1.0+RPXPTM)
        PXK = PXK*(1.0 + RPXPK)
        PXPF  = PXPF *(1.0+RPXPF )
  100 CONTINUE
        RETURN
        END
```

FUNCTION XKCLDH 74/74 OPT=1 FTN 4.4+R401

```
C
C
      REAL FUNCTION XKCLDH(FCLR,IREG)
      GO TO(100,200,200,200,200,200,200,200,900,900)IREG
  100 IF(0.65-FCLR) 120,140,140
  120 XKCLDH = 0.1
      GO TO 2000
  140 IF(0.1-FCLR) 160,180,180
  160 XKCLDH = -(2.2*FCLR)/0.55 + 2.3 + 0.22/0.55
      GO TO 2000
  180 XKCLDH = (2.3+(0.1-FCLR)*16.0)
      GO TO 2000
  200 XKCLDH = 1.2 +8.8*EXP(-16.87*FCLR)
      GO TO 2000
  900 IF(0.1-FCLR) 910,910,920
  910 XKCLDH = -0.35*FCLR + 0.155
      GO TO 200
  920 IF(0.05-FCLR) 930,930,940
  930 XKCLDH = -5.6*FCLR + 0.68
      GO TO 2000
  940 IF(0.03-FCLR) 950,950,960
  950 XKCLDH =-25.0*FCLR + 1.65
      GO TO 2000
  960 IF(0.01-FCLR) 970,970,980
  970 XKCLDH = -105.0*FCLR + 4.05
      GO TO 2000
  980 XKCLDH = -9700.0*FCLR + 100.0
 2000 CONTINUE
      RETURN
      END
```

SUBROUTINE DRUCK 74/74 OPT=1 FTN 4.4+R401

```
      SUBROUTINE DRUCK(MAXIYR)
C     DRUCKPROGRAMM FUER FOODANALYSIS PACKAGE
      DIMENSION DRUPOP(9,101),DRUEC1(11,101),DRUEC2(8,101),DRULAN(9,101
     1,DRUFO1(13,101),DRUFO2(7,101),DRUFO3(6,101),DRUFO4(10,101),
     2DRUPR1(6,101),DRUPR2(6,101),DRUPR3(7,101),NAME(12),FELD(5,51)
      DIMENSION NDRU(22)
      COMMON /DRUCK/ DRUPOP,DRUEC1,DRUEC2,DRULAN,DRUFO1,
     1DRUFO2,DRUFO3,DRUFO4,DRUPP1,DRUPR2,DRUPR3,NAME
C
C
      READ(1,8006) (NDRU(I),I=1,22)
      JJ=MAXIYR-1974
      DO 235 I=1,22
      IF(NDRU(I) .NE. 1) GO TO 235
      GO TO(1,2,3,4,5,6,7,8,9,11,12,10,13,14,15,16,17,18,19,21,22,23),I
    1 WRITE(9,1300) (NAME(J),J=1,12)
      WRITE(9,1320)
      DO 20 J=1,JJ
      IYR = 1974 + J
      WRITE(9,1310) IYR,(DRUPOP(L,J),L=1,9)
   20 CONTINUE
      GO TO 235
    2 WRITE(9,1505) (NAME(J),J=1,12)
      WRITE(9,1330)
      DO 30 J=1,JJ
      IYR = 1974+J
      WRITE(9,1341) IYR,(DRUEC1(L,J),L=1,7)
   30 CONTINUE
      GO TO 235
    3 WRITE(9,1510)   (NAME(J),J=1,12)
      WRITE(9,1350)
      DO 40 J=1,JJ
      IYR = 1974 + J
      WRITE(9,1360) IYR,(DRUEC2(L,J),L=1,8)
   40 CONTINUE
      GO TO 235
    4 WRITE(9,1520)   (NAME(J),J=1,12)
      WRITE(9,1370)
      DO 50 J=1,JJ
      IYR = 1974+J
      WRITE(9,1380) IYR,(DRULAN(L,J),L=1,9)
   50 CONTINUE
      GO TO 235
    5 WRITE(9,1530)   (NAME(J),J=1,12)
      WRITE(9,1390)
      DO 60 J=1,JJ
      IYR = 1974 + J
      WRITE(9,1401) IYR,(DRUFO1(L,J),L=1,8)
   60 CONTINUE
      GO TO 235
    6 WRITE(9,1540)   (NAME(J),J=1,12)
      WRITE(9,1410)
      DO 70 J=1,JJ
      IYR = 1974+J
      WRITE(9,1340) IYR,(DRUFO2(L,J),L=1,7)
   70 CONTINUE
      GO TO 235
```

SUBROUTINE DRUCK 74/74 OPT=1 FTN 4.4+R401

```
  7 WRITE(9,1550)   (NAME(J),J=1,12)
    WRITE(9,1430)
    DO 80 J=1,JJ
    IYR = 1974+J
    WRITE(9,1400) IYR,(DRUFO3(L,J),L=1,6)
 80 CONTINUE
    GO TO 235
  8 WRITE(9,1560)   (NAME(J),J=1,12)
    WRITE(9,1440)
    DO 90 J=1,JJ
    IYR = 1974+J
    WRITE(9,1385) IYR,(DRUFO4(L,J),L=1,10)
 90 CONTINUE
    GO TO 235
  9 WRITE(9,1570)   (NAME(J),J=1,12)
    WRITE(9,1450)
    DO 100 J=1,JJ
    IYR = 1974+J
    WRITE(9,1400) IYR,(DRUPR1(L,J),L=1,6)
100 CONTINUE
    GO TO 235
 11 WRITE(9,1580)  (NAME(J),J=1,12)
    WRITE(9,1460)
    DO 110 J=1,JJ
    IYR = 1974 + J
    WRITE(9,1400) IYR,(DRUPR2(L,J),L=1,6)
110 CONTINUE
    GO TO 235
 12 WRITE(9,1590)  (NAME(J),J=1,12)
    WRITE(9,1470)
    DO 120 J=1,JJ
    IYR = 1974 + J
    WRITE(9,1340) IYR,(DRUPR3(L,J),L=1,7)
120 CONTINUE
    GO TO 235
10  WRITE(9,1600) (NAME(J),J=1,12)
    WRITE(9,1480)
    DO 125 J=1,JJ
    IYR = 1974 + J
    WRITE(9,1402) IYR,(DRUEC1(L,J),L=8,11),(DRUFO1(L,J),L=9,10)
125 CONTINUE
    GO TO 235
 13 WRITE(9,3000) (NAME(J),J=1,12)
    WRITE(9,3010)
    DO 130 J=1,51
    FELD(1,J) = DRUPOP(1,J)/20.0
    FELD(2,J) = DRUPOP(2,J)
    FELD(3,J) = DRUPOP(3,J)
    FELD(4,J) = DRUPOP(9,J)
    FELD(5,J) = 0.0
130 CONTINUE
    CALL BILD(FELD,4)
    GO TO 235
 14 WRITE(9,3020) (NAME(J),J=1,12)
    WRITE(9,3030)
    DO 140 J=1,51
    FELD(1,J) = DRUPOP(6,J)
```

```
      FELD(2,J) = DRUPOP(7,J)
      FELD(3,J) = DRUPOP(8,J)
      FELD(4,J) = 0.0
      FELD(5,J) = 0.0
  140 CONTINUE
      CALL BILD(FELD,3)
      GO TO 235
   15 WRITE(9,3040) (NAME(J),J=1,12)
      WRITE(9,3050)
      DO 150 J=1,51
      FELD(1,J) = DRUEC1(3,J)
      FELD(2,J) = DRUEC1(4,J)
      FELD(3,J) = DRUEC1(5,J)
      FELD(4,J) = DRUEC1(6,J)
      FELD(5,J) = 0.0
  150 CONTINUE
      CALL BILD(FELD,4)
      GO TO 235
   16 WRITE(9,3060) (NAME(J),J=1,12)
      WRITE(9,3070)
      DO 160 J=1,51
      FELD(1,J) = DRUEC2(1,J)
      FELD(2,J) = DRUEC2(2,J)
      FELD(3,J) = DRUEC2(3,J)
      FELD(4,J) = DRUEC2(4,J)
      FELD(5,J) = DRUEC2(5,J)
  160 CONTINUE
      CALL BILD(FELD,5)
      GO TO 235
   17 WRITE(9,3080) (NAME(J),J=1,12)
      WRITE(9,3090)
      DO 170 J=1,51
      FELD(1,J) = DRULAN(4,J)
      FELD(2,J) = DRULAN(3,J)
      FELD(3,J) = DRULAN(1,J)
      FELD(4,J) = DRULAN(5,J)
      FELD(5,J) = DRULAN(6,J)
  170 CONTINUE
      CALL BILD(FELD,5)
      GO TO 235
   18 WRITE(9,3100) (NAME(J),J=1,12)
      WRITE(9,3110)
      DO 180 J=1,51
      FELD(1,J) = DRUF03(1,J)
      FELD(2,J) = DRUF03(2,J)
      FELD(3,J) = DRUF01(5,J)
      FELD(4,J) = DRUF01(6,J)
      FELD(5,J) = 0.0
  180 CONTINUE
      CALL BILD(FELD,4)
      GO TO 235
   19 WRITE(9,3120) (NAME(J),J=1,12)
      WRITE(9,3130)
      DO 190 J=1,51
      FELD(1,J) = DRUF04(5,J)
      FELD(2,J) = DRUF04(1,J)
      FELD(3,J) = DRUF04(3,J)
```

SUBROUTINE DRUCK 74/74 OPT=1 FTN 4.4+R401

```
      FELD(4,J) = DRUF04(10,J)
      FELD(5,J) = 0.0
  190 CONTINUE
      CALL BILD(FELD,4)
      GO TO 235
   21 WRITE(9,3140) (NAME(J),J=1,12)
      WRITE(9,3150)
      DO 200 J=1,51
      FELD(1,J) = DRUF04(2,J)
      FELD(2,J) = DRUF04(7,J)
      FELD(3,J) = DRUF04(4,J)
      SPTPC = DRUF04(10,J)*1000.0/DRUPOP(1,J)
      IF(SPTPC.GT.0) FELD(3,J) = SPTPC
      FELD(4,J) = 25.0
      FELD(5,J) = 0.0
  200 CONTINUE
      CALL BILD(FELD,4)
      GO TO 235
   22 WRITE(9,3160) (NAME(J),J=1,12)
      WRITE(9,3170)
      DO 210 J=1,51
      FELD(1,J) = DRUPR2(2,J)
      FELD(2,J) = DRUPR2(3,J)
      FELD(3,J) = DRUPR2(4,J)
      FELD(4,J) = 0.0
      FELD(5,J) = 0.0
  210 CONTINUE
      CALL BILD(FELD,3)
      GO TO 235
   23 WRITE(9,3165) (NAME(J),J=1,12)
      WRITE(9,3175)
      DO 230 J=1,51
      FELD(1,J) = DRUPR3(2,J)
      FELD(2,J) = DRUPR3(3,J)
      FELD(3,J) = 0.0
      FELD(4,J) = 0.0
      FELD(5,J) = 0.0
  230 CONTINUE
      CALL BILD(FELD,3)
  235 CONTINUE
 1300 FORMAT(1H1,12A2,30X,"POPULATION INDICTORS")
 1310 FORMAT(1H ,I4,8X,9F12.6)
 1320 FORMAT(1H0,12X,"     POP          BAB          TOT          FERT
     1  MORT          CBR          CDR          CGR          TOT15   ",/)
 1330 FORMAT(1H0,24X,"     CA           CNA           Y           YA
     1   YAX          YNA          YPC    ",/)
 1340 FORMAT(1H ,10X,I4,10X,7F12.6)
 1341 FORMAT(1H ,10X,I4,10X,7F12.4)
 1350 FORMAT(1H0,17X,"      I           IA           INA          IR
     1   IMN          IAP         IALV         IALD    ",/)
 1360 FORMAT(1H ,6X,I4,7X,8F12.5)
 1370 FORMAT(1H0,12X,"    CLGR         CLNG          CL           CLD
     1   CLW          CLR         TLLS         FCLR         CCLDH    ",/)
 1380 FORMAT(1H ,4X,I4,4X,8F12.6,3X,E12.6)
 1385 FORMAT(1H ,2X,I4,2X,10F12.6)
 1390 FORMAT(1H0,24X,"    SUAF         PXPF         ZPHG         GRPH
     1  GRGP         NGGP          ENZ         ENZFR    ")
```

```
TINE DRUCK      74/74   OPT=1                          FTN 4.4+R401        75/08/

 1402 FORMAT(1H ,16X,I4,8X,5F12.4,3F12.6)
 1401 FORMAT(1H ,12X,I4,8X,F12.5,F12.6,F12.3,F12.6,3F12.4,F12.6)
 1402 FORMAT(1H ,16X,I4,8X,3(F12.4,F12.6))
 1413 FORMAT(1H0,24X,"    YNAPC        PMCI         CAPH         PTFC
     1   FA          ZPHG         GRPH    ",/)
 1430 FORMAT(1H0,30X,"     FWT         SLVA         SLVMA        SLVAR
     1  LVPLM        IALV     ",/)
 1440 FORMAT(1H0, 8X,"     PTR         PTPCR         DPT         DPTPC
     1   PTN         PTAR        PTAPCR      PTPCSN      PTPCDR          SPT
     2   ",/)
 1450 FORMAT(1H0,30X,"    PXLVP         GRV          NGV         SLVV
     1   LVV           FSV     ",/)
 1460 FORMAT(1H0,30X,"    FDMV        FDMAR        FDMYR        FDMMR
     1    M           PXPTM    ",/)
 1470 FORMAT(1H0,24X,"    FDXV         FDXAR        FDXYR       FDX9YR
     1 FDX9AR       PTX9RR       PTX9SR    ",/)
 1480 FORMAT(1H0,35X,"IAS",7X,"IAKS",7X,"TECHN.AID",2X,"T.AID/SUAF",4X,
     1 "FOOD AID",3X,"F.AID/PTR")
 1505 FORMAT(1H1,12A2,30X,"CAPITAL ")
 1510 FORMAT(1H1,12A2,30X,"INVESTMENT ")
 1520 FORMAT(1H1,12A2,30X,"LAND INDICATORS")
 1530 FORMAT(1H1,12A2,30X,"AGRICULTURAL PRODUCTION")
 1540 FORMAT(1H1,12A2,30X,"YIELD")
 1550 FORMAT(1H1,12A2,30X,"LIVESTOCK AND FISH ")
 1560 FORMAT(1H1,12A2,30X,"PROTEIN INDICATORS")
 1570 FORMAT(1H1,12A2,30X,"PRICING ")
 1580 FORMAT(1H1,12A2,30X,"IMPORTS ")
 1590 FORMAT(1H1,12A2,30X,"EXPORTS ")
 1600 FORMAT(1H1,12A2,30X,"SHIFT AND AID")
 3000 FORMAT(1H1,12A2,40X,"POPUL. INDICATORS")
 3020 FORMAT(1H1,12A2,40X,"POPUL. GROWTH INDICATORS")
 3040 FORMAT(1H1,12A2,40X,"ECON. INDICATORS")
 3060 FORMAT(1H1,12A2,40X,"INVESTMENT")
 3080 FORMAT(1H1,12A2,40X,"LAND INDICATORS")
 3100 FORMAT(1H1,12A2,40X,"FOOD PRODUCTION")
 3120 FORMAT(1H1,12A2,40X,"PROTEIN INDICATORS")
 3140 FORMAT(1H1,12A2,40X,"PROTEIN PER CAPUT")
 3160 FORMAT(1H1,12A2,40X,"IMPORTS")
 3165 FORMAT(1H1,12A2,40X,"EXPORTS")
 3010 FORMAT(1H0,"POP = 1 (SCAL.FACT. = 20.0) , BAB = 2 , TOT = 3 , TOT1
     1S = 4 ")
 3030 FORMAT(1H0,"CBR = 1 , CDR = 2 , CGR = 3 ")
 3050 FORMAT(1H0," Y = 1 , YA = 2 , YAX = 3 , YNA = 4 ")
 3070 FORMAT(1H0," I = 1 , IA = 2 , INA = 3 , IR = 4 , IMN = 5 ")
 3090 FORMAT(1H0,"CLD = 1 , CL = 2 , CLGR = 3 , CLW = 4 , CLR = 5 ")
 3110 FORMAT(1H0,"FWT = 1 , SLVA = 2 , GRGP = 3 , NGGP = 4 ")
 3130 FORMAT(1H0,"PTN = 1 , PTR = 2 , DPT = 3 , SPT = 4 ")
 3150 FORMAT(1H0,"PTPCR = 1 , PTAPCR = 2 , DPTPC(SPTPC) = 3 , PTPCN(BASI
     1S VALUE) = 4 ")
 3170 FORMAT(1H0,"FDMAR = 1 , FDMYR = 2 , FDMMR = 3 ")
 3175 FORMAT(1H0,"FDXAR = 1 , FDXYR = 2 ")
 8005 FORMAT(1H1)
 8006 FORMAT(23I1)
      STOP
      END
```

SUBROUTINE BILD 74/74 OPT=1 FTN 4.4+R401

```
      SUBROUTINE BILD(EING,NR)
      DIMENSION FELD(102),EING(5,51),Z(51),CL(5)
      DATA CL/"1","2","3","4","5"/
      DATA STR/"-"/,BL/" "/,SPA/"I"/
      XMAX = EING(1,1)
      XMIN = XMAX
      DO 10 J=1,51
      DO 10 I = 1,5
      X = XMAX - EING(I,J)
      IF(X .LT. 0) XMAX = EING(I,J)
      X = XMIN - EING(I,J)
      IF(X .GT. 0) XMIN = EING(I,J)
   10 CONTINUE
      IF(XMAX .NE. XMIN) GO TO 15
      IF(XMAX .EQ. 0.0) XMAX = 1.0
      XMAX = XMIN + 0.5*ABS(XMAX)
      XMIN = XMIN - 0.5*ABS(XMAX)
   15 DIFF = XMAX - XMIN
      SPR = DIFF/50.0
      Z(1) = XMAX
      DO 20 K = 2,51
      Z(K) = Z(K-1) - SPR
   20 CONTINUE
      Y = SPR/2.0
      NZ = 50
      DO 80 K = 1,51
      NZ = NZ + 1
      IF(NZ .EQ. 51) GO TO 50
      DO 40 I1 = 1,102
   40 FELD(I1) = BL
      DO 45 I1 = 2,102,10
   45 FELD(I1) = SPA
      GO TO 60
   50 DO 55 I1 = 1,102
   55 FELD(I1) = STR
      NZ = 1
   60 CONTINUE
      FELD(1) = Z(K)
      DO 70 I = 1,NR
      M = 0
      DO 65 J = 1,50
      M = M + 2
      XHELP = ( EING(I,J+1) + EING(I,J))/2.0
      A = EING(I,J) - Z(K)
      IF(A .LT. -Y) GO TO 63
      IF(A .GT.  Y) GO TO 63
      FELD(M) = CL(I)
   63 A = XHELP - Z(K)
      IF(A .LT. -Y) GO TO 65
      IF(A .GT.  Y) GO TO 65
      FELD(M+1) = CL(I)
   65 CONTINUE
      A = EING(I,51) - Z(K)
      IF(A .LT. -Y) GO TO 70
      IF(A .GT.  Y) GO TO 70
      FELD(102) = CL(I)
   70 CONTINUE
```

SUBROUTINE BILD 74/74 OPT=1 FTN 4.4+R401

```
   80 WRITE(9,1000) (FELD(J), J=1,102)
      WRITE(9,1010)
C
C
 1000 FORMAT(1X,E11.4,2X,101A1)
 1010 FORMAT(12X,"1975",7X,"80",8X,"85        90         95        2000
     1    05         10         15         20         25    ")
      RETURN
      END
```

FUNCTION FAID 74/74 OPT=1 FTN 4.4+R401

```
      REAL FUNCTION FAID(IYR)
      DIMENSION AIDT(11),AIDF(11)
      COMMON /AID/ AIDF,AIDT,MAXIYR
      X = ((IYR-1975)*10.0)/(MAXIYR-1975)
      IU = INT(X) + 1
      IO = IU + 1
      FAID = AIDF(IU)*(IU - X ) + AIDF(IO)*(X + 1 - IU)
      RETURN
      END
```

FUNCTION TAID 74/74 OPT=1 FTN 4.4+R401

```
      REAL FUNCTION TAID(IYR)
      DIMENSION AIDT(11),AIDF(11)
      COMMON /AID/ AIDF,AIDT,MAXIYR
      X = ((IYR-1975)*10.0)/(MAXIYR-1975)
      IU = INT(X) + 1
      IO = IU + 1
      TAID = AIDT(IU)*(IU - X ) + AIDT(IO)*(X + 1 - IU)
      RETURN
      END
```

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