

Appendix I: User's Manual

The Excel Workbook, **U S Aggregate Marketing Loan Model.xls**, contains six spreadsheet pages labeled: **A, B, Log, OUTPUT, INCOMES, and MODEL**. **Spreadsheet A** contains the supply side of the U.S. Aggregate EDMP Model; **Spreadsheet B** contains the demand side of the model. Sheets **Log, OUTPUT, and MODEL** are generated by the SAS program to track the status of the SAS program and written back into Excel for possible use in diagnosing any problems.

We will first concentrate on **Sheets A and B**, which define the model tableaux, containing parameters under control of the model user, and receiving the raw optimal solutions written back by SAS.

Spreadsheet A, The Supply Side

- **Rows 1 through 10:** Scenario-base comparison post-optimal calculations. Scenario quantities and gradients (perfectly competitive prices) and base quantities and gradients and absolute and percentage differences of scenario from base. Each column is identified by its name within the EDMP model. Values in **Rows 2 and 7** for the scenario solution and **Rows 3 and 8** for the base solution **must be copied and pasted as values** from **Rows 16 and 17**.
- **Rows 12 through 15:** Parameters defining process supply slopes (Hessian elements) and base quantities: Capital requirements per unit (**Row 12**), decimal of excess capacity (**Row 13**) (which is the product of the percent excess capacity times the percent substitutable capital for that commodity and can be changed by the user). **Row 14** shows the target base quantities. For supply processes, there is no target base price. The base prices of supply processes are initially defined as the product of the Hessian element times the base quantity. In the process of calibration, these initial estimates may increase or decrease as necessary to calibrate to the base quantities.
- **Rows 16 through 24:** (**Rows 16 through 19**) are optimal solutions as written back into Excel by the SAS program. **Row 23** is the calculated value of the Hessian element, defined as the negative of **Row 12** divided by **Row 13** times **Row 14**. The Intercepts (**Row 24**) are determined as the negative of **Row 14** times **Row 32** plus **Row 21**. **Row 21** is the implicit gradient check for the uncalibrated intercept.
- **Rows 26 through 225 and Columns F through CX:** This block constitutes the supply side quadratic programming tableau of the EDMP model. **Column CX** contains the values for the right hand side (**RHS**) of the supply side of the model. **Column CY** labels the constraint rows and how the values were derived for the base solution. The SAS program automatically identifies the block **Rows 26 through 225 and Columns F through CX** as the quadratic programming tableau.
- **Rows 32 and 30** are the diagonal of the Hessian (**Row 32**) and its corresponding calibrated intercept (**Row 30**) for the base solution. The diagonal of the Hessian values are calculated in **Row 23 and must be pasted**

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as values in **Row 32**. The uncalibrated intercept values are calculated in **Row 24**. The uncalibrated intercept values are modified upward or downward until the base period prices and quantities are achieved to the desired level of accuracy, then transferred to **Row 32** by dividing **Row 32** by the ratio of the original intercept to the calibrated intercept, and **Row 30** is returned to its original value (**Row 24**).

- **Customizing the Supply Functions. Rows 31 and 29** are the diagonal of the Hessian (**Row 31**) and the corresponding calibrated intercept (**Row 29**) for the scenario solution. These rows allow customization of the model for any additive (parallel shift) or multiplicative (rotational) change that the user specifies to the base values of either the diagonal of the Hessian or the calibrated intercepts.
- **Rows 33 through 36** contain the elements that will be used to calculate the net income measures in the INCOMES page of the spreadsheet. They are free rows that do not constrain the solution to the model in any way.
- **Rows 37 through 227 and Columns F through CX** define the A_{ij} constraint matrix and right hand side.

Columns C and D: Customizing the model supplies and demands to a specific problem.

- **Column C** labels the parameters the user can specify to modify the production processes (A_{ij} entries), either the base solution or the scenario solution that will be compared with the base, and **Column D** contains the default values of the parameters. All model processes that are not specified by the user in **Column D** and remain at their default values are endogenously calculated as perfectly competitive adjustments within the program environment of the 1996 Farm Act, as modified by the 2002 Farm Act.
- In general, crop commodity processes allow the user to specify any of the following actions: (1) **Change the commodity yields per acre**, (2) **Change the commodity variable costs per acre**, (3) **Change commodity acreage**, (4) **Fix the commodity acreage**, (5) **Change commodity exports**, (6) **Fix commodity exports**, (7) **Change commodity competing imports**, and (8) **Fix commodity competing imports**.
- Livestock commodity processes allow the user to specify: (1) **Change the variable costs per unit**, (2) **Change livestock production**, (3) **Fix livestock commodity production**, (4) **Change livestock commodity exports**, (5) **Fix livestock commodity exports**, (6) **Change livestock commodity competing imports**, and (7) **Fix livestock commodity competing imports**.
- **Columns AX, AY, and AZ** are Government program activities: CRP payments, the lump sum direct payments, and ARP (set-aside) requirements, if they are required.
- **Columns BA through BZ** are crop insurance activities and crop insurance indemnities by crop commodity.
- **Columns CA through CQ** are: (1) purchases of variable inputs (hired labor, miscellaneous variable inputs, seed/genetics, specialized tech-

nology, fertilizers, chemicals, fuels, lubes, and electricity), (2) payments of overhead costs (fixed costs, capital replacement, interest, rent, and other residual overhead costs), and (3) cash flow items that are not part of farm income (family living costs, principal paid, farm-related income, off-farm income, and value of perquisites). The user can change the dollar prices of these inputs proportionally by modifying the entries in **Row 30** up or down from **-1.0**.

- **Columns CR through CU** are artifacts from an earlier version of the model and can be safely ignored.
- **Column CV** specifies the type of constraint (EQ, LE, GE, or FREE) and specifies which Hessian row and intercept row (base or scenario) are to be maximized in that particular solution. The Hessian row will be labeled “QUAD” in column CV, and the intercept row will be labeled “MAX.” The other Hessian and intercept rows will be labeled “FREE.”

These must be consistent on Spreadsheets A and B.

Spreadsheet B, The Demand Side

Spreadsheet B contains the demand and disposition activities of the model. These include domestic demands by commodity, storage and dis-storage of storable commodities, exports and competing imports of tradable commodities, and program activities that depend on national rather than farm-specific variables (including storage costs and marketing loan gain mechanisms).

- **Rows 1 through 10:** Scenario-base comparison post-optimal calculations. Scenario quantities and gradients (perfectly competitive prices) and base quantities and gradients and absolute and percentage differences of scenario from base. Each column is identified by its name within the EDMP model. Values in **Rows 2 and 7** and **3 and 8 must be copied and pasted as values** from **Rows 16 and 17**. **Rows 3 and 8** are for the base solution, and **Rows 2 and 7** are for the scenario solution.
- **Rows 12 through 14:** Parameters defining process supply slopes (Hessian elements) and base quantities: base quantity, target base price, and elasticity of demand. The base prices of demand processes are initially defined as the product of the Hessian element times the base quantity. In the process of calibration these initial estimates are increased or decreased as necessary to calibrate to the base quantities. Then they are transferred to **Row 32** by dividing Row 32 by the ratio of the original intercept to the calibrated intercept. Finally, Row 30 is returned to its original value (**Row 24**).
- In the final calibrated model, **Row 30** should be equal to the demand intercept (**Row 24**).
- **Rows 16 through 24:** Optimal solution as written back into Excel by SAS (**Rows 16 through 19**), calculated values of Hessian elements and intercepts (**Rows 23 and 24**), and calculated implicit gradients (**Row 21**).
- **Rows 26 through 160 and Columns F through DK:** This block constitutes the demand/disposition side quadratic programming tableau of the EDMP model. **Column DK** contains the values for the right hand side

(RHS) of the demand side of the model. The SAS program automatically identifies **Rows 26 through 160 and Columns F through DK** as the quadratic programming tableau. **Column DL** labels the constraint rows and documents how the values were derived for the base solution.

- **Columns C and D:** Columns C and D are not used in **Spreadsheet B** because all parameters under user control were specified in **Spreadsheet A**.
- **Rows 32 and 30:** As in **Spreadsheet A**, **Rows 32 and 30** are the diagonal of the Hessian (**Row 32**) and the corresponding calibrated intercept (**Row 30**) for the **Base Solution**. In **Spreadsheet B** the values of the **Hessian** elements have been altered by calibration factors. The diagonal of the **Hessian** values are calculated in **Row 22** and **pasted as values** in **Row 32**. The uncalibrated intercept values are calculated in **Row 24** and **pasted as values** into **Row 30**.
- Customizing the demand functions. **Rows 31 and 29** are the diagonal of the Hessian (**Row 31**) and the corresponding calibrated intercept (**Row 29**) for the **Scenario Solution**. Any additive or multiplicative change to the base values of either the diagonal of the Hessian or the calibrated intercepts can be specified by the user in these rows. This feature allows the user to specify any desired parallel or rotational shifts to any demand function.
- **Rows 33 through 36** contain the elements that will be used to calculate the net income measures in the **INCOMES** page of the spreadsheet. They are free rows that do not constrain the solution to the model in any way.
- **Columns F through AE** are domestic nonfarm demands by commodity.
- **Columns AF through AW** are storage and dis-storage of storable commodities.
- **Columns AX through BW** are exports and competing imports of tradable commodities.
- **Columns BX through CB** are inputs for national storage activities.
- **Columns CC through DH** are program activities that depend on national rather than farm-specific variables (marketing loan gains and loan deficiency payments).
- **Column DI** specifies the type of constraint (EQ, LE, GE, or FREE) and specifies the Hessian row and intercept row (base or scenario) to be maximized in that particular solution. The Hessian row will be labeled “QUAD” in column **DI**, and the intercept row will be labeled “MAX.” The other Hessian and intercept rows will be labeled “FREE.”

These must be consistent on Spreadsheets A and B.

Post-Optimal Calculations Spreadsheet

In the next section, we explain the use of the **INCOMES** spreadsheet, which can be custom configured to do post-optimal calculations as needed by the user. The **INCOMES** spreadsheet is automatically calculated from **Rows 2 and 7, Rows 3 and 8, and Rows 33 through 36** of **Spreadsheets A and B**.

We have not printed the row and column indices on the INCOMES spreadsheet to make it easier to read and facilitate associating the data with their variable names.

Four measures of farm well-being are calculated in **Rows 8 through 34: (1) shortrun net cash farm income, (2) longrun net farm income, (3) shortrun net cash flow, and (4) longrun net cash flow.**

- Shortrun net cash farm income does not include capital replacement, principal paid, family living expenses, off-farm income, or value of perquisites.
- Longrun net farm income includes all shortrun net cash farm income, subtracts capital replacement, and adds value of perquisites.
- Shortrun net cash flow excludes capital replacement and value of perquisites, but subtracts principal paid and family living costs, and adds off-farm income.
- Longrun net cash flow includes all shortrun net cash flow, subtracts capital replacement, and adds value of perquisites.

The following rows summarize levels of activities and derived calculations from the model:

- **Rows 38 through 42** summarize crop production activities, and **Rows 44 through 48** summarize livestock production activities.
- Domestic demand activities are summarized in **Rows 50 through 60. Rows 50 through 54** summarize quantities, and **Rows 56 through 60** summarize prices.
- Storage and dis-storage are shown in **Rows 63 through 67.**
- Exports and competing imports are shown in **Rows 69 through 73.**
- Loan deficiency payments and marketing loan gains are summarized in **Rows 75 through 85.** Sums of marketing loan gains by commodity are automatically transferred to the marketing loan gains section (**Rows 9 and 10 of Columns DV through EC**).
- Counter-cyclical payments are calculated by commodity in **Rows 88 through 92**, and their sums are automatically transferred to **Row 8 and 9 of Column F.** Although determined on an individual commodity basis, counter-cyclical payments are disbursed as lump sum payments that affect only net farm income.
- Direct payments associated with supported commodities are calculated in **Rows 94 through 98**, and their sums are automatically transferred to **Row 8 and 9 of Column E.** These are disbursed as lump sum payments in the Government programs columns of the net incomes section.
- Crop insurance subsidies are calculated in **Rows 100 through 104.**

- Domestic consumer surpluses and export consumer surpluses are shown in **Rows 107 through 117**. These are shown separately because different groups of consumers receive them.
- Producer gross commodity receipts, commodity cash expenses, and net cash income by commodity are calculated in **Rows 119 through 139**.
- Finally, the user can specify and print his/her own custom calculations in any unused area of the **INCOMES Spreadsheet**.

Solving the Model: The SAS Link Program

Appendix II contains the SAS code to optimize EDMP models with quadratic programming in Proc NLP. This code hotlinks SAS to an EDMP tableau in an Excel spreadsheet. It is executed in the background while running Excel. Upon reading a change in a trigger cell (cell A 17), SAS reads the tableau, optimizes the model, and prints results back to the spreadsheet, including an optimal solution, a complete tableau, and an iteration history. Five solutions may be run by incrementing cell A 17. After five solutions have been run, hit F8 to restore the program for another five solutions.