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**Commodity
Economics
Division**

A Regional
Farm-to-Retail
Data Base for the
U.S. Food Industry

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A REGIONAL FARM-TO-RETAIL DATA BASE FOR THE U.S. FOOD INDUSTRY, by
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ABSTRACT

This report documents the methodology and procedures employed in the
construction of a data base for the U. S. food industry. It provides
information on variables which describe the production, marketing, and demand
structure of the industry at the national, regional, and State level. The
data base contains over 500 variables and covers 1949-83. Aggregation
problems and solutions are discussed along with the procedures to adjust for
missing data.

Keywords: Farm, marketing, retail, data, food industry.

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INTRODUCTION

The U. S. food industry accounts for almost one-fourth of the gross national product and employs one-fifth of the total workforce [Manchester]. This report documents the methodology and procedures employed in the construction of a data base of the food industry. It provides information on variables describing the production and demand structure of the U. S. food industry at the national, regional and State levels. Construction of this data base is part of a research project to analyze the effects of economic changes on the food industry. The project uses a dual farm to retail multiproduct, multiregion model. The project is supported by a cooperative research agreement between the Department of Food and Resource Economics, University of Delaware, and the Economic Research Service, U. S. Department of Agriculture.

The data base collected for this project contains over 500 variables and was gathered from various published and unpublished U. S. Government statistical publications. Several problems have been encountered in the process of data collection. First, State-level data are not available for some years due to budgetary limitations at that time. Second, funding cutbacks and new procedures in data collection by various government agencies resulted in inconsistent time-series data. A related problem is the lack of data of the desired form during 1950-60. An enormous amount of time has been spent gathering data for all individual variables comprising the desired aggregated data in an attempt to attain a consistent series. Third, some data sets are simply not available at the State and regional levels. These data collection problems are addressed specifically where they occur in the description of the individual data subsets.

The data base currently covers 1949-83 and will be periodically updated as new data become available. All data sets are kept in microcomputer diskettes and are available upon request from the authors through the Department of Food and Resource Economics, University of Delaware, Newark, Delaware 19717.

SECTORS, PRODUCTS, AND REGIONS

The U. S. food industry is composed of the farm sector, food processing and distribution sector, and retail sector. The farm sector supplies the food products that are processed in the food processing sector and then supplied to the retail sector. This study identifies the food processing and distribution sector as the food marketing sector. The marketing sector includes all activities (assembly, processing, transporting and retailing of food products) from the farm to the consumer. The retail sector demands the food products

produced in the farm sector and processed and distributed by the marketing sector.

Given the substantial amount of output and input commodities considered in this report, a certain level of data aggregation had to be conducted. Farm production structure is assumed to be separable in six product groupings: meat animals, dairy products, poultry and eggs, feed grains, fruits and vegetables, and other food products. Production and price data for all individual products belonging to each commodity group are gathered for all 50 States. The variable inputs in the farm sector include hired labor, agricultural chemicals, feed, seed and livestock, farm capital, and miscellaneous inputs. State-level expenditure data for the five variable inputs are collected together with number of hired labor per State. Implicit State-level hired labor wage rates are then estimated. Prices for the four other variable inputs are specified at the national level. Fixed factors in the farm sector, land and family labor, are gathered at the State level.

The marketing sector is assumed to have five outputs, five inputs from the farm, and five nonfarm inputs. The five outputs are meat animals, dairy products, poultry and eggs, fruits and vegetables, and other food products. The farm sector output categories comprise the farm inputs used in the marketing sector while the nonfarm inputs are intermediate materials for food manufacturing, containers, supplies, hired labor, and fuel. A combination of national and State data are collected for the marketing sector variables.

The retail sector is assumed to demand the five major food products produced in the marketing sector. Five nonfood products are also specified: housing, medical care, apparel and upkeep, transportation, and other goods and services. A combination of national and State data are gathered for the retail sector variables.

Data for the three sectors are collected at the State-level whenever possible. When State or regional level data are not available, national level proxy variables are constructed. All State-level data are aggregated into four regions following the Bureau of Labor Statistics regional classification (see table).

TERMINOLOGIES AND ABBREVIATIONS

The following terms and abbreviations are used in this report.

Implicit Price: refers to a price, wage, etc. which is determined by dividing value of output (input expenditure) by quantity of output (input quantity).

Quantity Index: actual quantity of output (input) divided by the output (input) quantity in the base year which is 1967 in this report.

Price Index: actual or implicit price of output (input) divided by the output (input) price in the base year, 1967.

Arithmetic Weighted Aggregate (AWA): a procedure used to estimate an output (input) quantity or price aggregate derived through the formula:

$$AWA = \sum_{i=1}^{n} S_i X_i \quad \text{and} \quad \sum_{i=1}^{n} S_i = 1$$

where: S_i = percentage share (expenditure, value quantity, etc.) of the aggregate category's value of production, expenditure, etc. accounted for by the ith output (input).

X_i = i_{th} variable (quantity, price, etc.)

n = number of variables included in the aggregate.

Exponential Interpolation (EI): a method used to obtain values for missing observations within a time-series data set using the geometric mean formula:

$$\hat{X}_{t+1} = \sqrt{X_t\, X_{t+2}}$$

where: X_t = actual observation of a variable at time t.

X_{t+1} = estimated observation of the variable at time t+1.

X_{t+2} = actual observation of a variable at time t+2.

Exponential Extrapolation (EE): a method used to predict (backward and forward) missing observations beyond a given data set. The formula is:

$$X_{t+2} = X_{t+1} e^{\alpha t}$$

Table: Bureau of Labor Statistics regions

Northeast (region I)	North Central (region II)	South (region III)	West (region IV)
Connecticut	Illinois	Alabama	Arizona
Maine	Indiana	Arkansas	California
Massachusetts	Iowa	Delaware	Colorado
New Hampshire	Kansas	Florida	Idaho
New Jersey	Michigan	Georgia	Montana
New York	Minnesota	Kentucky	Nevada
Pennsylvania	Missouri	Louisiana	New Mexico
Rhode Island	Nebraska	Maryland	Oregon
Vermont	North Dakota	Mississippi	Utah
	Ohio	North Carolina	Washington
	South Dakota	Oklahoma	Wyoming
	Wisconsin	South Carolina	Alaska
		Tennessee	Hawaii
		Texas	
		Virginia	
		West Virginia	

Bureau of Labor Statistics, U.S. Department of Labor.

where: $X_{t+1} = X_t e^{\alpha t}$ and can be estimated as $\alpha = 1/t \ln \dfrac{X_{t+1}}{X_t}$.

Index Splicing (IS): a method used to obtain consistency between two indices which measure the same variable but have different base years. The procedure is to multiply the new series level (recent base year) by the old series level at an overlapping point.

Semi-Logarithmic Method (SLM): a procedure used to estimate annual percentage growth rate over a period of time. The first order derivative of the function with respect to time provides the annual growth rate in percentage basis. This growth rate is used to predict (backward and forward) missing values.

$$\hat{X}_t = bo + biT$$

where: X_t = actual data in year t expressed in logarithms.

T = time.

Least Squares Extrapolation (LSE): a procedure used to predict (backward and forward) missing observations beyond a given data set. The formula is similar to Least Squares Interpolation (LSI).

The following abbreviations are used to denote variables, government agencies, and statistical publications.

Variables
CPI   = consumer price index
PPI   = producer price index
WPI   = wholesale price index

Agencies
BC   = Bureau of the Census (USDC)
BEA   = Bureau of Economic Analysis (USDC)
BLS   = Bureau of Labor Statistics (USDL)
CRB   = Crop Reporting Board (SRS)
ESCS   = Economics, Statistics, and Cooperatives Service (USDA)

ERS   = Economic Research Service (USDA)
         IED = International Economics Division (ERS)
         NED = National Economics Division (ERS)
         NRED = Natural Resource Economics Division (ERS)

SRS   = Statistical Reporting Service (now National Agricultural Statistics Service)
USDA   = U. S. Department of Agriculture
USDC   = U. S. Department of Commerce
USDL   = U. S. Department of Labor

Publications
AS   = Agricultural Statistics
ASM   = Annual Survey of Manufactures
CM   = Census of Manufactures
ECIFS = Economic Indicators of the Farm Sector

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FCPE    = Food Consumption, Prices, and Expenditures
FISS    = Farm Income Situation Supplement
HS      = Historical Statistics of the United States, Colonial Times to 1970
SAUS    = Statistical Abstract of the United States
SFIS    = State Farm Income Statistics
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FARM SECTOR VARIABLES

This section discusses the collection of data for variables which pertain to
the farm production of food products. National and State-level data on farm
output (input) and price levels are collected for 1949-83. The State-level
data are then aggregated using the BLS four regional classifications. The AS
is the major source of data. However, some data sets are missing for some
States and/or for some years. Whenever data are not available from the AS,
other USDA and State-level statistical bulletins are used. In cases where
data do not exist, the missing observations are statistically estimated using
EI, EE, LSI, or LSE techniques. The following raw data are collected for the
farm sector variables:

Outputs

National and State output and price data are collected for individual products
comprising six aggregate commodity groups from the AS.

1. Meat Animals

    a. Cattle and Calves: Units--production, mil. lbs.; price,
       $/cwt.

    b. Hogs: Units--production, mil. lbs.; price, $/cwt.

    c. Sheep and Lambs: Units--production, mil. lbs.; price, $/cwt.

2. Dairy Products

    a. Milk: Units--production, mil. lbs.; price, $/cwt.

3. Poultry and Eggs

    a. Broilers: Units--production, mil. lbs.; price, cents/lb.

    b. Farm Chickens: Units--production, mil. lbs.; price,
       cents/lb.

    c. Turkeys: Units--production, mil. lbs.; price, cents/lb.

    d. Eggs: Units--production, mil.; price, cents/dozen.

4. Fruits and Vegetables

a. Vegetables: Units--production, thous. tons; price, $/ton.

b. Potatoes: Units--production, mil. cwt.; price, $/cwt.

c. Fruits and Tree Nuts: Units--Production, various units; price, various units. 1949-62, Fruits-Noncitrus, CRB, SRS, USDA; 1949-62, Citrus, Fruits, CRB, SRS, USDA; 1949-62, Tree Nuts, SRS, USDA; 1963-83, Fruit Outlook & Situation, ERS, USDA.

5. Feed Grains

a. Corn: Units--production, mil. bu.; price, $/bu.

b. Sorghum Grain: Units--production, mil. bu.; price, $/bu.

c. Barley: Units--production, mil. bu.; price, $/bu.

d. Oats: Units--production, mil. bu.; price, $/bu.

e. Hay: Units--production, mil. tons; price, $/baled ton.

6. Other Farm Products

a. Wheat: Units--production, mil. bu.; price, $/bu.

b. Sugar Crops: Units--production, thous. tons; price, $/ton.

c. Soybeans: Units--production, mil. bu.; price, $/bu.

d. Rice: Units--production, mil. cwt; price, $/cwt.

e. Cotton: Units--production, mil. bales; price, cents/lb.

f. Tobacco: Units--production, mil. lbs.; price, cents/lb. 1947-83, Annual Crop Survey, CRB, SRS, USDA.

Variable Inputs of Farm Production

Expenditure, price, and/or quantity data are gathered for the following farm variable inputs. Data are collected at the State-level unless otherwise stated.

1. a) Hired Farm Labor: Unit--thous. of workers. 1949-59, Farm Employment, SB-334, CRB, SRS, USDA; 1960-83, Farm Labor, SRS, USDA.

   b) Hired Farm Labor Expenditures: Unit--mil. $. 1949-72, FISS, USDA. 1973-76, SFIS, NED, ESCS, USDA; 1977-83, ECIFS, ERS, USDA.

2. a) Feed Price Index (national): Unit--1967=100. 1949-83, AS.

   b) Feed Expenditures (national): Unit--mil. $. 1949-83, ECIFS, ERS, USDA.

c) Feed Expenditures: Unit--mil. $. 1949-72, FISS, USDA; 1973-76, SFIS, NED, ESCS, USDA; 1977-83, ECIFS, ERS, USDA.

3. a) Seed Price Index (national): Unit--1967=100. 1949-83, AS.

   b) Seed Expenditures: Unit--mil. $. 1949-72, FISS, USDA; 1973-76, SFIS, NED, ESCS, USDA; 1977-83, ECIFS, ERS, USDA.

4. a) Livestock Price Index (national): Unit--1967=100. 1949-83, AS.

   b) Livestock Expenditures: Unit--mil. $. 1949-72, FISS, USDA; 1973-76, SFIS, NED, ESCS, USDA; 1977-83, ECIFS, ERS, USDA.

5. a) Agricultural Chemical Price Index (national): Unit--1967=100. 1949-83, AS.

   b) Fertilizer and Lime Expenditures: Unit--mil. $. 1949-72, FISS, USDA; 1973-76, SFIS, NED, ESCS, USDA; 1977-83, ECIFS, ERS, USDA.

   c) Pesticide Expenditures: Unit--mil. $. 1949-83, Suddendorf, unpublished data, NED, ERS, USDA.

6. a) Divisia Price Index of Capital Services (national): Unit--1967=100. 1949-83, AS.

   b) Farm Capital Depreciation and Other Consumption of Farm Capital. Unit--mil. $. 1949-72, FISS, USDA; 1973-76, SFIS, NED, ESCS, USDA; 1977-83, ECIFS, ERS, USDA.

   c) Farm Property Taxes: Unit--mil. $. 1949-72, FISS, USDA; 1973-76, SFIS, NED, ESCS, USDA; 1977-83, ECIFS, ERS, USDA.

   d) Interest on Farm Mortgage Debt: Unit--mil. $. 1949-72, FISS, USDA; 1973-76, FISS, NED, ESCS, USDA; 1977-83, ECIFS, ERS, USDA.

   e) Net Rent to Nonfarm Landlords: Unit--mil. $. 1949-72, FISS, USDA; 1973-76, FISS, NED, ESCS, USDA; 1977-83, ECIFS, ERS, USDA.

7. a) All Commodities Bought for Use in Production Price Index (national): Unit--1967=100. 1949-83, AS.

   b) Miscellaneous Input Expenditures: Unit--mil. $. 1949-72, FISS, USDA; 1973-76, FISS, NED, ESCS, USDA; 1977-83, ECIFS, ERS, USDA.

Fixed Factors of Farm Production

Quantity data at the State level are collected on the following fixed factors:

1. Farmland: Unit--thous. ac. 1950, 1954, 1959, 1964, 1969, 1974, 1978, 1982, Major Uses of Land in the United States, NRED, ERS, USDA.

2. Family Labor: Unit--thous. persons. 1949-59, Farm Employment, SB-334, SRS, CRB, USDA. 1960-1983, Farm Labor, SRS, USDA.

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<u>Farm Policy Variables</u>

Data are obtained on the following exogenous variables from the AS at the
national level unless otherwise stated.

1. Government Subsidies (State level): Unit--mil. $. 1949-83, ECIFS,
   ERS, USDA.

2. Research and Development: Unit--mil. $. 1948-83, SAUS, BC, USDC.

Other Data on Farm Production

1. U. S. Crop Marketing Distributions: Unit--percent share. 1962-83
   unpublished data, NED, ERS, USDA (corn, sorghum, barley, oats, hay,
   wheat, soybeans, flaxseed, cotton).

2. Exports (units are the same with the corresponding production
   data): oats, barley, hay, corn, sorghum, wheat, rice, cotton,
   sugar, tobacco, soybeans, eggs, vegetables, potatoes, fruits and
   nuts. 1949-83, Foreign Agricultural Trade of the United States,
   IED, ERS, USDA.

3. Carryover (units are the same with corresponding production data):
   oats, barley, hay, corn, sorghum, wheat, rice, cotton, sugar,
   tobacco, soybean, eggs, vegetables, potatoes, fruit and nuts.
   1949-83, AS, CRB, SRS, USDA.

FARM SECTOR VARIABLE MANIPULATIONS

A substantial amount of diverse information is compiled in this study. Data
standardization is required for consistency in aggregation. The procedures
used in accomplishing this task are as follows:

Farm Output

Two types of aggregation are conducted for farm outputs and prices:
aggregation among individual products and aggregation across States. Farm
production quantities for each output belonging to an aggregate commodity
group are adjusted to a standard unit of measure (SUM). The SUM output
quantities per State are added to form regional aggregates for the individual
output. The regional aggregates of the individual outputs are then combined
to form the regional commodity group aggregate. Output quantity indices
are then estimated.

The aggregation of farm prices is a more complicated task since simple
addition of prices would lead to an erroneous measure. Price levels for each
output are aggregated across States by using the AWA technique with
State-level output shares as weights. The regional price levels of the
individual outputs are then used to form regional commodity group price
aggregates using AWA with regional individual output shares as weights. Where
actual price data are not available, implicit prices are derived. Price
indices are then calculated. All prices, where applicable, include allowances
for unredeemed loans and purchases by the government. An exception is sugar

crop price which is adjusted by including payments made under the Sugar Act of 1948.

In 1982, the number of commercial vegetables reported in the AS was reduced from 22 to 9 major vegetable products. The Crop Reporting Board indicated the reduction was due to budgetary limitations. To ensure consistency in the vegetable output and price time series data, we adjusted the 1982 and 1983 data to the 22-vegetable level. This was attained by estimating the ratio of the 9-vegetable data to the 22-vegetable data in 1980 and using this ratio to adjust the 1982 and 1983 data.

The Crop Reporting Board started to publish an aggregate fruit and tree nut product category in 1962. This required the collection of production and value of production data per State for all individual products comprising the aggregate fruit and tree nut category from 1949-61.

Farm output and price data as reported in various government publications are either in the form of crop marketing year or calendar year data. Aggregating crop and calendar year data produces inconsistent results. Thus, crop year output and price data are adjusted to calendar year data using the U. S. crop marketing distribution (USCMD) data. Inasmuch as USCMD data are available only from 1962-83, the 1949-61 estimates are derived using the EE method.

In order to separate the effect of farm inventories, the net farm output calendar year data are determined as follows:

$$NFCO_{ij}{}^{t} = (QUP_{ij}{}^{t})\ (USCMD_{i}{}^{t}) + (QUP_{ij}{}^{t-1})\ (USCMD_{i}{}^{t-1})$$

where: $QUP_{ij}{}^{t} = [(PPC_{i}{}^{t})\ (RP_{i}{}^{t})].$

$PPC_{i}{}^{t} = (USC_{i}{}^{t})/(USP_{i}{}^{t}).$

and: $NFCO_{ij}{}^{t}$ = net farm output of product i in region j in calendar year t.

$QUP_{ij}{}^{t}$ = quantity of farm product i net of inventory in region j in crop year t.

$USCMD_{i}{}^{t}$ = U. S. crop marketing distribution of product i in crop year t.

$PPC_{i}{}^{t}$ = one minus the percent carry over of product i in crop year t.

$RP_{ij}{}^{t}$ = regional production of product i in crop year t and region j.

$USC_{i}{}^{t}$ = U. S. carryover of product i in crop year t.

$USP_{i}{}^{t}$ = U. S. production of product i in crop year t.

Calendar year farm output price was determined using the following procedure:

$$NCFP_{ij}{}^{t} = (RPP_{i}{}^{t})\ (USCMD_{i}{}^{t}) + (RPP_{i}{}^{t-1})\ (USCMD_{i}{}^{t-1})$$

where: $NCFP_{ij}{}^{t}$ = regional farm price of product i in r in calendar year t.

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$RPP_i{}^t$ = regional farm price of product i in r in crop year t.

$USCMD_i{}^t$ = as defined above.

Variable Farm Inputs

An implicit regional annual wage for hired farm labor is derived by dividing expenditures on hired labor by the number of hired laborers. The feed, seed, and livestock price is estimated using the AWA method with corresponding expenditure shares employed as weights. Expenditures on fertilizer, lime, and pesticides are aggregated at the regional level to obtain agricultural chemical expenditures. The price index for all commodities bought for use in agricultural production is used as a proxy variable for miscellaneous input price. Miscellaneous input expenditures are defined as total farm production expenditures less the sum of hired labor, agricultural chemicals, feed, seed and livestock and farm capital expenditures. The user cost of farm capital series is derived from unpublished ERS data (Shoemaker, 1986). Farm capital expenditures are assumed to be the sum of depreciation, taxes, interest on farm debt, and net rent to nonfarm landlords.

Fixed Inputs in Farm Production

Data on farmland are available only for the years the Census of Agriculture was conducted. Verifications were conducted with USDA personnel on how the intervening years' land data were estimated. We concluded that the missing years' land data were simply interpolated. For this study, missing land data are estimated using the EI procedure rather than through linear interpolation.

Other Variables in Farm Production

Funds spent on research and development in agriculture are adjusted from a fiscal to calendar year basis through the following procedure:

$$RDC^t = (RDF^t)(PRDC^t) + (RDF^{t-1})(PRDC^{t-1}).$$

RDC^t = dollars spent in agriculture for R & D in calendar year t.

RDF^t = dollars spent in agriculture for R & D in fiscal year t.

$PRDC^t$ = percent allocation of R & D funds in calendar year t.

FINAL FARM SECTOR VARIABLES

The following farm sector variables are in their final form and are available at the national and/or regional levels in the units shown (calendar years, 1949-83):

1. Outputs

    a. Meat Animals (national, regional): Units--production, mil. lbs.; price, $/cwt.

b. Dairy Products (national, regional): Units--production, mil.
      lbs.; price, $/cwt.

   c. Poultry and Eggs (national, regional): Units--production,
      mil. lbs.; price, cents/lb..

   d. Fruits and Vegetables (national, regional): Units--
      production, thous. tons; price, $/ton.

   e. Feed Grains (national, regional): Units--production, mil.
      bu.; price, $/bushel.

   f. Other Farm Products (national, regional): Units--production,
      mil. tons; price, $/ton.

2. Variable Inputs

   a. Hired Farm Labor (national, regional): Units--implicit wage
      rate, $/annual worker; total expenditures, thous. $.

   b. Agricultural Chemicals: Units--price index, national; total
      expenditures, regional, thous. $.

   c. Feed, Seed, Livestock: Units--price index, national; total
      expenditures, regional, thous. $).

   d. Farm Capital: Units--price index, national, total
      expenditures, regional, thous. $.

   e. Miscellaneous Inputs: Units--price index, national; total
      expenditures, regional, thous. $.

3. Fixed Inputs and Other Variables

   a. Land in Farms (regional): Unit--thous. ac.

   b. Family Labor (regional): Unit--thous. persons.

   c. Government Subsidies (regional): Unit--mil. $.

   d. Research and Development (national): Unit--mil. $.

MARKETING SECTOR VARIABLES

This section describes the collection of data for variables pertaining to the
processing and marketing of food products. A combination of national and
State data are collected for 1949-83. State-level data are then aggregated to
the four BLS regions.

Principal sources of data are published government documents such as the
Annual Survey of Manufactures, Census of Manufactures, Statistical Abstract of
the United States, and BLS publications. Whenever data were not available in

published form, we tried to obtain the missing information from various government agencies. In cases where data did not exist, we employed various techniques to complete the time-series data.

Raw data are collected for the following marketing sector variables.

Outputs: Marketing Sector

For purposes of this study, the output of the marketing sector is indicated by value of shipments by manufacture. Value of shipment data are gathered for the following food manufacturing industries:

1. Meat Products (201) by region: Unit--mil. $. 1947-82 census years, CM, BC, USDC; national data, annual, 1949-83, ASM, BC, USDC.

2. Dairy Products (202) by region: Unit--mil. $. 1947-82 census years, CM, BC, USDC; national data, annual, 1949-83, ASM, BC, USDC.

3. Poultry and Eggs (2016, 2017) by region: Unit--mil. $. 1947-82 census years, CM, BC, USDC; national data, annual, 1949-83, ASM, BC, USDC.

4. Fruits and Vegetables (203) by region: Unit--mil. $. 1947-82 census years, CM, BC, USDC; national data, annual, 1949-83, ASM, BC, USDC.

5. Grain Mill Products (204) by region: Unit--mil. $. 1947-82 census years, CM, BC, USDC; national data, annual, 1949-83, ASM, BC, USDC.

6. Bakery Products (205) by region: Unit--mil. $. 1947-82 census years, CM, BC, USDC; national data, annual, 1949-83, ASM, BC, USDC.

7. Sugar and Confectionary Products (206) by region: Unit--mil. $. 1947-82 census years, CM, BC, USDC; national data, annual, 1949-83, ASM, BC, USDC.

8. Fats and Oils (207) by region: Unit--mil. $. 1947-82 census years, CM, BC, USDC; national data, annual, 1949-83, ASM, BC, USDC.

9. Misc. Foods, Kindred Products (209) by region: Unit--mil. $. 1947-82 census years, CM, BC, USDC; national data, annual, 1949-83, ASM, BC, USDC.

Farm Inputs: Marketing Sector

The farm sector outputs are the marketing sector farm inputs. In terms of regional farm input demand, some modifications are made as explained in the section on variable manipulation.

Nonfarm Inputs: Marketing Sector

National data, unless otherwise stated, are collected from various statistical publications for the following nonfarm inputs used in the food manufacturing sector.

1. Intermediate Material for Food Manufacturing Price: Unit—PPI, 1967=100. 1949-83, WPI, BLS.

2. Processed Fuel Price: Unit—PPI, 1967=100. 1949-83, WPI, BLS.

3. Containers Price: Unit—PPI, 1967=100. 1949-83, WPI, BLS.

4. Supplies Price: Unit—PPI, 1967=100. 1949-83, WPI, BLS.

5. Average Hourly Earnings for Production Workers: Unit—$/hour. 1949-70, HS, BC, USDC; 1971-83, SAUS, BC, USDC.

6. Total Wages for Production Workers (State-level): Unit—mil. $. 1950-77, 1982-83, ASM, BC, USDC.

7. Total Manhours for Production Workers (State-level): Unit—thous. hrs. 1950-77, 1982-83, ASM, BC, USDC.

Other Data: Marketing Sector

1. a) Value Added, Food Mfg.: Unit—mil. $. 1949-70, HS, BC, USDC; 1971-83, SAUS, BC, USDC.

   b) Value Added, Food Mfg. (State level): Unit—mil. $. 1949-77, ASM, BC, USDC.

2. a) New Capital Expenditures: Unit—mil. $. 1949-70, HS, BC, USDC; 1971-83, SAUS, BC, USDC.

   b) New Capital Expenditures (State level): Unit—mil. $. 1954-77 ASM, BC, USDC.

3. Cost of Materials (State level): Unit—mil. $. 1954-77, 1982-83, ASM, BC, USDC.

4. Index of Food Mfg. Production: Unit—index 1967=100. 1949-69, HS, BC, USDC; 1970-83, SAUS, BC, USDC.

5. Number of Establishments (State level): 1948-82 census years only, CM, BC, USDC.

6. Processed Foods and Feeds Price: Unit—PPI, 1967=100. 1949-83, PPI, BLS.

7. Sales of Major Commodity Groups (State level): Unit—mil. $. 1948-82 census years only, Census of Wholesale Trade, BC, USDC.

8. Value of Manufacturers' Inventories by Industry Group: Unit—mil. $. 1949-83, ASM, BC, USDC.

9. Producer Price Index (Meat and Poultry, Dairy, Fruits and Vegetables, and Cereal and Bakery Products): Unit—index 1967-100. 1949-83, SAUS, BC, USDC.

MARKETING SECTOR VARIABLE MANIPULATIONS

The number of commodity groups in the marketing sector are reduced to five since feed grains are assumed to be an intermediate output/input in the farm sector. The remaining five commodity groups are: meat animal products, dairy products, poultry and eggs, fruits and vegetables, and other food products.

Outputs: Marketing Sector

Regional output in the marketing sector is estimated through the following approach. Value of shipment data per commodity group by region are collected from the Census of Manufactures, Area Statistics, for each census year from 1947-82. Other food products' value of shipment data are derived by adding grain mill products, bakery products, sugar and confectionery products, fats and oils, and miscellaneous foods and kindred products. The EI technique is then used to estimate value of shipment figures for the noncensus years. Percentage value of shipments to total national value of shipments of each region per product group are then computed. National data on an annual basis (1950-83) for value of shipments by commodity group are also collected from the Annual Survey of Manufactures. Using the regional percentage shares from the census data, we derived the regional value of shipments by multiplying the regional percentage shares with the annual national value of shipments from the ASM. The 1949 regional value of shipment data are estimated using either the LSE or SLM procedure. The LSE procedure is initially used and, if the predicted results are not consistent with the time-series data, the SLM method is used instead. Since the value of shipment data are in current dollars, they are adjusted by the PPI for each respective commodity to express the marketing sector output in real terms. The procedure is summarized as follows:

$$RVS_{kj}{}^t = [(PVSC_{kj}{}^t) \ (NVSA_k{}^t)/PIPF^t]$$

where: $PVSC = RVSC_{kj}{}^t/NVSC_{kj}{}^t$

$RVS_{kj}{}^t$ = regional value of shipments for commodity group k in region j in calendar year t deflated by the PPI for processed foods and feeds.

$PVSC_{kj}{}^t$ = percentage share of value of shipments using census data for commodity group k in region j in calendar year t.

$NVSA_k{}^t$ = national value of shipments for commodity group k in calendar year t from ASM.

$PIPF^t$ = PPI for each respective commodity in calendar year t.

$RVSC_{kj}{}^t$ = regional value of shipments for commodity group k in region j in calendar year t using census data.

$NVSC_{kj}{}^t$ = national value of shipments for commodity group k in calendar year t using census data.

Farm Inputs: Marketing Sector

Regional demand for farm products by the marketing sector does not necessarily correspond to regional farm output production. Hence, a methodology has been devised to establish indicators for regional demand for farm products at the marketing level. The Bureau of Census publishes industry value of shipments for all States. Among the value of shipments statistics available are those for meat products, dairy products, poultry and poultry products, fruits and vegetables, and grain products. Sales data from the 1947-82 Census of Manufactures are gathered on a State-level basis. The EE technique is then used to estimate value of shipment figures during the intervening years.

State value of shipment data per commodity group is then aggregated to form regional value of shipment data. The percentage value of shipment shares to total national value of shipment of each region per product group is estimated. Total U.S. farm supply per product net of exports is multiplied by the respective percentage shares to derive an indicator of regional demand for farm outputs at the marketing level. The procedure is summarized as follows:

$$RDF_{kj}{}^t = (NNP_k{}^t - NE_k{}^t)(PSS_{kj}{}^t)$$

where: $$NNP_k{}^t = \sum_{i=1}^{n} NNP_i{}^t.$$

$$NNP_i{}^t = (NNPC_i{}^t)(USCMD_i{}^t) + (NNPC_i{}^{t-1})(USCMD_i{}^{t-1}).$$

$RDF_{kj}{}^t$ = quantity of farm output demand for commodity group k in region j in calendar year t.

$NNP_k{}^t$ = national farm production of commodity group k in in calendar year t.

$NE_k{}^t$ = national exports of commodity group k in calendar year t.

$PSS_{kj}{}^t$ = percentage value of shipment share of commodity group k in region j for calendar year t.

$NNP_i{}^t$ = national farm production of product i comprising commodity group k in calendar year t.

$USCMD_i{}^t$ = U. S. crop marketing distribution of product i in crop marketing year t.

$NNPC_i{}^t$ = national farm production of product i in crop marketing year t.

FINAL MARKETING SECTOR VARIABLES

The following marketing sector variables are in their final form and are available at the national and/or regional levels in the unit shown (calendar year, 1949-83).

1. Outputs: Marketing Sector

    a. Meat Animal Products (regional): Unit--index, 1967=100.

    b. Dairy Products (regional): Unit--index, 1967=100.

    c. Poultry and Eggs (regional): Unit--index, 1967=100.

    d. Fruits and Vegetables (regional): Unit--index, 1967=100.

    e. Other Food Products (regional): Unit--index 1967=100.

2. Farm Inputs: Marketing Sector

    a. Meat Animal Products (regional): Unit--quantity demanded, mil. lbs.

    b. Dairy Products (regional): Unit--quantity demanded, mil. lbs.

    c. Poultry and Eggs (regional): Unit--quantity demanded, mil. lbs.

    d. Fruits and Vegetables (regional): Unit--quantity demanded, thous. tons.

    e. Other Food Products (regional): Unit--quantity demanded, mil. lbs.

3. Nonfarm Inputs: Marketing Sector

    a. Intermediate Materials for Food Manufacturing Price (national): Unit--PPI, 1967=100.

    b. Processed Fuel Price (national): Unit--PPI, 1967=100.

    c. Containers Price (national): Unit--PPI, 1967=100.

    d. Supplies Price (national): Unit--PPI, 1967=100.

    e. Average Hourly Earnings for Production Workers (national): Unit--$/hr.

4. Other Data: Marketing Sector

    a. Value added in Food Manufacturing (national): Unit--mil. $.

    b. New Capital Expenditures (national): Unit--mil. $.

    c. Index of Food Manufacturing Production (national): Unit--index, 1967=100.

    d. Number of Establishments (regional): Unit--(000).

RETAIL SECTOR VARIABLES

This section describes data collection for the variables pertaining to the retail sector demand for food products. A mixture of national and State-level data are collected for 1949-83. State-level data aggregations are performed to obtain regional estimates.

Published government documents are the principal data source. Unpublished data from various government agencies are used when published sources are not available. In cases where both published and unpublished data are not available, statistical techniques are used in estimating missing data.

Raw data are collected for the following retail sector variables.

Food Prices: Retail Sector

CPI data for all urban consumers are collected for New York, Chicago, Atlanta, and San Francisco. The city-level CPI's are assumed to be a good proxy for their corresponding regional CPI; that is, Northeast (New York), North Central (Chicago), South (Atlanta), and West (San Francisco).

1. Meat, Poultry, and Fish Price (city level): Unit--CPI, 1947-49=100, 1957-59=100, and 1967=100. 1949-83, CPI, and Bahr, BLS, USDL.

2. Meat Price (national): Unit--CPI, 1967=100. 1949-83, FCPE, ERS, USDA.

3. Poultry Price (national): Unit--CPI, 1967=100. 1949-83, FCPE, ERS, USDA.

4. Egg Price (national): Unit--CPI, 1967=100. 1949-83, FCPE, ERS, USDA.

5. Dairy Product Price (city level): Unit--CPI, 1947-49=100, 1957-59=100, and 1967=100. 1949-83, CPI, and Bahr, BLS, USDL.

6. Fruit and Vegetable Price (city level): Unit--CPI, 1947-49=100, 1957-59=100, and 1967=100. 1949-83, CPI, and Bahr, BLS, USDL.

7. Cereals and Bakery Products Price (city level): Unit--CPI, 1947-49=100, 1957-59=100 and 1967=100. 1949-83, CPI, and Bahr, BLS, USDA.

Nonfood Prices: Retail Sector

1. Housing Price (city level): Unit--CPI, 1947-49=100, 1957-59=100, and 1967=100. 1953-83, CPI, and Bahr, BLS, USDL.

2. Rent and Residential Price (national): Unit--CPI, 1967=100. 1949-83, SAUS, BC, USDC.

3. Apparel and Upkeep Price (city level): Unit--CPI, 1947-49=100, 1957-59=100, and 1967=100. 1953-83, CPI, and Bahr, BLS, USDL.

4. Apparel Price (national): Unit--CPI, 1967=100. 1949-83, SAUS, BC, USDC.

5. Transportation Price (city level): Unit--CPI, 1947-49=100, 1957-59=100, and 1967=100. 1949-83, CPI, and Bahr, BLS, USDL.

6. Medical Care Price (city level): Unit--CPI, 1947-49=100. 1957-59=100, and 1967=100. 1949-83, CPI, and Bahr, BLS, USDL.

7. Other Goods and Services Price (city level): Unit--CPI, 1947-49=100, 1957-59=100, and 1967=100. 1953-83, CPI, and Bahr, BLS, USDL.

8. All Services Price (national): Unit--CPI, 1967=100. 1949-83, SAUS, BC, USDC.

Consumer Expenditures: Retail Sector

The following national consumer food consumption expenditure data (mil. $) are collected from the ERS, USDA publication Food Consumption, Prices, and Expenditures for 1949-83: all farm foods, meat products, dairy products, poultry and eggs, fruits and vegetables, grain mill products, and bakery products.

Demographic Variables: Retail Sector

1. Personal Income (State level): Unit--bil. $. 1949-83, SAUS, BC, USDC.

2. Per Capita Income (State level): Unit--$. 1949-82, State Personal Income: Estimates for 1929-82, BEA, USDC.

3. Total Government Food and Nutrition Service Programs (national level): Unit--mil. $. 1949-83, AS.

Other Data: Retail Sector

1. Poultry Per Capita Consumption: Unit--lbs., ready to cook weight. 1949-83, FCPE, ERS, USDA.

2. Eggs, Per Capita Consumption: Unit--lbs., retail weight. 1949-83, FCPE, ERS, USDA.

3. Personal Consumption Expenditures: Unit--bil. $., 1949-83, SAUS, BC, USDC.

RETAIL SECTOR VARIABLE MANIPULATIONS

The national CPI for meat products is used as proxy variable for regional meat product retail price since the city-level CPI for meat products includes poultry and fish. A national CPI for poultry and eggs is constructed using the AWA procedure with per capita consumption of poultry and eggs as weights. The constructed national CPI for poultry and eggs is used as proxy variable for regional poultry and egg retail price.

The city-level data on CPIs for housing, apparel and upkeep, and other goods and services are not available for 1949-52. Estimates of the missing variables are derived by regressing the city-level CPI with their corresponding national-level CPI. The predicted values are derived using LSE.

There is no available data for other food product expenditure. To estimate the other food product expenditure, the consumer expenditures for meat products, dairy products, poultry and eggs, fruits and vegetables, grain mill products, and bakery products are added and subtracted from total consumer expenditures for food. The difference is then added back to grain mill products and bakery products consumer expenditures to estimate the other food product expenditure.

The following methodology is employed in estimating the regional retail demand for food products:

$$QRMk_{kj}^{t} = (RFPE_{kj}^{t})/(RFPI_{kj}^{t})$$

where: $RFPE_{kj}^{t} = (PP_{j}^{t})(USFP_{k}^{t})$.

QRM_{kj}^{t} = quantity demand for food product k in region j in calendar year t (in index form, 1967=100).

$RFPE_{kj}^{t}$ = regional food product expenditure for food product k in region j in calendar year t (in index form, 1967=100).

$RFPI_{kj}^{t}$ = regional food product price for food product k in region j in calendar year t (in index form, 1967=100).

PPY_{j}^{t} = percentage income share of region j to total national income in calendar year t.

$USFP_{k}^{t}$ = national food product consumer expenditures for food product k in calendar year t.

Regional personal consumption expenditures are estimated by multiplying national personal consumption expenditures with percentage income share of region j to total national income.

FINAL RETAIL SECTOR VARIABLES

The following retail sector variables are in their final form and are available at the national and/or regional levels in the units shown (calendar years, 1949-83).

1. Retail Food Demand

   a. Meat Animal Products (regional): Unit--index, 1967=100.

   b. Dairy Products (regional): Unit--index, 1967=100.

c. Poultry and Eggs (regional): Unit--index, 1967=100.

d. Fruits and Vegetables (regional): Unit--index, 1967=100.

e. Other Food Products (regional): Unit--index, 1967=100.

2. Retail Food Prices

a. Meat Animal Products (national): Unit--CPI, 1967=100.

b. Dairy Products (regional): Unit--CPI, 1967=100.

c. Poultry and Eggs (national): Unit--CPI, 1967=100.

d. Fruits and Vegetables (regional): Unit--CPI, 1967=100.

e. Other Food Products (regional): Unit--CPI, 1967=100.

3. Nonfood Prices: Retail Sector

a. Housing (regional): Unit--CPI, 1967=100.

b. Apparel and Upkeep (regional): Unit--CPI, 1967=100.

c. Transportation (regional): Unit--CPI, 1967=100.

d. Medical Care (regional): Unit--CPI, 1967=100.

e. Other Goods and Services (regional): Unit--CPI, 1967=100.

4. Demographic and Other Variables: Retail Sector

a. Personal Income (regional): Unit--bil. $.

b. Per Capita Income (regional): Unit--$)

c. Personal Consumption Expenditure (regional): Unit--bil. $.

d. Total Government Food and Nutrition Service Programs
   (national): Unit--mil. $.

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APPENDIX

The LSE results in this appendix are presented as follows. The first part contains the LSE and SLM equations used to estimate the missing values for the regional value of shipment data. The second part shows the LSE equations used to estimate the missing values for the regional nonfood retail prices.

1. Value of Shipments - Marketing Sector (LSE technique)

$$NE[1] \text{ meat animals} = \underset{(6.07)}{657.43} + \underset{(17.12)}{88.505} T \qquad R^2 = .90$$

$$W \text{ meat animals} = \underset{(4.06)}{1027.86} + \underset{(11.15)}{134.71} T \qquad R^2 = .79$$

$$NE \text{ dairy products} = \underset{(2.33)}{454.25} + \underset{(13.87)}{129.14} T \qquad R^2 = .86$$

$$NE \text{ fruits and vegetables} = \underset{(1.49)}{192.43} + \underset{(14.52)}{89.35} T \qquad R^2 = .87$$

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[1] NE = Northeast; NC = North Central; W = West; S = South; T = time

[2] (numbers in parenthesis are t-statistics)

2. Value of Shipments - Marketing Sector (SLM technique)

NC meat animals = 8.269 + .055 T R^2 = .95
                  (185.96) (26.22)

S meat animals = 6.87 + .069 T R^2 = .94
                 (105.76) (22.37)

NC dairy products = 7.19 + .074 T R^2 = .91
                    (85.04) (18.34)

S dairy products = 6.55 + .064 T R^2 = .88
                   (76.18) (15.74)

NE poultry and eggs = 2.58 + .138 T R^2 = .97
                      (33.31) (37.29)

NC poultry and eggs = 4.34 + .093 T R^2 = .95
                      (59.79) (26.98)

S poultry and eggs = 5.94 + .083 T R^2 = .97
                     (119.25) (35.15)

W poultry and eggs = 4.98 + .044 T R^2 = .74
                     (51.71) (9.58)

NC fruits and vegetables = 5.70 + .090 T R^2 = .99
                           (192.21) (63.93)

S fruits and vegetables = 5.84 + .079 T R^2 = .99
                          (205.76) (58.98)

W fruits and vegetables = 6.72 + .062 T R^2 = .98
                          (224.62) (43.8)

NE grain products = 5.58 + .037 T R^2 = .84
                    (95.72) (13.39)

NE other food products = 7.93 + .049 T R^2 = .95
                         (223.56) (26.25)

NC grain products = 6.88 + .046 T R^2 = .93
                    (145.97) (20.68)

NC other food products = 7.42 + .075 T R^2 = .95
                         (120.42) (25.76)

S grain products = 6.24 + .049 T R^2 = .92
                   (121.21) (20.23)

S other food products = 7.22 + .078 T R^2 = .97
                        (143.88) (32.59)

W grain products = 5.38 + .051 T R^2 = .95
                   (133.52) (26.80)

W other food products = 6.80 + .069 T R^2 = .97
(105.76) (22.37)

3. Regional nonfood CPI as a function of national nonfood CPI (LSE technique)

NE shelter = -47.63 + 1.51 US shelter R^2 = .99
(-15.30)   (61.71)

NC shelter = -80.05 + 1.81 US shelter R^2 = .98
(-16.06)   (46.21)

S shelter = -77.11 + 1.81 US shelter R^2 = .99
(-20.89)   (62.38)

W shelter = -101.00 + 1.99 US shelter R^2 = .99
(-29.62)   (74.47)

NE apparel = 5.23 + .93 US apparel R^2 = .99
(3.37)   (73.47)

NC apparel = 27.79 + .73 US apparel R^2 = .98
(16.47)   (52.78)

S apparel = -4.40 + 1.01 US apparel R^2 = .99
(-4.36)   (123.71)

W apparel = -8.34 + 1.06 US apparel R^2 = .99
(-7.58)   (118.63)

NE other goods/services = 23.57 + .75 US other goods/services R^2 = .98
(10.43) (52.21)

NC other goods/services = 41.73 + .73 US other goods/services R^2 = .98
(26.60) (73.49)

S other goods/services = 38.03 + .74 US other goods/services R^2 = .98
(17.88) (54.62)

W other goods/services = 32.65 + .84 US other goods/services R^2 = .98
(12.96) (52.48)