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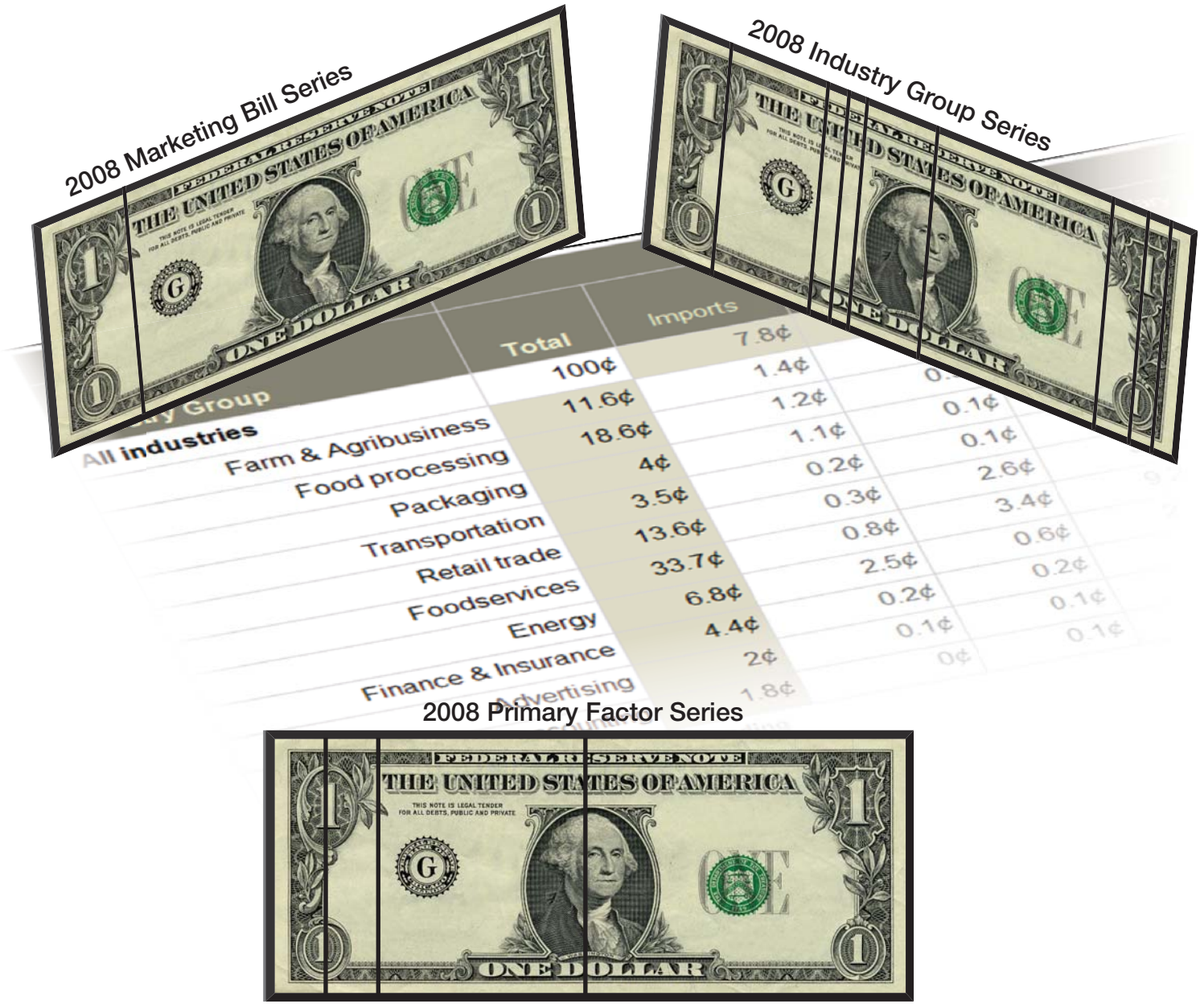
A Revised and Expanded Food Dollar Series

A Better Understanding of Our Food Costs

Patrick Canning



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A Revised and Expanded Food Dollar Series
A Better Understanding of Our Food Costs

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Abstract

A new ERS food dollar series measures annual expenditures on domestically produced food by individuals living in the United States and provides a detailed answer to the question "For what do our food dollars pay?" This new data product replaces the old marketing bill series, which was discontinued due to measurement problems and limited scope. The new food dollar series is composed of three primary series, shedding light on different aspects of evolving supply chain relationships. The *marketing bill series*, like the old marketing bill series, identifies the distribution of the food dollar between farm and marketing shares. The *industry group series* identifies the distribution of the food dollar among 10 distinct food supply chain industry groups. The *primary factor series* identifies the distribution of the food dollar in terms of U.S. worker salaries and benefits, rents to food industry property owners, taxes, and imports. To provide even more information about modern food supply chains, each of the three primary series is further disaggregated by commodity groupings (food/food and beverage), expenditure categories (total, food at home, food away from home), and two dollar denominations (nominal, real). The input-output methodology behind the new food dollar series and comparisons with the old marketing bill series are presented. Several key findings of the new series are highlighted and discussed.

Keywords: food dollar, farm share, marketing bill, industry value added, primary factor value added, input-output analysis, supply chain analysis

About the Authors

Patrick Canning is a senior economist with the U.S. Department of Agriculture's Economic Research Service.

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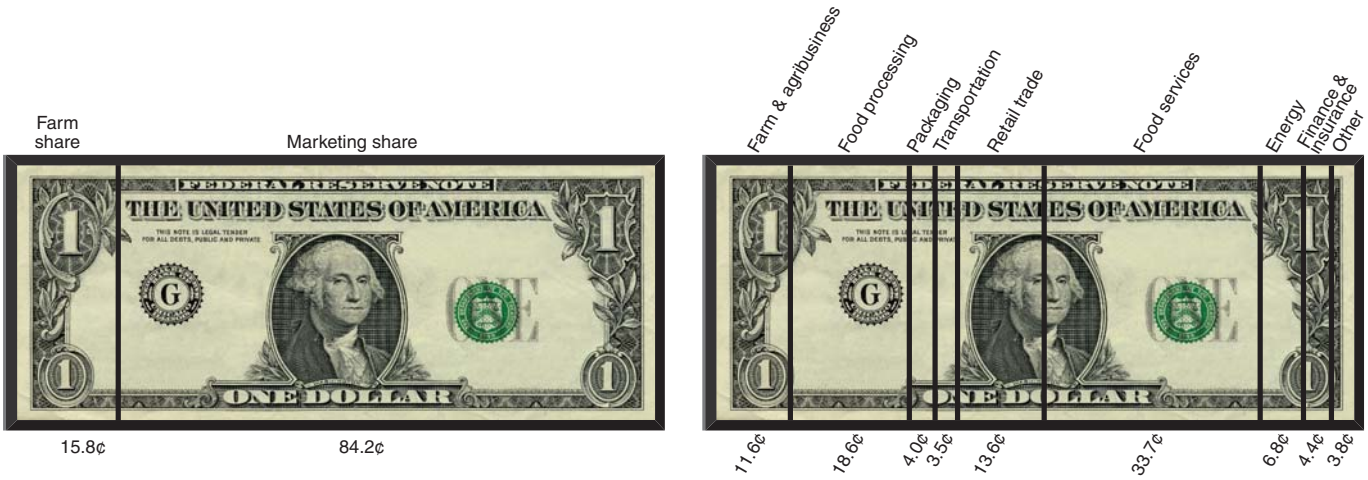
Summary

For many years, USDA's Economic Research Service (ERS) has analyzed annual spending by U.S. consumers on domestically produced food. ERS has published findings from this analysis in a series known as the marketing bill, which identified the costs of marketing the raw farm commodities contained in a typical dollar's worth of U.S.-produced food and the share of the typical food dollar going to farmers. Measurement problems, the discontinuation of several underlying data sources, and increased interest in evolving supply chain relationships prompted ERS to replace the old marketing bill series with a new expanded data series. This new series, named the food dollar series, provides a more detailed answer to the question, "For what do our food dollars pay?"

The New Food Dollar Series

The new food dollar series is composed of three primary series, each of which provides a different way of slicing the same food dollar to provide a variety of perspectives:

- The *marketing bill series*, like the previous series of that name, identifies the distribution of the food dollar between farm and marketing shares.
    - This series indicates that the costs of marketing farm commodities to U.S. food consumers were an average of 4 cents higher per consumer food dollar than was previously reported between 1993 and 2006. In 2008, the farm share was almost 16 percent.
- The *industry group series* identifies the value added from 10 distinct food supply chain industry groups to the food dollar (that is, the marginal contribution of each industry group to the final food product).
    - The farm and agribusiness share in this series differs from the farm share in the current marketing bill series (and the old marketing bill) in that it does not include nonfarm value added. In 2008, 4.2 cents of the 15.8-cent farm share was value added from nonfarm supply chain industry groups, such as energy, transportation, and financial services.
    - This series indicates that payments from each food dollar going to the energy industry group approached 7 cents in 2008, an increase of 75 percent since 1998. These estimates are higher than those provided by the old marketing bill series, which only measured direct energy use of food processors, retailers, and foodservice establishments.
- The *primary factor series* identifies the distribution of the food dollar in terms of U.S. worker salaries and benefits, rents to food industry property owners, taxes, and imports.
    - This series indicates that U.S. worker salaries and benefits coming from each food dollar steadily declined from 55 cents to 51 cents between 2001 and 2008.
    - Imported ingredients, both food and nonfood, accounted for a growing share of the food dollar, climbing from less than 5 cents in 1993 to nearly 8 cents in 2008.



To provide even more information about food supply chains, each of the three primary series is disaggregated into food-at-home and food-away-from-home series and into total food expenditures that do not include soft drinks and alcoholic beverages and total food expenditures that include them. Interestingly, in the food-at-home marketing bill series, the farm share of the food dollar remained around 24 cents from 1993 to 2008, suggesting that increasing expenditures on food services are behind much of the reduction in the farm share in the total marketing bill series.

In total, the new food dollar series includes 36 individual series, created by permutations of the three component series (marketing bill, industry group, primary factor), with the two commodity groupings (food/food and beverage), the three expenditure categories (total, food at home, food away from home), and the two dollar denominations (nominal, real). The series spans the period from 1993 to 2008 and will be updated annually.

How and Why Was the New Food Dollar Series Constructed?

Annual input-output (IO) data for the years 1993 to 2008, published by the Bureau of Labor Statistics; data from the 1997 and 2002 detailed U.S. benchmark IO accounts; and annual IO data for the years 1998 to 2008, published by the Bureau of Economic Analysis (BEA) were compiled and reconciled to

produce annual food marketing bill estimates for the period 1993-2008, using conventional IO analysis. Supply chain IO analysis determines where food dollars wind up (as income) by tracing the market value-added measures for 10 supply chain industry groups and three primary production factors (labor, domestic industry assets, and imports). All estimates were reported in both nominal (current price) and real (inflation-adjusted) dollars.

This new approach to assessing what our food dollars pay for is superior to the former approach in several important ways:

- The quality, timeliness, and completeness of the new source data ensures that a complete accounting of the entire food system is derived from a single consolidated data source.
- A precise approach to measuring and reporting the cost components of the entire food dollar in the new series avoids the potentially confusing divisions of the previous marketing bill series.
- The new food dollar series provides a more complete accounting of the modern global food system.

Introduction

Increases in marketing costs for U.S.-produced food commodities have outpaced increases in the payments farmers have received for these commodities over most of the past 40 years (Elitzak, 1999, 2004). Economic theory provides several market structures that could explain this trend. For example, a purely competitive market can produce regular fluctuations in the marketing margins of food commodities, driven by population growth and asymmetric supply elasticities for farm commodities and marketing services (Gardner, 1975). Alternatively, when a market segment becomes highly concentrated, collusive pricing strategies among large establishments within this segment can elevate prices, reducing market demand and suppressing prices received by producers who supply commodities to these establishments (Canan and Cotterill, 2006). However, a persistent increase in the U.S. food marketing bill over an extended period suggests that something more fundamental may also be behind the trend for food marketing costs to rise faster than farmers' proceeds, such as changes in both the structure of the food marketing system and in the socioeconomic characteristics of food consumers.

With passage of the Agricultural Marketing Act of 1946, Congress mandated that:

> "The Secretary of Agriculture is directed and authorized to **determine costs of marketing agricultural products in their various forms and through the various channels…**" [U.S. Code, Title VII, Chapter 38, Section 1622 (b)]

A measure known as the "farm share of the food dollar" was developed by USDA's Economic Research Service (ERS) to meet the mandate for reporting the marketing cost for overall food production. The ERS estimates have come to be called the "food marketing bill."

Beyond the information explicitly called for in the original mandate, the ERS food marketing bill program has historically provided an itemized analysis of annual marketing costs, called "components of the food marketing bill." Figure 1 illustrates the way ERS reported the two data series of the food marketing bill program, the farm share and the marketing bill, in the form of a dollar bill. Each section of the dollar depicts average costs by category for supplying a typical dollar's worth of food to U.S. households. In this format, costs can be expressed interchangeably in terms of cents on a dollar or percentage of total food costs.

ERS food marketing bill estimates have been based largely on a combination of annual data and less frequent Census benchmark statistics that must be adjusted, using conversion factors to conform to the food marketing bill concepts. Over time, the quality and quantity of data for estimating the food marketing bill has diminished, and the method for calculating the marketing bill has become unreliable. A number of authors have discussed food marketing bill estimation issues (Gale, 1967; Harp, 1987; Schluter, Lee, and LeBlanc, 1998; Elitzak, 1999). The aim of the present study is to introduce a systematic method for measuring the marketing bill, using annual data that are being generated on a regular basis.

Figure 1

Farm share and marketing bill of the 2006 food dollar computed by the old method

What a dollar spent on food paid for in 2006

Source: USDA, Economic Research Service.

This report presents the new approach developed by ERS for estimating the food dollar and its component parts.[1] With the new procedures, the complete food dollar, not just the food marketing bill, is divided into total value added for 10 industry groups: farm and agribusiness, food processing, packaging, transportation services, energy, retail trade, food services, finance and insurance, advertising, and legal-accounting-bookkeeping services. Next, the primary factor returns series divides the food dollar by the contributions of three primary production factor groups: domestic hired labor, domestic industry assets, and international imports. Finally, a cross-tabulation table divides the food dollar into the primary factor returns for each industry group. All estimates are reported in nominal (current price) and real (inflation adjusted) dollars. The box "The New Food Dollar Series: A Glossary of Key Terms," presents a list of terms used in the report and their definitions.

This new approach to assessing what our food dollars pay for is superior to the former approach in several important ways. First, the quality, timeliness, and completeness of the new source data ensure that a complete accounting of the entire food system is derived from a single consolidated data source. Because the new annual data are largely survey based, year-to-year changes to the supply chain structure, food expenditure patterns, and relative input and output commodity prices are reflected in these data, unlike in the previous marketing bill series. Second, a precise approach to measuring and reporting the cost components of the entire food dollar in the new series avoids the potentially confusing divisions of the previous marketing bill series. For example, the new food dollar industry group series reports total energy industry costs per dollar of food expenditures, whereas the old marketing bill series only reported the electric and gas utility costs paid by a subset of food marketing establishments, such as processors, retailers, and restaurants. Third, the new food dollar series provides a more complete accounting of the modern global food system. Examples include (1) the

[1]The Office of Management and Budget issued a Statistical Policy Directive in 2008 (*Federal Register*, Vol. 73, No. 46 / Friday, March 7, 2008 / Notices), that provides guidance to Federal statistical agencies on the release and dissemination of statistical products. It stresses the need for adherence to data quality standards through equitable, policy-neutral, and timely release of information to the general public, and calls for "transparent descriptions of the sources and methodologies used to produce the data."

The New Food Dollar Series: A Glossary of Key Terms

The new and expanded food dollar series uses different source data and estimation methods than the food marketing bill series that it replaces. The changes in methods lead to changes in some terminology. Although many of the key terms below have different meanings in other contexts, only the meaning germane to the context of this report is provided here.

Farm share: Producer value of total annual farm commodity sales that are linked to annual food dollar expenditures, excluding farm commodities that are purchased directly or indirectly by other farm operations. Examples of exclusions are the purchase of hay by a cattle ranch (direct transaction) or purchase by a poultry farm of animal feed containing grains purchased by a feed mill from a feed-grain farm (indirect transaction).

Food dollar: Total annual market value for all purchases of domestically produced foods by persons living in the United States.

Food marketing bill: The market value of all post-farm processes of food dollar supply chain industries, measured as the difference between food dollar expenditures and farm share commodity sales.

Imports: Food and non-food commodities that are imported from international sources and are used by U.S. food supply chain industries producing for the U.S. market.

Industry group: A collection, for accounting purposes, of establishments producing the same or similar output products, and of groups subcontracting to those establishments to support the production of output products.

Industry group value added: The compensation charged by all establishments in an industry group to buyers of their products for the services provided by the industry group's primary factors of production.

Market value: Price paid by a consumer for the purchase of a consumer good.

Nominal value: The dollar value of products and/or services purchased or appraised, based on prevailing prices at the time of purchase or appraisal.

Output taxes: The value of excise, sales, property, and severance taxes (less subsidies), customs duties, and other non-tax Government fees levied on establishments.

Primary factors of production: Assets such as labor, machinery and equipment, physical structures, land and other natural resources, and intellectual property that are employed or operated by an industry group toward fulfilling the demand for the industry product.

Producer value: Compensation received by producers for the sale of their products.

Real value: The dollar value of products and/or services purchased or appraised, based on prices prevailing during a specific time period.

Property income: The pre-tax income or capital gain accruing to owners of non-labor primary factors of production.

Salary and benefits: The pre-tax employee wages plus employer and employee costs for employee benefits.

Supply chain industry: Any industry dedicating resources and/or processes toward fulfilling the demand for a product.

explicit measurement of the costs for internationally produced food and non-food ingredients embodied in all domestically produced food commodities, (2) the explicit food dollar series accounts for food-at-home and food-away-from-home expenditures to assess the role of changes to these two distinct food market segments, and (3) the reporting of all food dollar series in both nominal and real (inflation adjusted) values, to decompose the role of price and volume changes for goods and services embodied in our annual food expenditures. Each of these advantages to the new food dollar series are facilitated by the new source data and input-output analysis methods, and none of these features can be effectively measured using the old data sources and estimation procedures.

A New Approach To Estimating and Presenting the Food Dollar

Input-output analysis is used to measure the food marketing bill, and supply chain analysis is used to measure the value-added components of the food dollar. To facilitate these new estimation procedures, a precise operational definition of food dollar expenditures and the farm share is established.

Today's food marketing system is globally integrated, with many food commodity supply chains having multistage production processes that produce several product and packaging varieties. For example, both domestic and imported wheat is milled in the United States and the flour is widely used by bakeries, who in turn may incorporate fresh fruits and processed ingredients of both domestic and imported origins into their bakery products. In this and many other circumstances, clarity is needed for estimating the costs of marketing U.S. agricultural products, beginning with a concise definition of food dollar expenditures. We use the following definition:[2]

> *Food dollar expenditures are the annual purchases, by people living in the United States, of food products that (1) are produced on a U.S. farm and undergo no off-farm process beyond storage, transport, and basic packaging, or (2) are processed at a domestic food-manufacturing establishment.*

As input to these food dollar purchases, farms produce commodities that are either directly consumed as foods or used as ingredients in processed foods. If we denote this farm production as the *raw food dollar*, then the *farm share* and the *food marketing bill* are defined as follows:

> *Farm share is measured as the average payment from each food dollar expenditure that farmers receive for their raw food dollar commodities. The food marketing bill is measured as the average value added to the raw food dollar from each consumer food dollar expenditure.*

Accounting for Imported Ingredients in Domestically Produced Food

Domestically produced food commodities often rely on imported commodities to facilitate their production, and the food dollar series should include the value added from these imports.

Imported primary (farm fresh) and processed foods purchased by people living in the United States are not included in the proposed definition of food dollar expenditures. When used as ingredients by domestic food manufacturers, however, these imports must be treated as a food dollar expenditure. Otherwise, the exclusion of imported wheat used by a U.S. flourmill will erroneously lead to exclusion of domestic fruit filling used by a bakery that purchased the milled import wheat. Similarly, exclusion of imported fruit filling used by the same bakery will erroneously exclude domestic wheat in other flour purchased by the bakery.

[2]Purchases of food by domestic institutions for people in these institutions and food purchases by domestic employers for their employees are included. Commodities such as table salt and bottled water that have no farm ingredients are excluded.

The commingling of imports in domestically produced foods is not limited to food ingredients. Products such as imported petroleum, fertilizers, and transportation equipment are used extensively by domestic establishments producing food. Among the food ingredients that are imported and sold in U.S. markets, those that are commingled with other ingredients and marketed as a product substantially different from the one entering the country are included in the ERS measures of food dollar expenditures, whereas imported food ingredients sold directly in final markets do not enter into the measures.

Measuring Food Dollar Expenditures and the U.S. Farm Share

The first step in the estimation process is to measure average food dollar expenditures and the farm share of those expenditures, using input-output analysis.

Input-output (IO) analysis facilitates the study of interdependencies, both among industries throughout an economy and between industry and final market sales. In the IO framework, an "industry" is a group of establishments that produce similar products, and "final market sales" are all sales of goods or services produced by industries and classified into "commodity groups," other than sales of goods or services for use by a domestic industry for the production of another commodity or service during the current accounting period. A food dollar expenditure is an example of a final market sale. For IO analysis, three subaccounts make up the economic model:

1. A column vector $\boldsymbol{y}$ itemizes total final market sales of C distinct commodities, each uniquely produced by one of the C distinct industry groups.
2. A column vector $\boldsymbol{x}$ itemizes total availability of domestic industry output plus imports for each of the C commodity groups.
3. A total requirement matrix, L, also known as the Leontief matrix, is a table with C columns and rows for each industry/commodity group, reporting average annual sales by each industry (such as grain farming) per dollar of final market demand for each commodity (such as bakery products).

These three subaccounts are related by the simple matrix algebra identity, $L \cdot y = x$, in which multiplication of the final demand vector y by the total requirement matrix L exactly produces the industry output vector x. One convention of IO analysis is the assumption of linearly homogeneous production technologies. A linear technology implies, for example, that if 100 bushels of wheat are required for 9,000 loaves of whole wheat bread sold to U.S. households, then 50 bushels are required for the 4,500 loaves sold to a subset of these households.

Let *S_fd* denote a column vector that reports the share of each final demand element in y that represents a food dollar expenditure, with the one exception that household purchases of imported foods are included in the share calculation.[3] Next, with subscripts denoting the row and column dimensions of any matrix and with a defined as the set of all rows containing agricultural

[3]Including household purchases of imported foods is necessary for the IO model to trace through the total farm sales linked to food dollar expenditures. These imported food purchases are deducted in a later step.

industry/commodity groups, a measure of *import-inclusive gross farm sales* associated with the food dollar expenditures is obtained as follows:

$$(1) \qquad x_a^{fd} = L_{a,C} \cdot y_C^{fd}, \quad \text{where } y_C^{fd} = \overline{S\_fd}_C \cdot y_C$$

The *fd* superscript on x_a in equation 1 is to indicate that the *x* vector is conditional to the multiplication of the final demand vector *y* by the share vector *S_fd*. The $^{-}$ symbol above a vector indicates a conversion into a square diagonal matrix. This matrix algebra procedure facilitates row-to-column multiplication of commodity share values in *S_fd* with the corresponding commodity final demand value in *y*.

Farm-to-farm payments must be netted out of the gross farm sales measured in equation 1. To explain, note that, in equation 1, gross farm industry sales include interindustry sales by the farm industry, some of which are direct and indirect farm-to-farm sales. For example, a feedlot operation purchases cattle from a ranch (direct) and animal feed from a feed manufacturer that, in turn, purchased grain from a grain farm (indirect). To avoid double counting intraindustry farm sales, one should net out all payments to a farm establishment that are passed on and subsequently go directly or indirectly to another farm establishment:

$$(2) \qquad x_a^{net} = x_a^{fd} - \left(\underbrace{A_{a,a}}_{\substack{farm-to-farm \\ direct}} + \underbrace{\hat{A}_{a,a}}_{\substack{farm-to-farm \\ indirect}} \right) . x_a^{fd}$$

Equation 2 indicates that the import-inclusive net farm sales equal gross farm sales minus the portion of these sales that were purchased by other farm establishments, either directly or through one or more nonfarm industry establishments. In equation 2, $A_{a,a}$ is a matrix describing farm-to-farm direct transactions per dollar of output for each farm commodity, the $A_{a,a}$ matrix with ^ above it describes total farm-to-farm indirect transactions per dollar of output for each farm commodity,[4] and x_a^{fd} is as defined in equation 1.

To obtain the farm share measure, one must deduct household purchases of imported farm and processed food commodities from the import-inclusive food dollar and the subset of those purchases representing household purchases of imported farm commodities from the net farm sales measured in equation 2. By IO accounting convention, all commodity transactions are divided between domestic and imported sources in proportion to their total availability. If s_m_c denotes the import share of available product for all commodities $c \in C$, the farm share measure that is mandated by Congress is obtained as follows:

$$(3) \qquad farm\ share\ = i_a' \cdot \left[x_a^{net} - \overline{S\_m_a} \cdot y_a^{fd} \right] \ \div \ i_C' \cdot \left[\left(\bar{i}_C - \overline{S\_m_c} \right) \cdot y_C^{fd} \right]$$

In equation 3, the numerator is a summation of import-exclusive net farm sales and the denominator is a summation of import-exclusive food dollar sales.[5] A detailed mathematical derivation of the expressions used in equations 1 to 3 is provided in a technical appendix to this report.

[4] A formal derivation of the farm-to-farm indirect matrix is provided in the appendix (see equations A29 and A30).

[5] In this context, "import-exclusive" indicates the deduction of imported food dollar purchases. The numerator in equation 3 deducts sales of only raw (farm fresh) food commodities such as imported fresh produce, and the denominator in the equation deducts all imported food dollar sales.

Annual Food Dollar Estimation Model

The second step is to appropriate data sources to carry out annual estimation of these data series.

The Bureau of Economic Analysis (BEA) publishes a detailed benchmark U.S. input-output table in 5-year intervals, with a 5-year lag between data enumeration and public release of the IO tables (www.bea.gov/industry). Because of their close link to survey-based primary source data and their detailed industry coverage, the BEA benchmark accounts provide the most complete source of information for compiling estimates of equations 1 to 3. The two most recent BEA benchmark IO table releases cover the years 2002 and 1997 and are largely based on the Economic Census data enumerated in those years. After some aggregation of the 1997 and 2002 BEA benchmark accounts to ensure a one-to-one matching of industry groupings, the benchmark tables cover 392 industries.

The Bureau of Labor Statistics (BLS) provides annual input-output tables that are based on the structural matrix of the most recent BEA detailed benchmark IO table (www.bls.gov/emp/ep_data_input_output_matrix.htm). The current BLS annual IO accounts cover calendar year economic flows of the U.S. national economy for 1993 to 2008, and the accounts are reported in both nominal (current-year) and constant (inflation-adjusted) dollars. Industry output of goods and services is broken into 202 distinct commodity groups, and personal consumption expenditures on food are distinguished by category of purchase.[6] For the present analysis, these categories are broken out into two groups: food and beverages purchased for off-premises consumption (food-at-home), and all other food consumption expenditures (food-away). Examples of food-at-home expenditures include (but are not limited to) food purchased at grocery stores, farmers' markets, or nontraditional food retailers such as convenience stores. Examples of "food-away" expenditures include (but are not limited to) food purchased at restaurants, sports arenas, supplied by employers to employees, and supplied in domestic institutions, for example, school lunches.

The approach in this report is to update the food marketing bill measure obtained from the 2002 detailed benchmark table for the years 2003 to 2008, using the BLS annual IO tables, and to "back-cast" the food marketing bill measure obtained from the 1997 detailed benchmark table for the years 1993 to 1996. For the years 1998 to 2001, an indexing procedure is employed that captures the relative year-to-year changes in the food marketing bill between 1997 and 2002, as measured by the annual BLS data, while ensuring that the benchmark year estimates are replicated in the index of the BLS series (see Kuchler and Burt, 1990). Documentation of the data development work and the estimation model is provided in the technical appendix to this report. Documentation of input-output data sources and concepts is available from BEA at www.bea.gov/scb/pdf/2009/06%20June/0609_indyaccts_primer_a.pdf .

Historically, alcoholic beverages and soft drinks have not been included in food marketing bill estimates; however, commodities such as wine grapes, hops, and cane sugar are major U.S. crops. Recognizing that certain beverage products such as diet soft drinks use little if any farm commodities, the present analysis nonetheless includes a separate food and beverage dollar series.

[6]Annual updates by BLS of the BEA 2002 benchmark IO account (aggregated to about 200 commodity/industry groups) are obtained from annual GDP data and gross industry output data, converted to chain-weighted year 2000 dollars based on consumer price index (CPI) and producer price index (PPI) statistics. An efficient information processing algorithm know as "RAS" is used to update the benchmark technical coefficients for consistency with the new (survey-based) GDP and gross industry output data (www.bls.gov/emp/ep_projections_methods.htm).

Farm Share and Food Marketing Bill Estimates: 1993 to 2008

In the third step, the farm share and food marketing bill series are compiled and analyzed.

Figure 2 presents the 2006 food dollar decomposed into farm share (14.2 cents) and food marketing bill (85.8 cents) components. A comparison with figure 1 highlights two important differences between the revised and the old food marketing bill series. In the 2006 depiction in figure 1, the former series reports a larger farm share value. The result holds true for each year with overlapping measures. The new and the old series use different data sources, which partly explains why the results are different. Beyond this, the step outlined in equation 2 in the new input-output-based estimates, netting out of farm-to-farm direct and indirect transactions, accounts for most of the difference between the old and new farm share estimates over the 1993 to 2006 period where the two series overlap. Farm-to-farm transactions amount to a double-counting of farm sale proceeds of each food dollar, so it is appropriate

Figure 2

Farm share and marketing share of the food dollar computed by the new method

2006 Marketing bill

2008 Marketing bill

Source: USDA, Economic Research Service.

to adjust for them. The IO accounts provide a systematic means of making these adjustments.

Table 1 reports the estimated farm share and food marketing bill for the U.S. nominal food dollar and the nominal food and beverage dollar, for the period 1993 to 2008, using the new methodology. For the most part, the two series (food versus food and beverage) differ only in levels, with similar year-to-year percentage changes over the study period. For this reason, only the more traditional food dollar series is discussed below.

In 1993, the farm share of total food dollar expenditures was 18.4 cents, and for the next 4 years it hovered around 18 cents. Beginning in 1998, the farm share of total food dollar expenditures began to decline, reaching 15.3 cents on the food dollar by 2002, a 17-percent drop from the 1998 level. With the exception of 2006 (after the first 2-year decline in farm producer prices in the decade), the 2002 farm share represents a bottoming out of this series over the study period.

The farm share of food-away-from-home expenditures started to decline in 1998, and, by 2002, this share had fallen to 4.8 cents, or half of its 1996 level. For the most part, the 2002 farm share of food-away-from-home expenditures represents a bottoming out, with the exception of a sharp drop in 2006 to 4.1 percent, which is the lowest measured level over the study period for both the nominal food dollar and the nominal food and beverage dollar.

Although the farm share of at-home food expenditures does fall off slightly from 1998 to 2002, the series remains above 22 percent and below 24 percent over the study period, with the exception of the first (1993) and final (2007-08) 2 study

Table 1
Marketing bill and farm share of the U.S. nominal food dollar, 1993 to 2008

	Food dollar						Food & beverage dollar*					
	Total		Food at home		Food away		Total		Food at home		Food away	
	Farm share	Market bill	Farm share	Market bill	Farm share	Market bill	Farm share	Market bill	Farm share	Market bill	Farm share	Market bill
	Percent											
1993	18.4	81.6	24.6	75.4	10.5	89.5	16.2	83.8	20.1	79.9	10.1	89.9
1994	17.6	82.4	23.4	76.6	9.6	90.4	15.3	84.7	19.1	80.9	9.1	90.9
1995	18.1	81.9	23.9	76.1	9.7	90.3	15.6	84.4	19.6	80.4	9.0	91.0
1996	17.9	82.1	23.3	76.7	9.6	90.4	15.2	84.8	19.1	80.9	8.5	91.5
1997	17.8	82.2	23.3	76.7	9.4	90.6	15.1	84.9	19.1	80.9	8.5	91.5
1998	17.0	83.0	22.7	77.3	8.2	91.8	14.4	85.6	18.6	81.4	7.3	92.7
1999	16.2	83.8	22.3	77.7	6.9	93.1	13.8	86.2	18.2	81.8	6.1	93.9
2000	15.9	84.1	22.3	77.7	6.2	93.8	13.5	86.5	18.2	81.8	5.5	94.5
2001	15.5	84.5	22.1	77.9	5.5	94.5	13.1	86.9	18.0	82.0	4.9	95.1
2002	15.3	84.7	22.1	77.9	4.8	95.2	12.8	87.2	18.1	81.9	4.1	95.9
2003	15.4	84.6	22.3	77.7	5.1	94.9	12.9	87.1	18.2	81.8	4.5	95.5
2004	15.4	84.6	22.8	77.2	5.0	95.0	13.2	86.8	18.5	81.5	4.6	95.4
2005	15.3	84.7	22.5	77.5	5.0	95.0	13.0	87.0	18.3	81.7	4.5	95.5
2006	14.2	85.8	22.2	77.8	4.1	95.9	12.6	87.4	17.9	82.1	4.1	95.9
2007	15.8	84.2	24.0	76.0	4.8	95.2	13.7	86.3	19.4	80.6	4.6	95.4
2008	15.8	84.2	24.3	75.7	4.7	95.3	14.0	86.0	19.7	80.3	4.6	95.4

*Includes soft drinks and alcoholic beverages.
Source: USDA, Economic Research Service.

years. In these 3 years, the farm share of at-home food expenditures was in the low- to mid-24-cent range.

These results present a compelling case that the growing costs and expenditures of eating out are behind the downward trend in the farm share value over the study period. Under this interpretation of the data, the added costs of food preparation and cleanup services in foodservice establishments are driving up the marketing share and driving down the farm share.

To further examine farm share trends over the study period, we compiled the farm share series in constant (inflation-adjusted) year 2000 prices. Calculations of food dollar expenditures and farm commodity sales associated with these expenditures are compiled as if all transaction prices were fixed at year 2000 levels. Year 2000 estimates will thus be identical to those reported in table 1, whereas estimates for prior and subsequent years will reflect changes in volumes of purchased food and farm commodities, holding prices constant.[7] Table 2 reports these results.

[7]"Volume" in this context is not the same as units or quantity, since different factors such as quality, production recipe, and production technologies can change over time for any given commodity.

Between 1993 and 2000, the farm share measure in constant 2000 prices declined at a lower rate than did the nominal measure. This lower rate of decline implies that overall nominal farm commodity prices were falling relative to the prices of goods and services used for marketing these farm commodities to U.S. households. However, starting in 2002, the overall nominal price farm share began to rise relative to the real (inflation-adjusted) measure, implying that farm commodity prices over this period were rising relative to the prices for food marketing bill goods and services. This rise became more pronounced in 2006 to 2008, coinciding with the upturn in the nominal farm share during this period.

Decomposing the real farm share measure into at-home and food-away expenditures shows that the pre-2000 price trends for farm commodities and for food marketing bill goods and services generally moved together for the at-home expenditures over the 1993 to 2000 period, leading to very similar trends in both the nominal (table 1) and real (table 2) farm share measures over this period. The food marketing bill prices for food-away increased sharply relative to farm commodity prices over this interval. After 2000, farm commodity prices began to gain on food marketing bill prices for at-home food purchases, while food-away marketing bill prices continued to increase relative to the price of farm commodities through 2003. After 2003, farm commodity price increases started outpacing the price of the food marketing bill goods and services for food-away expenditures.

Taken together, the nominal and real farm share measures demonstrate that relative prices are important in shaping the farm share measure but are not the only factor. For example, although farm commodity prices began rising faster than the overall price for food-away marketing bill commodities, the nominal farm share of the food-away dollar trended lower over this interval, except in 2007, when the farm share rose after a sharp decline in 2006. The declining farm share in the face of rising farm commodity prices indicates that the volume of food-away services was increasing, possibly due to the foodservice category's declining relative price. If consumers are eating out more, higher farm commodity prices can coincide with a lower farm share measure due to the added food services purchased per dollar of food expenditures. Further,

Table 2

Marketing bill and farm share of the U.S. real food dollar, 1993 to 2008

	Food dollar						Food & beverage dollar*					
	Total		Food at home		Food away		Total		Food at home		Food away	
	Farm share	Market bill	Farm share	Market bill	Farm share	Market bill	Farm share	Market bill	Farm share	Market bill	Farm share	Market bill
	Percent											
1993	17.1	82.9	22.9	77.1	8.5	91.5	14.7	85.3	18.9	81.1	7.8	92.2
1994	15.3	84.7	20.6	79.4	7.2	92.8	13.1	86.9	16.9	83.1	6.6	93.4
1995	16.2	83.8	21.9	78.1	7.5	92.5	13.9	86.1	18.0	82.0	6.9	93.1
1996	17.0	83.0	22.4	77.6	8.3	91.7	14.2	85.8	18.3	81.7	7.2	92.8
1997	16.3	83.7	21.6	78.4	8.0	92.0	13.8	86.2	17.7	82.3	7.1	92.9
1998	16.1	83.9	21.6	78.4	7.6	92.4	13.5	86.5	17.7	82.3	6.6	93.4
1999	16.1	83.9	22.1	77.9	6.8	93.2	13.6	86.4	18.1	81.9	6.0	94.0
2000	15.9	84.1	22.3	77.7	6.2	93.8	13.5	86.5	18.2	81.8	5.5	94.5
2001	15.8	84.2	22.2	77.8	6.0	94.0	13.3	86.7	18.0	82.0	5.3	94.7
2002	14.6	85.4	20.7	79.3	5.1	94.9	12.2	87.8	16.9	83.1	4.4	95.6
2003	15.0	85.0	21.2	78.8	5.7	94.3	12.6	87.4	17.3	82.7	4.9	95.1
2004	14.8	85.2	21.5	78.5	5.4	94.6	12.6	87.4	17.3	82.7	4.9	95.1
2005	14.2	85.8	20.5	79.5	5.0	95.0	12.0	88.0	16.6	83.4	4.5	95.5
2006	12.9	87.1	20.1	79.9	3.9	96.1	11.7	88.3	16.2	83.8	4.1	95.9
2007	13.9	86.1	20.2	79.8	5.4	94.6	12.1	87.9	16.3	83.7	5.1	94.9
2008	13.9	86.1	21.5	78.5	4.3	95.7	12.4	87.6	17.2	82.8	4.3	95.7

*Includes soft drinks and alcoholic beverages.
USDA, Economic Research Service.

even if the relative prices for farm commodities and food marketing services remain constant, growth in the share of away-from-home food expenditures would lower the overall farm share measure, since the food-away farm share is substantially lower than the food-at-home farm share.

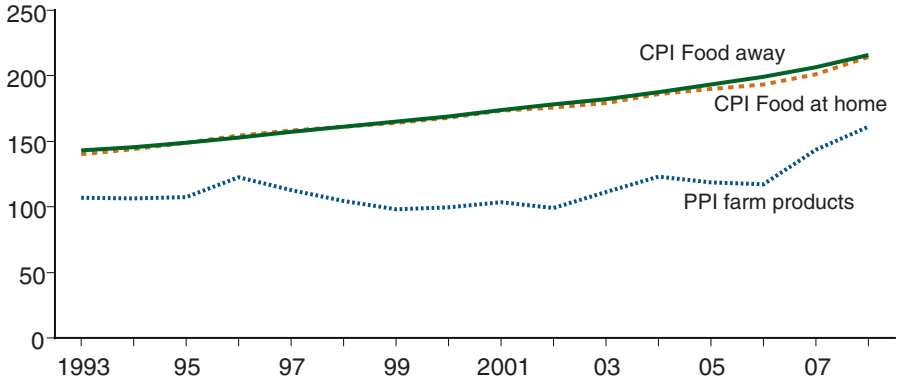
The prices referred to in the comparisons between nominal and real (inflation-adjusted) farm share measures represent the implicit per unit costs of a bundle of commodities purchased over the course of a year. Unlike fixed food basket price indexes, this bundle can change over time. For at-home expenditures, a household may change the specific products purchased within each commodity group, such as by buying more organic brands or purchasing more food-preparation services like pre-marinated meats. For away-from-home food expenditures, a household may change food-away destinations from limited-service to full-service establishments. Each of these examples can have food price implications that do not conform to the conventional notion of price inflation, but are instead caused by year-to-year changes in the product mix purchased within each commodity group. These cost-based price measures should not be confused with conventional commodity price indexes.

When BLS reports its annual indexes of consumer food prices and producer commodity prices, its measure explicitly controls for product-mix changes. By using a fixed basket of food products, the BLS index of prices avoids factors such as the introduction of marinated beef or a shift from limited-service to full-service restaurants. The importance of price comparisons under the two approaches is demonstrated in figure 3, which reports the BLS annual indexes of consumer food prices for at-home and food-away expenditures from 1993 to 2008. The figure also reports a total farm commodity (food and nonfood) producer price index (PPI) over the same interval. These price indexes support

Figure 3

Index of farm and food commodity prices, 1993-08

Index 1992-84=100



PPI = Producer Price Index; CPI = Consumer Price Index.
Source: Bureau of Labor Statistics, U.S. Department of Labor.

the IO analysis finding that the farm share of food dollar expenditures increased substantially in 2007 and 2008 due to higher farm commodity prices; however, the BLS price indexes also show very little difference in the year-to-year changes to at-home versus food-away food prices. The BLS data appear to contrast with the results in table 1 that indicate that the food-away marketing bill share of the food dollar increased throughout most of the study period while the food-at-home-share remained roughly constant.

The divergence between the BLS data and the ERS data in table 1 can be explained by several possible trends. If the bundle of food-away meals purchased by U.S. food consumers changed during this period, with consumers buying more food and/or services with higher marketing margins, this change would be reflected in the farm share measure but would not immediately show up in the fixed-bundle price indexes. In addition, farm commodity producer prices paid by the foodservice industry may have declined relative to the prices paid by food retailers, which can occur in the absence of overall changes to the price of farm commodities. To examine this issue more closely, a new approach to measuring the components of food dollar expenditures is introduced in the next section.

Components of the Food Dollar

In the next step, we use supply chain analysis to trace the market value of total food dollar expenditures back to the sources of value added and to the assets employed by participants in the food dollar supply chain.

Within the IO accounting framework, the market value of all final market sales, including all food dollar expenditures, is exactly equal to the sum total of all value added by every industry that is either directly or indirectly linked to the commodity supply chain. This result is simple to demonstrate by recalling that equation 1 identifies the gross outputs of all industries directly and indirectly linked to the import-inclusive food dollar expenditures. Multiplying both sides of equation 1 by the inverse of the Leontief matrix, and noting that inverting the Leontief matrix and summing the resulting matrix down each column produces a row vector of industry value-added coefficients, v_m', gives the following:[8]

$$\underbrace{v\_m_C' \cdot x_C^{fd}}_{\substack{\text{summation of value added to food dollar across all C industries}}} = \underbrace{i_C' \cdot y_C^{fd}}_{\substack{\text{summation of import-inclusive food dollar expenditures}}} \quad (4)$$

In this expression, the a subscript used in equation 1 was replaced by the *C* subscript, since all industry contributions to market value are studied in the present context, not just the farm share. Although equation 4 precisely gives the value contribution of all industries supporting the food dollar supply chain, this turns out to be too much information; most of the roughly 400 industries in the BEA detailed benchmark IO accounts, and roughly 200 industries in the annual BLS IO accounts, either directly or indirectly contribute some value to the production of food. The challenge is how to process this information in a way that informs our understanding of how value accumulates along the supply chain, from the production and application of farm inputs to the purchase of food products by or for U.S. households, as well as to show how this process changes from year to year.

A matrix reduction procedure in IO analysis (see chapter 3 in Leontief, 1986) to facilitate supply chain studies is suited for precisely this type of problem. Developed in the 1960s to facilitate a supply chain study of the U.S. metalworking industries, the original application identified four branches of production belonging to the metalworking industry group. Using precise mathematical computations, all industries not identified with these branches of production—here we use the term supply chain (SC) industries—were eliminated, but their value-added contributions were exactly allocated to the SC industries in proportion to the materials and services supplied. It is useful to refer to these non-SC industries as subcontracting establishments.

A simple aggregation of key industry groups that comprise the food supply chain industries can provide direct measurements of the value added to the food dollar by each group. A substantial portion of the value from each food dollar expenditure, however, is produced by numerous other industries that support some or all of the identified supply chain industries. The wholesale trade industry is a case in point. Agribusiness wholesalers, grocery wholesalers, and foodservice wholesalers provide supplies and services to three

[8]The row vector "v_m" measures the average import-inclusive value added per dollar of industry output from the employment of industry assets (e.g., hired labor, machinery, physical structures, natural resources). The value added equals 1 minus the sum of all purchased-input coefficients, which equals $i' \cdot L^{-1}$.

very distinct food supply chain groups. The role and structure of each of these three wholesale industry groups has evolved differently over time, and the groups are more closely allied to their industry clients than to each other. The matrix reduction procedure introduced in this section is a systematic approach to measure these relationships, whereas a simple aggregation of the wholesale trade industry would obscure the relationships.

To state this measure formally, let S denote the set of M different supply chain industry groups that facilitate production and delivery of food commodities to U.S. households, such that $S = \{s_1, s_2, ..., s_M\}$. Let v_m^* denote the reestimated value-added coefficients representing only the supply chain industries, but also reflecting the combined value-added coefficients of their subcontracting industries. Equation 4 is then modified for the reduced food supply chain IO system and to reflect the deduction of household import food expenditures, as follows:

(5)
$$v\_m_S^{*'} \cdot x_S^{fd\_net} = y_S^{fd\_net},$$

$$where: \quad x_S^{fd\_net} = x_S^{fd} - \overline{S\_m}_S \cdot y_S^{fd},$$

$$and: \quad y_S^{fd\_net} = (i_S - S\_m_S)' \cdot y_S^{fd}.$$

Each product of a supply chain value-added coefficient and its corresponding net industry output represents the value contribution of the specific supply chain industry. Dividing each element-wise product by the summation on the right in equation 5 produces the value contributions of each supply chain industry, and its subcontractors, to each food dollar expenditure:

(6)
$$industry\ group\ value-added\ food\ dollar = \overline{v\_m}_S^{*} \cdot x_S^{fd\_net} \div y_S^{fd\_net}$$

Industry Group Value-Added Composition of the Food Dollar

To carry out the supply chain analysis, supply chain industries are clustered into 10 industry groups, based on their contributions to the different stages of food production or to key food supply chain services.

The following supply chain industry groupings were selected:

1. Farm and agribusiness
2. Food processing
3. Food retailing
4. Foodservices (restaurants and other establishments serving food away from home)
5. Transportation
6. Energy
7. Packaging
8. Finance and insurance
9. Advertising
10. Legal, accounting, and bookkeeping

Figure 4 summarizes the value-added components of the 2006 food dollar by industry group, as formally stated in equation 6, to facilitate a comparison with 2006 cost-component measures from the old food marketing bill series reported in figure 1. Under the new IO-based food dollar series, a complete accounting of each supply chain industry group's contribution to the value of food purchases is measured and reported. This facilitates a more informative account of the roles and impacts of the different industry groups in the

Figure 4

Industry group value-added shares of the food dollar

2006 industry group value-added

"Other" comprises advertising (2.4¢) and legal and accounting (1.6¢).

2008 industry group value-added

"Other" comprises advertising (2.0¢) and legal and accounting (1.8¢).

Source: USDA, Economic Research Service.

formation of food market values and the effects of the industries on producer prices of food commodities. For example, consider the segments labeled "Energy" in figures 1 and 4. Under the old food marketing bill series (figure 1), the energy segment represented the average costs per food dollar expenditure for electricity, natural gas, and other fuel purchases by food processing, wholesaling, retailing, and foodservice establishments. Energy costs of the farm and agribusiness, transportation, and packaging industries, for example, are not reflected in the 3.5-cent energy segment in this figure. In figure 4, the same 2006 food dollar reported 5.8 cents of energy per food dollar expenditure, because this larger measure incorporates the energy value of every food dollar supply chain industry. This is part of the reason the transportation and packaging industry groups show smaller segments in figure 4 than in figure 1. Both transportation and packaging are energy-intensive industries, and when the value of energy used by these groups is deducted from their contribution to the food dollar, their contributions noticeably decline. The same reasoning applies to each industry group reported in figure 4. For example, any packaging, finance and insurance, and transportation service costs incurred by each of the other supply chain industry groups are not reflected in the value contributions of those industries, but are instead consolidated into the appropriate industry group segment.

Another informative comparison is between the farm share segment in figure 2 and the farm and agribusiness value-added segment in figure 4. In figure 4, farm and agribusiness value-added contributions to the food dollar that trace back to other supply chain industry groups, such as energy and transportation, are deducted from the farm share value reported in figure 2 in order to arrive at the farm and agribusiness value-added contribution. For 2006, these energy, transportation, and other services amounted to 3.5 cents (14.2 - 10.7) of each food dollar. The remaining 10.7 cents represents value contributions of the industry assets employed by farm and agribusiness establishments to support the production of farm commodities.

Primary Factor Return Composition of the Food Dollar

The next step is to distribute industry value-added proceeds to the owners of the primary factors employed by industry.

Each industry produces a product by a process that typically involves purchasing output products of other industries (intermediate inputs) and then employing its own industry assets to use these intermediate inputs to produce a new and different output. The industry assets are the primary factors of production that add value to the intermediate products purchased from other industries. In IO accounts, industry value added is recorded as income and is allocated as returns to primary factors as follows (type of payments to the factor owners in parenthesis):

a) Domestic hired labor (salary and benefits)

b) Domestic industry capital (returns to capital;[9] taxes on output[10])

c) International assets[11] (international payments)

[9]Represents pre-income tax payments to capital owners, including property, plant, and equipment.

[10]Includes excise/sales/property/severance taxes, customs duties, and other fees and assessments, and deducts subsidies.

[11]Import commodity proceeds cannot be traced back to foreign labor and capital markets by industry group, so these proceeds are valued at their import prices and treated as returns to nondomestic industry assets.

With the exception of imports, the BLS annual IO accounts do not itemize industry value added, but report the combined value added by food supply chain industries. BEA annual IO accounts provide this detailed breakout beginning in 1997, and the information is incorporated for the available years (see appendix for detailed explanation).

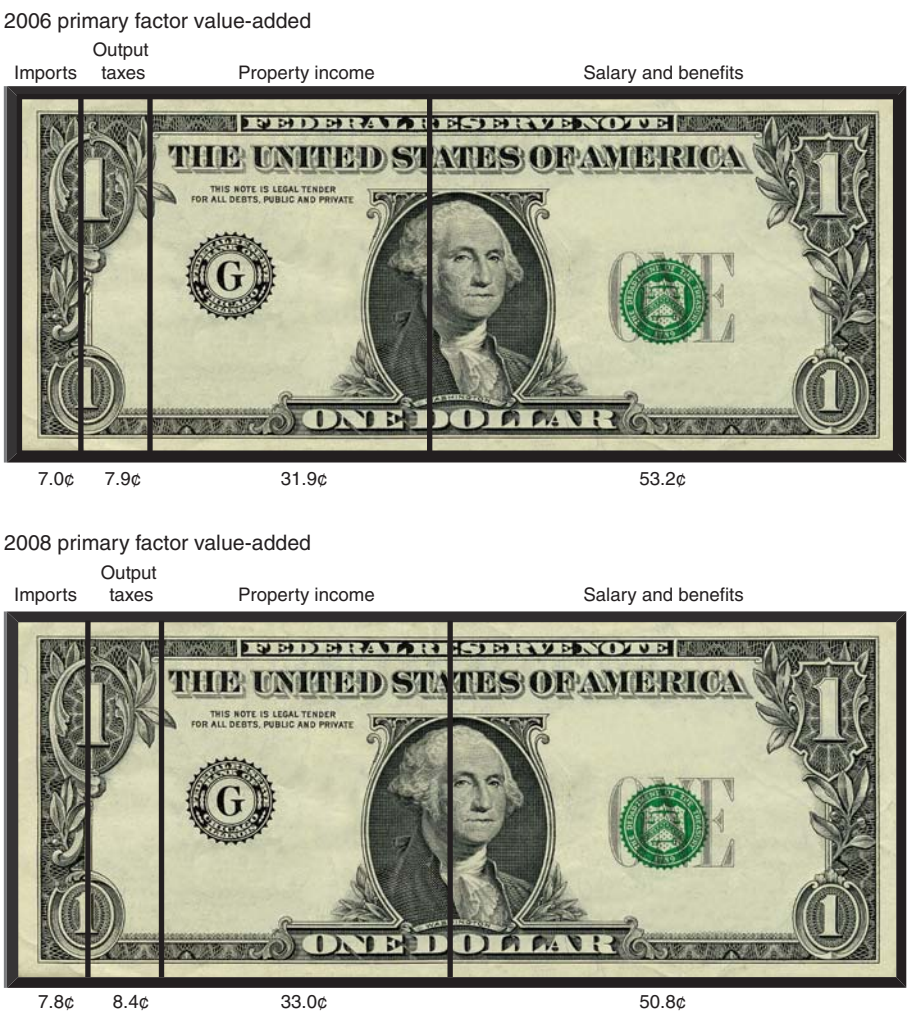
BEA annual data are used to measure the primary factor value-added food dollar, obtained by a restatement of equation 6 with the addition of a second subscript, *p*, defined over each type of primary factor $v\_m_{S,P}$ (see equation A35 in the appendix for a formal statement of this measure):

(7) $$primary\ factor\ value\ added\ food\ dollar = v\_m^{*}_{P,S} \cdot x_S^{fd\_net} \div y_S^{fd\_net} \ .$$

Figure 5 summarizes the allocation of the 2006 food dollar into total payments to primary factors of production, obtained from application of equation 7 to the 2006 IO data. A comparison of the salary and benefits segments in figure 5 with the labor segment of the old food marketing bill series (figure 1) again reveals a stark contrast. In the present analysis (fig. 5),

Figure 5

Primary factor return shares of the food dollar



Source: USDA, Economic Research Service.

salary and benefits include all domestic labor compensation for work toward fulfilling the demand for all food dollar purchases. Figure 5 indicates that slightly over half of every food dollar expenditure covers salaries and benefits of U.S. workers. Previously, labor excluded farm and agribusiness labor earnings (fig. 1), since only food marketing bill cost components were measured. The old series also had gaps in the measurement of labor earnings in other supply chain industries, including those for some transportation and manufacturing industry workers. These differences resulted in the substantially lower reported labor earnings per food dollar in figure 1.

Analysis of Industry Group Primary Factor Returns: 1993 to 2008

The next steps measure changes to the value composition of food dollar expenditures over time to assess changes to the structure of the food system and the composition of food expenditures.

A more informative allocation of the food dollar market value is by a cross-tabulation of industry group value added by the primary factor group. This is obtained by conversion of the net industry output vector in equation 7 to a diagonal matrix:

$$(8)\quad cross-tabulation\ value\ added\ food\ dollar = v\_m^{*}_{P,S} \cdot \overline{x}_S^{fd\_net} \div y_S^{fd\_net} \quad .$$

Table 3 reports the computation of equation 8 using data on U.S. total, at-home, and food-away nominal food dollar expenditures from 1993 to 2008. Results are reported for each primary factor return and total return to assets and for all industries combined. Results are also itemized for each of the 10 supply chain industry groups, for a total of 165 categories. Table lines are numbered for ease of reference.

Overall, the salaries of U.S. workers accounted for the highest portion of the food dollar among primary factor returns (table 3, line 2). Returns to workers comprise wages, salaries, and benefits, such as both employer and employee contributions to pension and insurance funds, and include all income and wage taxes (State and Federal) on these salaries. In 1997, the salaries of U.S. workers accounted for half of total food dollar expenditures. This amount climbed 10 percent by 2001, reaching about 55 cents of every food dollar spent, on average, but had fallen back to 51 cents by 2008. Among supply chain industry groups, foodservice workers accounted for the largest share of salary and benefits, reaching nearly 22 cents of the total food dollar in 2006 (table 3, line 32). Most of the supply chain industry groups mirrored the overall trend of increasing labor returns from the late 1990s into the early 2000s, followed by a dropping off through 2008. A notable exception to this trend was farming and agribusiness labor, where labor returns per food dollar expenditure generally declined throughout the study period, from a high of about 4 cents in 1997 to a low of 2.8 cents in 2007 (table 3, line 7).

Industry capital, or property, has the next highest primary factor returns per food dollar expenditure, ranging between 32 and 36 cents for the average dollar spent on food between 1997 and 2008 (table 3, line 3). Property incomes were at their highest share (35.8 cents) of overall food dollar expen-

Table 3

Cost components of the U.S. nominal food dollar, 1993 to 2008

Primary factor cost	1990s							2000s								
	93	94	95	96	97	98	99	2000	01	02	03	04	05	06	07	08
								Total food dollar								
All industries																
1. Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2. Labor					50.0	53.9	53.8	54.6	54.9	54.7	53.4	53.4	52.9	53.2	51.3	50.8
3. Property					35.8	33.3	34.0	32.6	32.8	32.3	33.5	32.7	32.8	31.9	33.2	33.0
4. Taxes					9.0	7.6	6.8	6.7	6.7	7.6	7.4	7.7	7.3	7.9	8.1	8.4
5. Imports	4.7	4.6	5.3	5.3	5.1	5.2	5.4	6.0	5.6	5.5	5.7	6.2	7.0	7.0	7.4	7.8
Farm and agribusiness																
6. Total	14.5	14.0	14.4	14.1	14.1	13.5	12.9	12.4	12.0	11.8	11.9	11.6	11.3	10.7	11.8	11.6
7. Labor					4.0	3.9	4.0	3.9	3.8	3.9	3.4	3.0	3.0	3.0	2.8	2.9
8. Property					7.6	8.2	8.3	8.0	7.6	6.8	7.6	7.3	7.4	6.5	7.3	7.0
9. Taxes					1.1	0.0	-0.7	-0.8	-0.6	0.1	-0.2	0.2	-0.4	0.0	0.4	0.3
10. Imports	1.3	1.2	1.5	1.4	1.5	1.4	1.4	1.3	1.1	1.1	1.1	1.1	1.2	1.2	1.3	1.4
Food processing																
11.Total	21.7	22.6	22.5	23.4	23.6	23.4	22.7	21.7	21.6	21.3	20.9	20.3	20.4	18.9	19.0	18.6
12. Labor					11.8	13.9	13.0	13.0	12.7	12.7	12.2	12.5	12.6	11.8	11.2	10.9
13. Property					9.1	7.2	7.5	6.6	6.9	6.7	6.7	5.8	5.7	5.2	5.8	5.6
14. Taxes					1.5	1.1	1.0	1.0	0.9	1.0	1.0	0.9	1.0	0.9	0.9	0.9
15. Imports	1.1	1.1	1.2	1.3	1.2	1.2	1.2	1.2	1.1	1.0	1.0	1.1	1.1	1.0	1.2	1.2
Packaging																
16. Total	4.7	4.8	5.2	5.0	4.7	4.8	4.8	4.7	4.7	4.7	4.5	4.3	4.3	4.1	4.1	4.0
17. Labor					2.3	2.3	2.3	2.3	2.4	2.3	2.3	2.0	1.9	1.8	1.8	1.8
18. Property					1.3	1.3	1.3	1.3	1.2	1.2	1.1	1.2	1.1	1.1	1.0	1.0
19. Taxes					0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.1	0.1	0.1
20. Imports	0.8	0.8	1.0	1.0	0.8	0.9	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.1
Transportation																
21.Total	4.5	4.6	4.5	4.5	4.4	4.4	4.3	4.1	4.0	4.0	3.8	3.8	3.8	3.8	3.5	3.5
22. Labor					2.5	2.7	2.6	2.5	2.5	2.4	2.3	2.2	2.2	2.1	1.9	2.0
23. Property					1.4	1.4	1.3	1.2	1.2	1.2	1.2	1.2	1.3	1.3	1.2	1.1
24.Taxes					0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
25. Imports	0.2	0.2	0.2	0.2	0.3	0.2	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Retail trade																
26. Total	13.9	14.3	14.4	14.7	14.6	14.4	14.5	14.2	14.2	14.4	14.6	14.0	14.3	13.7	13.8	13.6
27. Labor					8.3	8.0	8.1	8.1	8.1	8.2	8.1	7.6	7.7	7.3	7.4	7.5
28. Property					3.8	3.4	3.4	3.1	3.1	3.3	3.6	3.4	3.6	3.5	3.5	3.2
29. Taxes					2.2	2.7	2.7	2.7	2.6	2.6	2.7	2.6	2.7	2.7	2.7	2.6
30. Imports	0.2	0.2	0.2	0.3	0.2	0.3	0.3	0.3	0.3	0.2	0.3	0.3	0.3	0.3	0.3	0.3
Foodservice																
31.Total	28.3	27.9	27.5	26.6	27.0	27.6	28.5	29.4	30.0	30.4	30.9	32.3	31.5	34.9	33.3	33.7
32. Labor					16.3	17.7	18.1	18.8	19.3	19.3	19.5	20.4	19.8	21.8	20.6	20.3
33. Property					7.5	6.8	7.1	7.2	7.4	7.8	8.0	8.4	8.1	9.1	8.8	9.2
34. Taxes					3.0	2.6	2.7	2.8	2.8	2.8	2.9	3.0	3.0	3.3	3.1	3.4
35 Imports	0.4	0.4	0.4	0.5	0.3	0.5	0.6	0.6	0.6	0.5	0.5	0.6	0.6	0.7	0.7	0.8

—continued

Table 3

Cost components of the U.S. nominal food dollar, 1993 to 2008—Continued

Primary factor cost	1990s							2000s								
	93	94	95	96	97	98	99	2000	01	02	03	04	05	06	07	08
Total food dollar																
Energy																
36. Total	5.0	4.6	4.3	4.4	4.2	3.9	4.1	4.8	5.0	4.9	5.1	5.2	6.2	5.8	6.2	6.8
37. Labor					1.1	1.1	1.2	1.2	1.3	1.3	1.1	1.1	1.2	1.0	1.1	1.3
38. Property					1.9	1.9	1.9	2.1	2.2	2.0	2.1	2.1	2.4	2.1	2.3	2.3
39. Taxes					0.5	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.4	0.4	0.4	0.6
40. Imports	0.6	0.6	0.6	0.6	0.7	0.4	0.6	1.0	1.0	1.2	1.4	1.7	2.2	2.2	2.3	2.5
Finance and insurance																
41. Total	3.7	3.6	3.5	3.6	3.7	3.9	4.1	4.3	4.3	4.2	4.0	4.1	4.0	3.9	4.1	4.3
42.Labor					1.7	2.1	2.3	2.4	2.3	2.3	2.2	2.2	2.2	2.1	2.3	2.3
43. Property					1.7	1.6	1.6	1.7	1.7	1.8	1.7	1.7	1.7	1.6	1.7	1.8
44. Taxes					0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2
45. Imports	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Advertising																
46. Total	2.4	2.3	2.4	2.5	2.6	2.7	2.7	2.7	2.5	2.4	2.4	2.4	2.3	2.3	2.3	2.0
47. Labor					1.4	1.5	1.5	1.6	1.5	1.4	1.3	1.3	1.3	1.3	1.2	1.1
48. Property					1.0	1.0	1.0	0.9	0.9	0.9	0.9	1.0	0.9	0.9	0.9	0.8
49. Taxes					0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
50. Imports	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Legal, accounting, and bookkeeping																
51. Total	1.3	1.3	1.3	1.3	1.3	1.4	1.5	1.6	1.7	1.8	1.8	1.8	1.8	1.8	1.7	1.8
52. Labor					0.8	0.9	0.9	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.1
53. Property					0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.7	0.7	0.6	0.6	0.7
54. Taxes					0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
55. Imports	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
At-home food dollar																
All industries																
56. Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
57. Labor					46.8	50.5	50.3	51.3	51.3	51.3	49.6	49.5	49.0	49.1	46.6	46.2
58. Property					38.3	36.0	37.2	35.6	35.9	34.8	36.6	35.5	35.7	34.7	36.2	36.2
59. Taxes					8.7	7.3	6.1	6.0	6.0	7.2	6.9	7.4	6.7	7.5	7.9	7.8
60. Imports	5.6	5.5	6.2	6.2	6.2	6.2	6.4	7.1	6.7	6.6	7.0	7.6	8.6	8.8	9.3	9.8
Farm and agribusiness																
61. Total	19.8	19.0	19.5	18.7	18.9	18.5	18.1	17.7	17.4	17.4	17.6	17.6	17.0	17.2	18.5	18.3
62. Labor					5.4	5.3	5.6	5.5	5.6	5.7	5.0	4.6	4.6	4.8	4.4	4.3
63. Property					10.2	11.3	11.7	11.6	11.2	10.1	11.3	11.2	11.3	10.5	11.5	11.3
64. Taxes					1.4	0.0	-1.1	-1.2	-1.0	0.1	-0.3	0.2	-0.7	0.0	0.5	0.5
65. Imports	1.8	1.6	2.0	1.8	1.9	1.9	1.9	1.8	1.6	1.5	1.6	1.6	1.8	1.9	2.1	2.1
Food processing																
66. Total	30.7	31.8	31.3	32.1	32.5	32.6	32.5	31.9	32.1	32.1	31.7	31.9	31.5	31.3	30.5	30.1
67. Labor					16.2	19.3	18.6	19.1	18.8	19.0	18.5	19.6	19.4	19.5	17.9	17.7
68. Property					12.6	10.1	10.8	9.8	10.4	10.1	10.2	9.1	8.8	8.6	9.3	9.1
69. Taxes					2.1	1.5	1.4	1.4	1.4	1.4	1.5	1.5	1.5	1.5	1.5	1.4
70. Imports	1.5	1.6	1.6	1.7	1.6	1.7	1.7	1.7	1.6	1.5	1.6	1.7	1.7	1.7	1.9	1.8

—continued

Table 3

Cost components of the U.S. nominal food dollar, 1993 to 2008—Continued

Primary factor cost	1990s							2000s								
	93	94	95	96	97	98	99	2000	01	02	03	04	05	06	07	08
								At-home food dollar								
Packaging																
71. Total	5.6	5.7	6.1	5.9	5.5	5.7	5.7	5.7	5.7	5.8	5.5	5.3	5.3	5.1	5.0	4.9
72. Labor					2.7	2.8	2.8	2.7	2.9	2.9	2.8	2.4	2.4	2.2	2.2	2.2
73. Property					1.5	1.6	1.6	1.5	1.4	1.5	1.3	1.4	1.4	1.3	1.2	1.2
74. Taxes					0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
75. Imports	0.9	1.0	1.2	1.1	1.0	1.1	1.2	1.3	1.2	1.2	1.2	1.3	1.3	1.4	1.3	1.4
Transportation																
76. Total	5.8	5.9	5.8	5.7	5.6	5.8	5.7	5.5	5.5	5.5	5.3	5.5	5.4	5.6	5.1	5.1
77. Labor					3.2	3.4	3.4	3.3	3.4	3.3	3.1	3.2	3.1	3.1	2.8	2.8
78. Property					1.8	1.8	1.7	1.6	1.6	1.7	1.7	1.8	1.8	1.9	1.8	1.8
79. Taxes					0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
80.Imports	0.2	0.2	0.2	0.3	0.4	0.3	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4
Retail trade																
81. Total	24.1	24.3	24.2	24.2	24.2	24.0	24.1	23.9	23.9	24.0	24.7	24.3	24.4	24.8	24.3	24.2
82. Labor					13.8	13.3	13.4	13.7	13.7	13.6	13.7	13.3	13.1	13.2	12.9	12.8
83. Property					6.3	5.8	5.7	5.2	5.3	5.6	6.0	6.0	6.1	6.3	6.2	6.2
84. Taxes					3.7	4.5	4.5	4.5	4.4	4.4	4.5	4.5	4.6	4.8	4.7	4.6
85. Imports	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.6	0.5	0.4	0.5	0.5	0.5	0.5	0.6	0.6
Foodservice																
86. Total	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.9	0.9	1.0	1.0	1.0	0.9	0.9	0.9	0.9
87. Labor					0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.5
88. Property					0.3	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
89. Taxes					0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
90. Imports	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Energy																
91. Total	5.7	5.1	4.8	5.0	4.7	4.3	4.6	5.5	5.7	5.7	5.9	6.2	7.4	6.9	7.5	8.2
92. Labor					1.2	1.2	1.3	1.4	1.5	1.4	1.3	1.2	1.3	1.2	1.3	1.4
93. Property					2.1	2.1	2.2	2.4	2.5	2.3	2.4	2.4	2.8	2.5	2.7	3.1
94. Taxes					0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6
95. Imports	0.8	0.7	0.7	0.8	0.9	0.5	0.7	1.2	1.3	1.5	1.7	2.1	2.7	2.8	3.0	3.2
Finance and Insurance																
96. Total	3.9	3.8	3.6	3.7	3.8	4.0	4.3	4.6	4.6	4.6	4.3	4.4	4.3	4.3	4.5	4.8
97. Labor					1.7	2.2	2.4	2.5	2.5	2.4	2.3	2.4	2.3	2.3	2.4	2.5
98. Property					1.8	1.7	1.7	1.8	1.9	1.9	1.8	1.8	1.8	1.8	1.8	2.0
99. Taxes					0.2	0.1	0.2	0.2	0.2	0.2	0.1	0.2	0.2	0.1	0.2	0.2
100. Imports	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Advertising																
101. Total	2.5	2.4	2.5	2.6	2.7	2.7	2.7	2.7	2.4	2.3	2.3	2.3	2.2	2.2	2.1	1.9
102. Labor					1.5	1.6	1.5	1.6	1.4	1.3	1.3	1.2	1.2	1.2	1.2	1.0
103. Property					1.1	1.0	1.0	0.9	0.8	0.9	0.9	0.9	0.9	0.9	0.8	0.8
104. Taxes					0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
105. Imports	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1

—continued

Table 3

Cost components of the U.S. nominal food dollar, 1993 to 2008—Continued

Primary factor cost	1990s							2000s								
	93	94	95	96	97	98	99	2000	01	02	03	04	05	06	07	08
At-home food dollar																
Legal, accounting, and bookkeeping																
106. Total	1.4	1.3	1.4	1.4	1.4	1.5	1.5	1.6	1.7	1.7	1.8	1.7	1.7	1.7	1.7	1.8
107. Labor					0.8	0.9	0.9	1.0	1.1	1.1	1.1	1.0	1.0	1.0	1.0	1.0
108. Property					0.6	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
109. Taxes					0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
110. Imports	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Away-from-home food dollar																
All industries																
111. Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
112. Labor					54.6	58.6	58.7	59.3	59.8	59.6	58.8	58.5	58.2	58.0	57.1	56.9
113. Property					32.3	29.5	29.4	28.4	28.4	28.6	29.2	29.0	28.9	28.8	29.5	29.5
114. Taxes					9.6	7.9	7.8	7.8	7.7	8.0	8.0	8.1	8.1	8.3	8.2	8.2
115. Imports	3.7	3.7	4.1	4.2	3.6	4.0	4.1	4.5	4.1	3.8	4.0	4.3	4.8	4.9	5.2	5.4
Farm and agribusiness																
116. Total	8.0	7.5	7.5	7.3	7.2	6.3	5.4	4.8	4.2	3.6	3.9	3.7	3.6	3.1	3.6	3.4
117. Labor					2.0	1.8	1.6	1.4	1.3	1.2	1.1	1.0	1.0	0.9	0.9	0.8
118. Property					3.8	3.7	3.3	2.9	2.5	2.0	2.3	2.2	2.3	1.8	2.1	2.0
119. Taxes					0.6	0.1	-0.2	-0.2	-0.1	0.1	0.0	0.1	-0.1	0.1	0.1	0.1
120. Imports	0.9	0.8	0.9	0.8	0.9	0.8	0.7	0.6	0.5	0.4	0.4	0.4	0.5	0.4	0.5	0.5
Food processing																
121. Total	10.3	10.3	10.5	10.8	10.8	10.1	8.4	7.1	6.3	5.7	5.7	5.2	5.3	4.4	4.8	4.6
122. Labor					5.5	6.0	4.8	4.3	3.8	3.4	3.4	3.2	3.3	2.7	2.8	2.7
123. Property					3.9	3.0	2.6	2.1	1.9	1.7	1.8	1.4	1.4	1.2	1.4	1.4
124. Taxes					0.7	0.5	0.4	0.3	0.3	0.3	0.3	0.2	0.3	0.2	0.2	0.2
125. Imports	0.7	0.7	0.7	0.7	0.6	0.6	0.5	0.5	0.4	0.3	0.3	0.3	0.4	0.3	0.4	0.4
Packaging																
126. Total	3.5	3.6	3.9	3.7	3.5	3.5	3.4	3.4	3.2	3.2	3.1	3.0	3.0	2.9	2.9	2.9
127. Labor					1.7	1.7	1.6	1.6	1.6	1.6	1.5	1.3	1.3	1.2	1.3	1.2
128. Property					1.0	1.0	1.0	0.9	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7
129. Taxes					0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
130. Imports	0.6	0.6	0.8	0.7	0.6	0.7	0.7	0.8	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8
Transportation																
131. Total	2.8	2.8	2.7	2.7	2.6	2.5	2.3	2.1	1.9	1.8	1.8	1.8	1.7	1.7	1.6	1.5
132. Labor					1.5	1.5	1.3	1.2	1.2	1.1	1.1	1.0	1.0	0.9	0.8	0.8
133. Property					0.8	0.8	0.7	0.6	0.6	0.5	0.6	0.6	0.6	0.6	0.5	0.5
134. Taxes					0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
135. Imports	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Retail trade																
136. Total	0.7	0.8	0.8	0.8	0.7	0.6	0.7	0.6	0.4	0.5	0.5	0.5	0.6	0.6	0.6	0.5
137. Labor					0.4	0.4	0.4	0.3	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3
138. Property					0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.1
139. Taxes					0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
140. Imports	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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Table 3

Cost components of the U.S. nominal food dollar, 1993 to 2008—Continued

Primary factor cost	1990s							2000s								
	93	94	95	96	97	98	99	2000	01	02	03	04	05	06	07	08
Away-from-home food dollar																
Foodservice																
141. Total	63.8	64.5	64.3	64.3	64.6	66.1	68.5	69.9	71.8	73.1	73.0	73.7	73.1	75.0	73.9	74.1
142. Labor					39.1	42.1	43.5	44.5	45.9	46.4	46.0	46.3	45.9	46.7	45.7	45.8
143. Property					17.9	16.4	17.0	17.1	17.7	18.7	18.9	19.0	18.7	19.6	19.6	19.7
144. Taxes					7.1	6.4	6.6	6.7	6.7	6.8	6.8	6.9	7.0	7.2	6.9	6.9
145. Imports	0.9	1.0	1.1	1.2	0.6	1.3	1.4	1.6	1.5	1.3	1.3	1.4	1.5	1.6	1.7	1.8
Energy																
146. Total	4.2	3.8	3.7	3.7	3.5	3.3	3.4	3.8	3.9	3.8	3.9	4.0	4.6	4.4	4.7	5.0
147. Labor					0.9	1.0	1.0	1.0	1.0	1.0	0.9	0.9	0.9	0.8	0.9	0.9
148. Property					1.6	1.7	1.7	1.8	1.8	1.6	1.7	1.7	1.9	1.7	1.8	2.0
149. Taxes					0.4	0.4	0.4	0.4	0.3	0.4	0.4	0.3	0.4	0.4	0.4	0.4
150. Imports	0.5	0.4	0.4	0.5	0.6	0.3	0.4	0.7	0.7	0.8	1.0	1.1	1.5	1.5	1.6	1.7
Finance and insurance																
151. Total	3.5	3.4	3.3	3.4	3.5	3.7	3.9	4.0	3.9	3.8	3.6	3.7	3.6	3.5	3.7	3.9
152. Labor					1.6	2.0	2.2	2.3	2.2	2.1	2.0	2.1	2.0	2.0	2.1	2.1
153. Property					1.7	1.5	1.5	1.5	1.6	1.5	1.4	1.5	1.5	1.4	1.5	1.5
154. Taxes					0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
155. Imports	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Advertising																
156. Total	2.2	2.2	2.2	2.3	2.4	2.6	2.6	2.8	2.7	2.6	2.6	2.6	2.5	2.5	2.5	2.2
157. Labor					1.3	1.5	1.5	1.6	1.6	1.5	1.5	1.4	1.4	1.4	1.3	1.2
158. Property					1.0	0.9	1.0	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.0	0.9
159. Taxes					0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
160. Imports	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Legal, accounting, and bookkeeping																
161. Total	1.2	1.1	1.2	1.2	1.2	1.3	1.5	1.6	1.8	1.9	2.0	1.9	1.9	1.9	1.8	2.0
162. Labor					0.7	0.8	0.9	1.0	1.1	1.2	1.2	1.1	1.1	1.1	1.1	1.2
163. Property					0.5	0.5	0.5	0.5	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.7
164. Taxes					0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
165. Imports	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source: USDA, Economic Research Service.

ditures in 1997, and at their lowest in 2006 at just under 32 cents. Property incomes amounted to roughly one-third of the total food dollar in 2007 and 2008. Farm and agribusiness property income (including land) were highest among food supply chain industry groups from 1997 to 2001, reaching 8.3 cents in 1999 (table 3, line 8). From 2002 onward, the foodservice industry had the highest returns to capital, surpassing 9 cents of every dollar spent on U.S.-produced food by U.S. households in 2006 and 2008 (table 3, line 33). Property income of food processors fell off substantially over the study period (table 3, line 13). On a percentage basis, property income for packaging and advertising also dropped substantially, while returns to capital for the energy and the legal/accounting/bookkeeping industries trended higher throughout the study period as a share of total food dollar expenditures.

Taxes (less subsidies) and fees on industry output include Federal excise taxes and custom duties, State and local sales and property taxes, and some nontax fees and assessments. From 1997 to 2008, these production costs ranged between a low of 6.7 cents in 2000 to a high of 9.0 cents in 1997 (table 3, row 4). The highest property income taxes fell on the food retailing and foodservice industries (table 3, rows 29 and 34). Overall output taxes on farming and agribusiness were negative in some years, owing to the Federal production subsidies on numerous farm commodities (table 3, line 9).

Imports of food and nonfood ingredients have been the fastest growing of the primary factor returns. Because detailed country-of-origin input-output tables are not available for these imports, only the total primary factor value contributions are reported for each supply chain industry group, based on the commodity values of imports entering the country.[12] Less than 5 cents of the value of U.S.-produced food sold to U.S. households in 1993 was for imported commodities. By 2008, this value had increased 65 percent, reaching 7.8 cents of each dollar spent on U.S.-produced foods (table 3, line 5). Between 1993 and 2001, farm and agribusiness imports were the leading contributors to the import value of U.S.-produced food (table 3, line 10). In 2002, the energy industry overtook all other industries in total import value contributions to the food dollar, and by 2008 imported energy of 2.5 cents on the dollar (table 3, line 40) was almost twice that of the industry group with the next highest import value, farm and agribusiness at 1.4 cents (table 3, line 10). The overall increase in import share of the food dollar between 2001 and 2008 coincides with declines in the domestic wage share over this period.

The foodservice industry led total food dollar value contributions (in nominal dollars) of the supply chain industry groups (table 3, line 31), followed by the food processing industry (table 3, line 11). However, value added to the food dollar by these two industry groups has been going in different directions. A comparison of the contribution of the two groups between the 1990s and the first decade of the 2000s shows that foodservices added about 8.3 cents in value to each dollar spent on food, an increase of over 30 percent, whereas food processors did not increase their value contribution. The largest percentage increase in value contribution among the industries was 74 percent from the energy industry group (table 3, line 36), followed by an increase of 38 percent from the legal/accounting/bookkeeping industry group (table 3, line 51).

For at-home and food-away expenditures, the range of total returns to primary factors for salaries and output taxes over the study period was lower for the at-home food dollar than the food-away food dollar, whereas the range of total payments for imports and returns to capital was lower for total food-away food expenditures. For the food-away expenditures, the foodservice industry group dominated supply chain value added, accounting for about three-quarters of total value, and this industry group generated a higher than average share of its value added from salaries and retail sales taxes (table 3, lines 141-145). For at-home expenditures, the food processing industry accounted for close to a third of total food value over the study period (table 3, line 66), and the food retailing industry group accounted for about a quarter (table 3, line 81). Among supply chain industry groups, the changes in value contributions of the energy industry were the most pronounced, rising from 4.3 cents per dollar of at-home food expenditures in 1998 to 8.2 cents in

[12]For example, the value of imported fertilizer is treated as import value added of the farm and agribusiness industry. The foreign natural gas industry contribution to the cost of imported nitrogen fertilizers is not reallocated to the energy industry.

2008. About 90 percent of this increase was from higher energy imports and higher returns to capital.

Table 4 reports the value components of the U.S. real (inflation-adjusted) expenditures of total, at-home, and food-away food dollars from 1993 to 2008. The table shows results for total domestic primary factor returns, total import primary factor returns, and the sum of those two factor returns, for all industries combined and each of the 10 supply chain industry groups, for a total of 99 categories. Table lines are numbered for reference.

A comparison of the nominal total industry import value added (table 3, line 5) and the corresponding real (inflation-adjusted) series (table 4, line 3) shows a close correspondence over the period 1993 to 2000—both dollar series climbed from 4.7 cents to 6.0 cents. Between 2000 and 2006, however, the nominal series became volatile, dropping to 5.5 cents by 2002 and rising to 7 cents by 2006, whereas the real import value-added series remained about the same over the period. By 2008, the nominal series had reached 7.8 cents and the real series declined to 5.6 cents. Because the real import value-added industry series in table 4 is measured in constant year 2000 prices for domestic and imported commodities, the volatility of post-2000 nominal import values (table 3) in relation to the real import values (table 4) over this period reflects volatility in the prices of imports relative to domestic commodities used by the food system. Notably, nominal import value added reached 9.7 cents of the at-home food dollar (table 3, line 60) in 2008, compared with a real (inflation-adjusted) value of 7.1 cents (table 4, line 36). Imported energy, primarily crude oil and petroleum products, is behind this surge in import value. Energy is the only import commodity group to have an increase in real value added over the period 2000-08, even as the price of imported energy increased rapidly over this interval (table 4, line 24).

Between 1996 and 2005, the real (inflation-adjusted) value added by food services gradually increased from 27 to 32 cents of each dollar spent on U.S.-produced food (table 4, line 19). Over this same interval, the price of food services remained roughly equal to their year 2000 level. In 2006, the price of food services declined, and the volume of these services purchased per dollar spent on food spiked 14 percent. In 2007-08, the average price of food services rose but remained below their year 2000 level, and the volume of purchases remained high, keeping nominal foodservice value added near its 2006 level.

The volume of retail trade services purchased in each real food dollar generally increased between 1993 and 2007, from 12.9 to 15.4 cents, but dropped off in 2008 to 13.3 cents of the total food dollar (table 4, line 16). Trade services per nominal food dollar remained in the 14- to 15-cent range over this interval, implying that the price of retail food services per unit of volume declined over the interval before spiking upward in 2008.

Figure 6 provides some context for these findings. Using annual data on the total number of supermarkets, full-service restaurants, and limited-service restaurants per capita in the United States for the years 2000-08, the figure charts these data as indexes representing the percentage of their respective year 2000 per capita establishment-count totals. For example, the chart indicates that there were roughly 10 percent fewer supermarkets per capita in the United States in 2008 than in 2000. Fewer food retail stores per capita

Table 4

Cost components of the U.S. real food dollar, 1993 to 2008

Primary factor cost	1990s							2000s								
	93	94	95	96	97	98	99	2000	01	02	03	04	05	06	07	08
								Total food dollar								
All industries																
1. Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2. Val. added	95.3	95.4	95.1	94.9	94.6	94.4	94.2	94.0	94.1	94.1	94.0	94.0	93.8	94.0	93.6	94.4
3. Imports	4.7	4.6	4.9	5.1	5.4	5.6	5.8	6.0	5.9	5.9	6.0	6.0	6.2	6.0	6.4	5.6
Farm and agribusiness																
4. Total	13.2	12.0	12.7	13.1	12.8	12.7	12.7	12.4	12.2	11.3	11.6	11.2	10.8	10.0	10.7	10.8
5. Val. added	12.0	10.9	11.4	11.9	11.5	11.3	11.4	11.1	11.0	10.1	10.4	10.1	9.6	8.8	9.4	9.6
6. Imports	1.2	1.0	1.2	1.2	1.3	1.4	1.4	1.3	1.2	1.2	1.2	1.1	1.3	1.2	1.3	1.1
Food processing																
7. Total	23.2	24.6	23.9	23.9	24.1	23.5	22.5	21.7	21.1	20.9	20.4	19.7	20.3	18.6	19.2	19.2
8. Val. added	22.3	23.6	23.0	22.9	23.0	22.3	21.3	20.6	20.0	19.9	19.4	18.6	19.2	17.7	18.1	18.3
9. Imports	0.9	0.9	1.0	1.0	1.1	1.2	1.2	1.2	1.1	1.0	1.1	1.1	1.1	1.0	1.1	0.9
Packaging																
10. Total	4.9	5.0	5.1	5.0	4.8	4.9	4.8	4.7	4.7	4.8	4.6	4.4	4.4	4.1	4.0	3.8
11. Val. added	4.1	4.2	4.2	4.1	3.9	3.9	3.8	3.7	3.7	3.7	3.6	3.3	3.3	3.0	3.0	2.8
12. Imports	0.8	0.8	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.0	1.0
Transportation																
13. Total	4.9	5.0	4.8	4.8	4.7	4.7	4.4	4.1	4.0	4.5	4.0	4.1	4.2	4.2	4.0	3.9
14. Val. added	4.7	4.8	4.6	4.6	4.5	4.4	4.1	3.8	3.8	4.2	3.7	3.8	3.9	4.0	3.7	3.7
15. Imports	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.2	0.3	0.3	0.3	0.2	0.3	0.3	0.2
Retail trade																
16. Total	12.9	13.3	13.3	13.9	14.1	14.3	14.5	14.2	14.6	15.1	15.7	15.1	15.4	14.4	15.4	13.3
17. Val. added	12.7	13.1	13.1	13.7	13.8	14.1	14.2	13.9	14.3	14.8	15.4	14.8	15.1	14.2	15.1	13.1
18. Imports	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.3	0.2
Foodservice																
19. Total	28.0	28.0	28.1	27.1	27.5	27.7	28.3	29.4	29.9	30.0	30.5	32.4	31.6	36.0	33.5	35.7
20. Val. added	27.6	27.6	27.6	26.7	27.0	27.1	27.7	28.8	29.3	29.5	30.0	31.9	31.1	35.4	32.9	35.2
21. Imports	0.4	0.4	0.4	0.5	0.5	0.6	0.6	0.6	0.6	0.5	0.5	0.6	0.5	0.6	0.6	0.5
Energy																
22. Total	5.1	4.7	4.6	4.6	4.4	4.3	4.6	4.8	4.9	5.2	4.9	4.8	5.1	4.6	4.9	5.0
23. Val. added	4.3	3.9	3.8	3.8	3.5	3.6	3.8	3.8	3.8	3.8	3.6	3.4	3.7	3.1	3.3	3.6
24. Imports	0.8	0.8	0.8	0.8	0.8	0.7	0.8	1.0	1.1	1.4	1.3	1.4	1.5	1.5	1.5	1.4
Finance and Insurance																
25. Total	3.6	3.6	3.4	3.4	3.5	3.7	3.9	4.3	4.4	4.3	4.2	4.4	4.4	4.3	4.6	4.6
26. Val. added	3.5	3.5	3.3	3.3	3.4	3.6	3.8	4.2	4.2	4.1	4.1	4.3	4.2	4.1	4.4	4.5
27. Imports	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2
Advertising																
28. Total	2.5	2.5	2.6	2.6	2.7	2.7	2.7	2.7	2.5	2.3	2.3	2.3	2.3	2.3	2.3	2.1
29. Val. added	2.4	2.4	2.5	2.6	2.6	2.6	2.6	2.6	2.4	2.3	2.2	2.3	2.2	2.2	2.2	2.0
30. Imports	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Legal, accounting, and bookkeeping																
31. Total	1.6	1.5	1.5	1.5	1.5	1.5	1.5	1.6	1.7	1.7	1.7	1.6	1.6	1.6	1.5	1.6
32. Val. added	1.5	1.5	1.5	1.5	1.4	1.5	1.5	1.6	1.6	1.7	1.7	1.6	1.6	1.5	1.5	1.6
33. Imports	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

—continued

Table 4

Cost components of the U.S. real food dollar, 1993 to 2008—Continued

Primary factor cost	1990s							2000s								
	93	94	95	96	97	98	99	2000	01	02	03	04	05	06	07	08
	At-home food dollar															
All industries																
34. Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
35. Val. added	94.2	94.4	94.0	93.8	93.5	93.3	93.1	92.9	93.1	93.1	93.0	92.9	92.5	92.6	92.3	93.1
36. Imports	5.8	5.6	6.0	6.2	6.5	6.7	6.9	7.1	6.9	6.9	7.0	7.1	7.5	7.4	7.7	6.9
Farm and agribusiness																
37. Total	18.5	16.7	17.8	18.0	17.7	17.6	17.9	17.7	17.5	16.1	16.6	16.5	15.8	15.8	15.7	16.9
38. Val. added	16.8	15.2	16.1	16.3	15.9	15.7	16.0	15.9	15.8	14.5	14.9	14.9	14.0	14.0	13.8	15.2
39. Imports	1.7	1.4	1.7	1.7	1.7	1.9	1.9	1.8	1.7	1.6	1.6	1.6	1.8	1.8	1.9	1.7
Food processing																
40. Total	33.2	35.2	34.2	33.6	33.9	33.0	32.2	31.9	31.2	31.0	30.6	30.5	31.1	31.0	30.7	32.1
41. Val. added	31.9	33.9	32.8	32.2	32.4	31.4	30.5	30.2	29.6	29.5	29.0	28.9	29.4	29.4	29.0	30.7
42. Imports	1.3	1.3	1.3	1.4	1.5	1.7	1.7	1.7	1.6	1.5	1.6	1.7	1.7	1.6	1.7	1.4
Packaging																
43. Total	6.5	6.7	6.7	6.5	6.2	6.1	5.9	5.7	5.6	5.5	5.3	5.1	5.1	4.8	4.7	4.6
44. Val. added	5.4	5.6	5.5	5.3	5.1	4.9	4.7	4.5	4.3	4.3	4.1	3.8	3.8	3.5	3.5	3.4
45. Imports	1.0	1.1	1.2	1.2	1.2	1.2	1.2	1.3	1.2	1.2	1.2	1.2	1.3	1.2	1.2	1.2
Transportation																
46. Total	6.4	6.5	6.3	6.2	6.1	6.1	5.8	5.5	5.5	6.2	5.5	5.8	5.8	6.2	5.7	5.9
47. Val. added	6.2	6.2	6.1	5.9	5.8	5.7	5.4	5.1	5.1	5.8	5.1	5.4	5.5	5.9	5.3	5.5
48. Imports	0.2	0.2	0.3	0.3	0.4	0.4	0.4	0.4	0.3	0.4	0.4	0.4	0.3	0.4	0.5	0.3
Retail trade																
49. Total	20.1	20.4	20.6	21.1	21.6	22.7	23.5	23.9	25.3	26.5	27.8	27.8	27.7	28.1	28.7	25.6
50. Val. added	19.8	20.1	20.2	20.7	21.1	22.2	22.9	23.4	24.8	26.0	27.2	27.3	27.2	27.6	28.1	25.2
51. Imports	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.6	0.5	0.5	0.6	0.5	0.5	0.5	0.6	0.4
Foodservice																
52. Total	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.8
53. Val. added	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.8
54. Imports	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Energy																
55. Total	6.6	6.0	5.9	5.8	5.6	5.3	5.5	5.5	5.4	5.4	5.2	5.1	5.4	4.9	5.2	5.5
56. Val. added	5.5	5.0	4.8	4.8	4.5	4.4	4.4	4.3	4.1	3.9	3.7	3.6	3.8	3.2	3.4	3.8
57. Imports	1.1	1.1	1.1	1.1	1.1	0.9	1.1	1.2	1.3	1.5	1.5	1.6	1.7	1.7	1.8	1.7
Finance and insurance																
58. Total	3.8	3.7	3.6	3.7	3.8	4.1	4.2	4.6	4.6	4.4	4.2	4.4	4.5	4.5	4.7	5.0
59. Val. added	3.8	3.7	3.6	3.7	3.8	4.0	4.2	4.5	4.5	4.3	4.2	4.4	4.4	4.4	4.7	4.9
60. Imports	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Advertising																
61. Total	2.2	2.2	2.3	2.4	2.4	2.5	2.5	2.7	2.5	2.4	2.4	2.4	2.4	2.4	2.4	2.2
62. Val. added	2.2	2.2	2.3	2.3	2.4	2.5	2.5	2.6	2.4	2.4	2.3	2.4	2.3	2.3	2.3	2.1
63. Imports	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Legal, accounting, and bookkeeping																
64. Total	1.8	1.7	1.7	1.7	1.7	1.7	1.6	1.6	1.6	1.5	1.5	1.5	1.5	1.4	1.4	1.4
65. Val. added	1.8	1.7	1.7	1.7	1.7	1.6	1.6	1.6	1.6	1.5	1.5	1.4	1.4	1.4	1.3	1.4
66. Imports	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

—continued

Table 4

Cost components of the U.S. real food dollar, 1993 to 2008—Continued

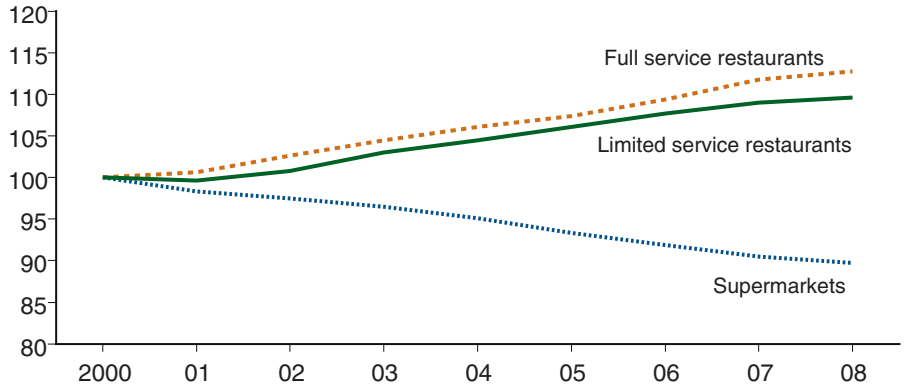
Primary factor cost	1990s							2000s								
	93	94	95	96	97	98	99	2000	01	02	03	04	05	06	07	08
								Away-from-home food dollar								
All industries																
67. Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
68. Val. added	96.6	96.7	96.4	96.3	96.1	95.8	95.7	95.5	95.7	95.7	95.7	95.7	95.6	95.7	95.4	96.1
69. Imports	3.4	3.3	3.6	3.7	3.9	4.2	4.3	4.5	4.3	4.3	4.3	4.3	4.4	4.3	4.6	3.9
Farm and Aagribusiness																
70. Total	4.9	4.3	4.4	4.7	4.7	4.8	4.8	4.8	5.0	4.7	5.2	4.8	4.5	3.7	4.9	4.0
71. Val. added	4.4	3.8	3.9	4.2	4.1	4.2	4.2	4.2	4.4	4.1	4.5	4.3	3.9	3.2	4.2	3.5
72. Imports	0.5	0.4	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.7	0.5
Food processing																
73. Total	6.0	5.9	6.0	6.1	6.4	7.4	7.3	7.1	7.4	7.8	7.6	6.9	7.1	5.7	5.8	5.0
74. Val. added	5.6	5.6	5.6	5.7	6.0	7.0	6.8	6.7	7.0	7.4	7.1	6.5	6.7	5.3	5.4	4.7
75. Imports	0.3	0.3	0.3	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.5	0.4	0.4	0.3
Packaging																
76. Total	3.4	3.5	3.6	3.5	3.4	3.5	3.5	3.4	3.3	3.3	3.2	3.1	3.1	2.9	2.8	2.6
77. Val. added	2.9	2.9	2.9	2.8	2.8	2.8	2.7	2.6	2.6	2.6	2.4	2.3	2.3	2.1	2.1	1.9
78. Imports	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.7	0.8	0.7	0.8	0.8	0.8	0.7	0.7
Transportation																
79. Total	2.6	2.6	2.5	2.5	2.4	2.5	2.3	2.1	2.0	2.2	2.1	2.1	2.1	2.1	1.9	1.8
80. Val. added	2.5	2.5	2.4	2.3	2.3	2.3	2.1	1.9	1.9	2.0	1.9	1.9	1.9	1.9	1.8	1.7
81. Imports	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.2	0.2	0.1	0.1	0.2	0.1
Retail trade																
82. Total	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.4	0.5	0.5	0.4	0.5	0.4	0.5	0.4
83. Val. added	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.4	0.5	0.5	0.4	0.5	0.4	0.5	0.4
84. Imports	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Foodservice																
85. Total	70.5	71.6	71.5	71.0	71.0	69.5	69.7	69.9	69.9	69.8	70.1	71.2	71.1	74.0	72.4	74.6
86. Val. added	69.5	70.5	70.3	69.7	69.6	68.0	68.2	68.3	68.5	68.5	68.8	69.9	69.8	72.7	71.1	73.4
87. Imports	1.1	1.1	1.2	1.3	1.4	1.5	1.5	1.6	1.4	1.3	1.3	1.3	1.3	1.3	1.4	1.2
Energy																
88. Total	4.4	4.1	4.0	4.0	3.8	3.8	3.8	3.8	3.8	3.9	3.7	3.7	3.8	3.5	3.7	3.8
89. Val. added	3.8	3.5	3.4	3.4	3.2	3.2	3.2	3.1	3.0	3.0	2.8	2.7	2.9	2.5	2.7	2.9
90. Imports	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.8	0.9	0.9	0.9	1.0	1.0	1.1	0.9
Finance and insurance																
91. Total	3.3	3.3	3.2	3.3	3.4	3.6	3.7	4.0	4.0	3.8	3.7	3.9	3.9	3.9	4.1	4.2
92. Val. added	3.3	3.2	3.1	3.3	3.3	3.5	3.7	3.9	3.9	3.8	3.7	3.8	3.9	3.8	4.1	4.1
93. Imports	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Advertising																
94. Total	2.4	2.4	2.5	2.5	2.6	2.6	2.7	2.8	2.5	2.5	2.4	2.5	2.4	2.4	2.4	2.2
95. Val. added	2.4	2.3	2.4	2.5	2.5	2.6	2.6	2.7	2.5	2.4	2.4	2.4	2.4	2.4	2.3	2.2
96. Imports	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Legal, accounting, and bookkeeping																
97. Total	1.8	1.7	1.7	1.7	1.7	1.7	1.6	1.6	1.6	1.5	1.5	1.5	1.5	1.4	1.4	1.4
98. Val. added	1.8	1.7	1.7	1.7	1.7	1.6	1.6	1.6	1.6	1.5	1.5	1.5	1.5	1.4	1.3	1.4
99. Imports	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source: USDA, Economic Research Service.

Figure 6

Number of establishments per capita, 2000-08

Index 2000=100



Source: USDA, ERS calculations based on the Quarterly Census of Employment and Wages, Bureau of Labor Statistics, U.S. Department of Labor, and Annual Population Estimates, Census Bureau, U.S. Department of Commerce.

would indicate that food retailing services per establishment had increased, suggesting that declines in the average price of food retailing services over the study period might have resulted from increasing economies of scale in the provision of the services.

A comparison of table 3, line 141 and table 4, line 85 shows that the nominal foodservice value added per food-away dollar ran slightly higher than the real (inflation-adjusted) volume shares between 2000 and 2004, but beginning in 2005 the nominal foodservice share fell below real share value. Since the nominal foodservice share also gained about 4 cents of the overall food-away dollar between 2000 and 2004, these results indicate that the average cost of food services increased relative both to its year 2000 price and to overall food prices between 2000 and 2004. From 2005 to 2008, average foodservice prices fell below their year 2000 level, but the nominal foodservice share of the food-away dollar continued to increase due to growth in the volume of foodservices in the food-away dollar. Returning to figure 6, note that from 2000 forward, the rate of increase in the number of full-service restaurants per capita outpaced the increase in limited-service restaurants. This suggests that U.S. food consumers were purchasing more services per meal over time, which could explain at least some of both the price and volume changes in foodservices over the period.

The Food Dollar: Looking Ahead

Historical observations of relationships among food dollar expenditures, the component values of those expenditures, and both producer and consumer food prices can inform our understanding of the implications of USDA food market forecasts for the food dollar.

Several determinants of change in U.S. food markets between 1993 and 2008 are especially notable. The increasing demand for food services by U.S. households, followed by an increased demand for higher priced services (e.g., full- versus limited-service restaurants), was instrumental in driving down the farm share of the food dollar over a portion of the study period. Even in periods where the relative price of farm commodities appeared to be gaining on retail food prices, increasing purchases of food services—essentially, paying others to prepare meals and clean up afterwards—drove the farm share and the farm and agribusiness value-added shares down. A weakening of the U.S. dollar relative to other international currencies drove up the prices of imported ingredients for the food system. Yet, while the real value of most imports remained a roughly constant share of the real food dollar over the study period (table 4), the real value of imported energy increased by over 50 percent, and this—coupled with the sharp increase in energy prices starting in 2003—pushed the import share of the nominal food dollar up by more than 300 percent overall (1993 to 2008), to as high as 8.2 cents for the 2008 at-home food dollar. Although the food retailing nominal value-added share was largely unchanged over the study period, an examination of the constant price value share of food retailing shows that food retailing services substantially increased over the interval, but these volume increases were offset by equally substantial price decreases for these services.

Energy value shares can be influenced by energy prices, but can also be affected by the types of food products households purchase, as well as by labor market conditions. Between 1997 and 2007, the U.S. food system increased its energy use, and both tight labor markets and consumer demand for more food processing services were found to loom large in these increases (Canning et al., 2010). Rapid consolidation of the food retailing industry and economies of scale appear to be behind the decline in price and increase in volume of food retailing services over the study period. Continuing consolidation in the food retailing industry may produce more scale economies, but these could be offset by increased incentives for price collusion.

A few observations stand out regarding the new estimation methodology described in this report:

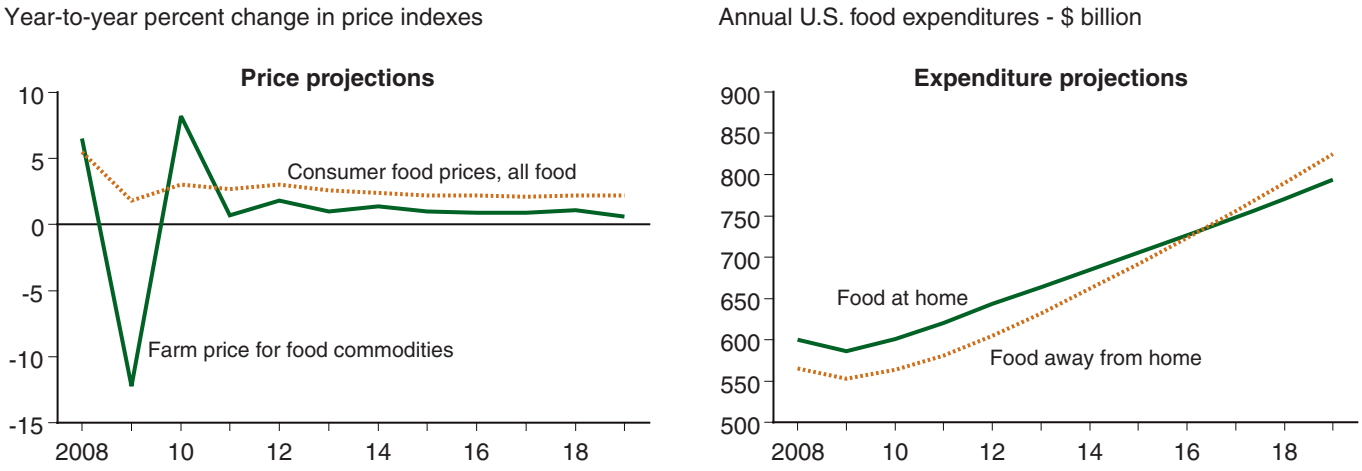
- A lower farm share measure is obtained in the new food dollar series than the measure under the old marketing bill, largely accounted for by the deduction of farm-to-farm transactions, as specified in equation 2.
- Comparing real (inflation-adjusted) estimates of the farm share with nominal (current-value) estimates allows us to see to what extent changes in the farm share over time are attributable to changes in farm-level prices relative to other prices in the economy, and to what extent the farm share changes are attributable to changes in the quantity of services and materials provided by the food marketing system.

- Separately comparing changes in the farm share for food away from home and food at home allows us to see to what extent changes in the farm share over time are attributable to the increase in food consumed away from home.
- Estimates of value added by individual sectors of the food supply chain provide a new, more comprehensive way of looking at where the consumer's food dollar goes.
- Dividing the food dollar by sector, and then separately by factor, avoids the potentially confusing divisions of the marketing bill method, which combined the two.

The official USDA annual outlook projections are based on clear and defensible assumptions about key market outcomes (U.S. Department of Agriculture, 2010). Presented as a point of departure for discussions of alternative farm and food industry outcomes, the current long-term report includes projections out to 2019 for U.S. farm-level food commodity prices, consumer food prices for both at-home and food-away expenditures, and total at-home and food-away food expenditures (figure 7). Farm commodity prices are projected to initially lose ground for a few years on retail food prices and then to keep pace through most of the next decade. Food-away expenditures are forecast to outpace at-home expenditures over this period. Both sets of projections point to a falling farm share measure.

Figure 7

Long-term U.S. price and expenditure projections, 2008-19



Source: USDA Agricultural Projections to 2019, Interagency Agricultural Projections Committee/USDA, 2010.

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Appendix: Data Sources and Mathematical Derivation of the Food Dollar Series

A direct measure of the *food dollar* and the *farm share*, using input-output (IO) analysis, is stated concisely in equation 3 of this report, and measurement of value-added food dollar components is stated in equation 5. Although these measures are a conventional application of IO analysis, substantial preliminary data processing is needed to compile the source data into the required structure for implementing this analysis.

Data Sources

The principal source data for this report are the annual U.S. input-output tables published by the U.S. Department of Labor's Bureau of Labor Statistics (BLS). The BLS IO data series is released at 2-year intervals, with each release adding two annual data tables to the time series. The most recent release, in December 2009, provides annual tables for 1993 to 2008 (www.bls.gov/emp/). Ancillary source data on industry value added by primary production factors are obtained from the annual industry Make and Use tables (before redefinitions) published each year by the U.S. Department of Commerce's Bureau of Economic Analysis (BEA). A mid-2010 release by BEA includes annual Make and Use tables for 1998 to 2008 (www.bea.gov/industry/). The IO-based food dollar series in the present report are benchmarked to give more detailed estimates, using 1997 and 2002 benchmark IO Make and Use tables, also published by BEA. These benchmark accounts are released in 5-year intervals, with a 5-year lag between enumeration and release. For example, final release of the 2002 benchmark account was in mid-2008.

Additional source data are required to address a problem of aggregation bias in the available IO accounts. Although wholesale and retail trade margins are directly measured from primary data sources in the IO accounts, the composite wholesale and retail industries that facilitate these margin services are assumed to employ identical technologies for all users. As discussed in Hirst (1974), this convention produces an aggregation bias for the energy use by trade industry establishments serving the food system. The Economic Census (www.census.gov/econ/) and Annual Survey of Retail Trade (www.census.gov/retail/) provide data for electricity and natural gas utility expenses per dollar of trade margin revenues for several 4-digit wholesale and retail North American Industry Classification System (NAICS) industry groups (www.census.gov/eos/www/naics/). These data are integrated into the IO accounts to address the identified aggregation bias (discussed in the next section).

To implement the IO estimation procedure for the new food dollar series, all five data sources discussed above must be fully integrated, and a concordance matrix was developed to map the relationships among the industry/commodity aggregations of the five accounts. To facilitate a clean concordance across these NAICS-based data systems, some aggregation of the BLS industry/commodity groups was required. As a starting point for the data compilation procedures, the 202-order BLS IO tables are reduced to a 184-order aggregated annual IO table, the 400-plus order 1997 and 2002 benchmark BEA tables are both reduced to the same 390-order aggregated

benchmark tables, and the 92-order annual BEA IO tables are reduced to a 90-order aggregated IO table.

Disaggregation and Decomposition of IO Accounts

The basic building blocks of input-output analysis are the "make," "use," "value added," and "final demand" tables, denoted by the matrices M and U and the vectors v and f, respectively.[13] For a given year, the make table itemizes the value for production of each commodity $c \in C$ by each industry $i \in I$. The use table itemizes annual outlays of each industry $i \in I$ for purchases of each commodity $c \in C$. The value-added table itemizes annual outlays of each industry $i \in I$ for total payments to primary factor owners $p \in P$. The final demand table itemizes total final market expenditures on each commodity $c \in C$. These four building block tables are published biannually by BLS.

Additionally, BLS publishes a supplemental final demand table that provides a detailed breakout of final demand expenditures. This data, along with the benchmark and annual make and use tables published by BEA, facilitates the computation of various share and binary vectors used extensively in this appendix to disaggregate and decompose the BLS IO accounts. The share vectors are denoted *s_id*, where *id* identifies the share metric that is declared as needed. The binary vectors are denoted *b_id*, where *id* is declared as needed to identify a target commodity group. Binary vectors have unit values positioned in the appropriate sequence of a vector to identify target groups and have null values elsewhere.

Procedures for compiling the BLS building block tables to carry out the analysis in this report involve several steps:

For each annual table from 1993 to 2008, convert the commodity by industry use table into a commodity-by-commodity interindustry transaction table (Z):

$$Z_{C,C} = U_{C,I} \cdot (\{\overline{\mathrm{M}_{I,C} \cdot i_C}\}^{-1} \cdot M_{I,C}) \quad \text{(A1)}$$

The 'i' is a unit vector that, when post- (pre-) multiplied into a matrix, produces a vector of the matrix row (column) sums. Equation A1 consolidates the production of each commodity $c \in C$ by the different industries producing the commodity into a single composite industry, such that there is a one-to-one mapping of industries to commodities.

For each annual table from 1993 to 2008, convert the primary factor by the industry value-added table into an import-inclusive primary factor by commodity value-added table, and update the final demand table accordingly.

Let *s_m* denote the vector representing import shares of available product for each commodity $c \in C$, as derived from the BLS supplemental final demand table.[14] Then the import-inclusive commodity value-added table is as follows:

$$\mathrm{v\_m}_{\mathrm{C,P}} = \left[\left(v'_I \cdot \left(\{\ \overline{M_{I,C} \cdot i_C}\}^{-1} \cdot M_{\mathrm{I,C}}\right)\right)' \ \vdots\ \overline{s\_m}_C \cdot f_C\right] \quad \text{(A2)}$$

[13]Math notation is as follows: matrices are denoted with capitalized letters, vectors with lowercase letters, sets with capitalized and italicized letters, and set elements (and scalars) with lower case italicized letters. Dimensions are identified by subscripts in row/column order. A prime ($'$) is the transpose operator, a $'-'$ above a vector denotes its conversion to a diagonal matrix, and $\{\}^{-1}$ indicates a matrix inversion.

[14]The BLS accounts treat commodity imports as components of final demand, entering the accounts as negative values, whereas the approach used here is to treat imports as an industry outlay (analogous to a draw-down of international inventories), and so positive values are entered.

This change requires that final demand also be updated:

(A3) $y_C = (\overline{i_C - S\_m_C}) \cdot f_C$.

To verify that the procedures are properly carried out, the following relationships must hold among the three expressions:

(A4) $Z \cdot i + y = Z' \cdot i + v_m \cdot i$

Decouple the electricity and natural gas utility outlays of wholesale and retail service industries.

According to the 2002 Economic Census, food retailers spent an average of 3.9 cents on electric utilities for every dollar in retail margin revenues, whereas the average of this expenditure across all retail establishments was 1.3 cents. Available data facilitates the disaggregation of retail services into 11 distinct users' groups, requiring a wide range of electric utility purchase coefficients. Similar scenarios exist for the wholesale industry and for natural gas utilities in both industries. To capture this wide variability, wholesale and retail industry utility outlays are decoupled and consolidated into a new 'trade utilities' (*tu*) industry, as follows:

(A5) $Z^{new}_{C,tu} = \overline{b\_ge_C} \cdot (Z_{C,wt} + Z_{C,rt})$,

where *b_ge* is a binary vector identifying the natural gas and electric utility rows, *tu* denotes the position of the new trade utility industry column, and *wt* and *rt* denote the positions of the wholesale and retail trade industry columns, respectively. No value-added outlays are attributed to the new trade utility industry:

(A6) $v\_m^{new}_{tu,P} = 0$

The original wholesale and retail outlay columns are updated accordingly:

(A7) $Z^{new}_{C,wt} = (\overline{i_c - b\_ge_C}) \cdot Z_{C,wt}$. ,

(A8) $Z^{new}_{C,rt} = (\overline{i_c - b\_ge_C}) \cdot Z_{C,rt}$.

Trade industry outlays for primary factor value added are unchanged.

Sales of the new trade utility commodity are measured based on the share of total outlays going to electricity and natural gas utilities for wholesale establishments selling each commodity $c \in C$ (s_we_C, s_wg_C), the share of total outlays going to electricity and natural gas utilities for retail establishments selling each commodity $c \in C$ (s_re_C, s_rg_C),[15] and the trade margin matrices summarizing the wholesale and retail margins added to fob[16] values reported in the interindustry transaction matrix (*Z_wt, Z_rt*):

(A9) $Z^{new}_{tu,C} = (S\_we_C + S\_wg_C)' \cdot Z\_wt_{C,C} + (s\_re_C + s\_rg_C)' \cdot Z_{rt_{C,C}}$

No trade or transportation margin costs are attributed to the utility outlays, so if we denote *tt* the set of all trade and transportation margin industries (and

[15]Utility outlays of the trade industries are based on the Census business expense data by 4-digit NAICS. These data are normalized to each year's BLS estimates of wholesale and retail industry utility outlays.

[16]Interindustry transactions are recorded 'free on board' (fob), and each transaction has accompanying wholesale and retail margin costs. The BLS accounts update total trade margin costs by industry, but do not itemize the margins of each transaction, so the relevant BEA benchmark margin rates are assumed and scaled up or down for each industry to replicate the updated total margin costs.

the set of row/column positions of these industries in the transaction matrix), we have:

(A10) $Z\_tt^{new}_{C,tu} = 0$

Final market sales of the new trade utility commodity are similarly computed:

(A11) $y_{tu} = (S\_we_C + S\_wg_C)' \cdot y\_wt_C + (S\_re_C + S\_rg_C)' \cdot y_{rt_C}$

The appropriate portions of the proceeds in the new trade utility sales row are deducted from the wholesale and retail sales rows in the updated transaction matrix and final demand vector. No trade or transportation margin costs are attributed to the utility outlay, so we have:

(A12) $y\_tt_{tu} = 0$

Decouple the foodservice margins from food-away expenditures.

In the IO accounts, food-at-home expenditures are separately recorded as fob food commodity purchases, along with the trade margins associated with these purchases. Conversely, nearly all food-away purchases are recorded as expenditures on foodservices, where the food commodities are indirectly purchased as part of the service. To facilitate calculations of food dollar expenditures, the foodservices (*fs*) are decoupled from the food-away (*fa*) commodity purchases:

(A13) $Z^{new}_{C,fa} = \overline{b\_fa_C} \cdot Z_{C,fs}$,

(A14) $Z^{new}_{C,fs} = Z_{C,fs} - Z^{new}_{C,fa}$.

No value-added outlays are attributed to the new food-away industry:

(A15) $v\_m^{new}_{fa,P} = 0,$

(A16) $v\_m^{new}_{fs,P} = v\_m_{fs,P}$.

All intermediate and final market sales of the new food-away and foodservice commodities are fixed shares of the old consolidated foodservice commodity sales:

(A17) $Z^{new}_{fa,C} = Z_{fs,C} \cdot s\_fa,$,

(A18) $Z^{new}_{fs,C} = Z_{fs,C} \cdot (1 - S\_fa$),

where *s_fa* is computed as:

(A19) $s\_fa = (i'_C \cdot Z^{new}_{C,fa}) \cdot \{i'_C \cdot Z_{C,fs} + v\_m_{fs,P} \cdot i_P\}^{-1}$.

The new trade and transport margin matrices are computed as:

(A20) $Z\_tt^{new}_{C,fa} = \overline{b\_fa}_C \cdot Z\_tt_{C.fs} \cdot s\_fa$,

(A21) $Z\_tt^{new}_{C,fs} = Z_{tt_{C,fs}} - Z\_tt^{new}_{C,fa}$.

Itemize total industry value-added outlays into primary factor payments to labor, other industry assets, and taxes on industry output.

Industry value-added tables of the BLS annual accounts are reported as total outlays to all primary factor owners. Both the BEA benchmark and annual accounts report primary factor payments to labor, other industry assets, and taxes on industry output. Because the 1997 and 2002 benchmark industry accounts map into the annual BLS accounts and are also used to benchmark the annual food dollar series, 1997 and 2002 primary factor payment shares calculated from the benchmark tables are applied to the BLS data for those years. For the years 1998 to 2008 (excluding 2002), primary factor payment shares calculated from the nearest benchmark year tables are applied to the annual BLS data to formulate initial estimates, $v^0_{C,p}$. A maximum entropy mathematical programming model (Golan et. al., 1994) is employed to reconcile BEA annual data with more aggregated commodity group coverage ($c^+ \in C^+$) but more detailed factor payment coverage ($p \in P$), and with BLS annual data having more detailed commodity groups ($c \in C$) but more aggregated factor payment data (P).

Minimize,

(A22) $\sum_{c \in C} \sum_{p \in P} (v^0_{c,p})^{-1} \cdot Ln\left(\frac{\tilde{v}_{c,p}}{v^0_{c,p}}\right)$,

Subject to,

(A23) $\sum_{c \in C^+} \tilde{v}_{c,p} = v_{c+,p} \quad \forall\ c^+ \in C^+, p \in P$,

(A24) $\sum_{p \in P} \tilde{v}_{c,p} = v_{c,p}\ \forall\ c \in C$.

A solution to the model in equations A22 to A24 replicates both the annual BLS total factor payment values and the annual BEA detailed factor payment share values, while producing the minimum percentage difference between annual factor payment estimates and the nearest corresponding benchmark factor payment values. Since each entropy distance measure in the objective function (equation A22) is weighted by the reciprocal of its preliminary estimate, the maximum entropy solution can be solved iteratively using a RAS-type algorithm (McDougall, 1999). This is beneficial, since there are occasional negative primary factor value-added outlays that are handled more routinely using RAS.[17]

Identify and measure the proportion of each final demand commodity outlay that meets the criteria for food dollar or food and beverage dollar expenditure.

[17]Splitting the primary factor payment matrix into its positive and negative elements allows proportional scaling of both matrices to adjust positive and negative values in the same direction.

The BLS detailed final demand table identifies food-at-home and food-away personal consumption expenditures and their accompanying margin costs, denoted *fh_pce* and *fa_pce*. Some food commodity outlays and the margin expenditures associated with them are not of farm origin, including salt, certain food products of the chemical industry, and water products sold by food retailers. All remaining food commodity expenditures are part of the food dollar bundle (*fd*). Dividing the total final demand into the food dollar produces the food dollar share value (including imports) of total final demand:

$$S\_fd_c = \{\overline{y}_c\}^{-1} \cdot (\overline{b\_fd_c} \cdot (fa\_pce_C + fh\_pce_c)) \quad \text{(A25)}$$

If x_C is a vector reporting total domestic availability (domestic production plus imports) of each commodity $c \in C$, then the direct requirement matrix ($A_{C,C}$) summarizes outlays of each domestic industry $i \in I$ for each commodity $c \in C$ per unit of available industry product:

$$A_{C,C} = Z^{new}_{C,C} \cdot \{\overline{x}_C\}^{-1} \quad \text{(A26)}$$

The total requirement matrix, also called the Leontief matrix, is obtained as follows:

$$L_{C,C} = \{\overline{i}_C - A_{C,C}\}^{-1} \quad \text{(A27)}$$

From equations A27 and A25, total farm industry group (a) sales (including those from imports) required to accommodate total import-inclusive food dollar expenditures can be obtained as follows:

$$x^{fd}_a = L_{a,C} \cdot \underbrace{\overline{S\_fd}_C \cdot y_C}_{=y^{fd}_C} \quad \text{(A28)}$$

To avoid double counting of sales within the farm industry, all payments to a farm industry that are passed on and subsequently go directly or indirectly to another farm industry are netted out:[18]

$$x^{net}_a = (\overline{i}_a - A_{a,a} - \hat{A}_{a,a}) \cdot x^{fd}_a = x^{fd}_a - (\underbrace{A_{a,a}}_{\substack{farm-to-farm\\direct}} + \underbrace{\hat{A}_{a,a}}_{\substack{farm-to-farm\\indirect}}) \cdot x^{fd}_a \ , \quad \text{(A29)}$$

where,

$$\hat{A}_{a,a} = (\textstyle\sum_{k=0}^{k^*} A_{a,C} \cdot A^k_{C,C}) \cdot A_{C,a} \ . \quad \text{(A30)}$$

In equation A30, A^k refers to the matrix product (e.g., $A^2 = A \cdot A$) and k^* represents the exponent where the matrix product $A^{k^*} \approx 0$.

[18]For example, part of proceeds from broiler sales cover the purchase of chicks from a hatchery and animal feed from a feed manufacturer who, in-turn, purchased grain from a grain farm.

Supply Chain Analysis To Measure Value Components of the Food Dollar

A matrix reduction procedure in IO analysis (Leontief, 1986, chapter 3) to facilitate supply chain studies produces a clean decomposition of industry cost contributions by supply chain categories.

To demonstrate, organize industries/commodities into supply chain (*sc*) and non-chain (*nc*) groups respectively. The derivation for import-inclusive gross farm industry output in equation A28 is restated here, using the new supply chain partition:

$$\text{(A31)} \quad x_{sc}^{fd} = L_{sc,sc} \cdot y_{sc}^{fd} + L_{sc,nc} \cdot y_{nc}^{fd}$$

Equation A31 states that total outlays of supply chain industries reflect their total requirements to meet final sales for the supply chain and the 'non-chain' commodities. This can be restated as a reduced supply chain input-output system by multiplying both sides through by the inverse of $L_{sc,sc}$ and rearranging terms:

$$\text{(A32)} \quad \underbrace{y_{sc}^{fd} + L_{sc,sc}^{-1} \cdot L_{sc,nc} \cdot y_{nc}^{fd}}_{=y_{sc}^{*}} = L_{sc,sc}^{-1} \cdot x_{sc}^{fd}$$

The innovation of this matrix reduction is the second inversion of the supply chain quadrant in the original total requirement matrix, $L_{sc,sc}$. It turns out that the second inversion of this submatrix produces the reduced structural supply chain matrix (see proof in Leontief, 1986):

$$\text{(A33)} \quad L_{sc,sc}^{-1} = I_{sc} - \underbrace{[A_{sc,sc} + A_{sc,nc} \cdot (\overline{i}_{nc} - A_{nc,nc})^{-1} \cdot A_{nc,sc}]}_{=A_{sc,sc}^{*}}$$

The reduced structural matrix $A^{*}_{sc,sc}$ describes both the direct requirements of the supply chain interindustry purchases per unit of output and the supply chain industry requirements of the non-chain industries. Combining equations A32 and A33 and rearranging terms produces the supply chain input-output model:

$$\text{(A34)} \quad x_{sc}^{fd} = (\overline{i}_{sc} - A_{sc,sc}^{*})^{-1} \cdot y_{sc}^{*}$$

To use this model for conducting supply chain value-added analysis, the reduced supply chain primary factor value-added coefficient vector must also be obtained, and this is done using the same procedures applied to estimates of the reduced structural matrix:

$$\text{(A35)} \quad v\_m_{sc,P}^{*} = v\_m_{sc,P}^{*} + [L'_{sc,sc}]^{-1} \cdot L'_{nc,sc} \cdot v\_m_{nc,P}$$

In A35, total primary factor value added of non-chain industries per unit of output for each supply chain industry is added to the supply chain industries' direct value-added requirements. The resulting value-added coefficient vector

captures the combined value contributions of each supply chain industry and the collective value added from all the subcontracted services. Supply chain analysis proceeds as follows:

(A36) $$i' \cdot y^*_{sc} = i'_{sc} \cdot (\overline{x}^{fd}_{sc} \cdot v\_m^*_{sc,P}) \cdot i_P$$

Unlike conventional IO cost analysis, the vector within the brackets in equation A36 attributes total costs of final market expenditures to a short list of supply chain industries. To the extent that non-chain industries contribute to market costs, these costs are attributed to supply chain industries by a precise measure of the 'subcontracted' non-chain industry services provided to each stage of the analyzed commodity supply chains.