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Texas Food and Fiber Methodology

Addendum to *The Food and Fiber System and Production Agriculture's Contributions to the Texas Economy*

TEXAS A&M AGRILIFE EXTENSION

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The Texas A&M AgriLife Extension Service and the Office of the Texas Comptroller of Public Accounts have jointly published reports on the economic contributions of the Texas food and fiber system since 2004. Reports are prepared in advance of the state's biennial legislative sessions, which begin in January of odd-numbered years. The latest report is available from the Texas A&M AgriLife Extension Agricultural Economics website and the Texas A&M AgriLife Extension Service website.

The report focuses on the contribution of the state's food and fiber system (FFS) to the state's gross domestic product (GDP). Although total output, or gross sales, is often used as an indicator of economic contribution, GDP is preferable for two reasons. First, GDP is a more appropriate measure of the returns to land, labor, capital, and management resources and represents value added to the economy. Second, using GDP as the measure of economic contribution prevents double-counting of jobs and dollars in the supply chain. Each industry's contribution to GDP is calculated as its value of production (sales or receipts and other operating income, and inventory change) less its intermediate inputs (consumption of goods and services purchased from other industries or imported). Thus, the GDP contribution of a bakery excludes the previous contributions of wheat farms and flour mills.

Contribution of the Texas Food and Fiber System

The purpose of the study was to estimate and report the contribution of the food and fiber system from inputs to the farm through retail. Fiber was included in the title to account for cotton, wool, and mohair. At the time of first publication, a plethora of economic impact studies on individual commodities and multiple studies on the same commodities left people wondering which one was "right." In addition, a number of studies in Texas continued to proclaim that agriculture was meaningless and too small to matter to the state's economy. Few studies, at that time, had attempted to develop economic impact estimates for agriculture through the retail sector. Most economic impact studies had examined an individual, specific sector and estimated the impacts from that sector, or farm gate, back through its supply chain. This research was interested in going both forward and back from production. The GDP contribution is estimated as a share of actual GDP; no multipliers are applied to this data, eliminating concerns about double-counting impacts along supply chains.

The GDP contribution for each industry in Texas is obtained from the U.S Department of Commerce, Bureau of Economic Analysis. Specifically, the "Annual Gross Domestic Product (GDP) by State" table is accessed from the "GDP and Personal Income" link in the Regional Data section of the site's Interactive Data tab. The analysis relies on the nominal (current dollar) GDP estimates. BEA GDP data become available in June of most years, and data are lagged two years at publication. For example, 2014 data were published in June of 2016.

Table 1 and Figure 1 of each biennial report describe the food and fiber system's contribution to GDP both in nominal (current) dollars and as a percentage of the state's total GDP. The FFS is defined as agriculture, fishing, and hunting; agricultural processing and retailing; and the portion of other industries' GDP attributable to agriculture. Prior to the creation of the initial report in 2004, Extension and Comptroller staff estimated the share of each industry that is part of the FFS based on the results of other studies, data from the Census and other state and federal sources, including the Comptroller's sales tax data.

These shares are displayed in Table A1 of this paper. For example, agricultural fertilizers and pesticides make up 3 percent of the state's chemical production. Similarly, farm machinery makes up 1 percent of the state's machinery manufacturing.

The second column of Table 1 reports the nominal dollar value of each industry's portion of the food and fiber system. The dollars attributable to the FFS within each industry are the product of each industry's FFS share multiplied by industry GDP from the BEA data. The sum of the industry FFS contributions is the contribution of the entire food and fiber system. The percent of Texas GDP attributed to the FFS is calculated as the total FFS contribution divided by the state's total GDP. Each industry's relative contribution to the food and fiber system is calculated by dividing the industry's FFS contribution by total FFS dollars. The 10-year history of both the nominal (current) dollar value of the FFS and the FFS share of the GDP are displayed in Figure 1.

Figure 2 of the Food and Fiber report displays the economic contribution of all Texas industries both in nominal dollars and as shares of GDP. The FFS contributions are calculated as described above and as reported in Table 1 and Figure 1. The contributions of other industries are calculated based on the share of each industry not attributed to agriculture. Thus, the mining industry's contribution to Texas GDP is 99.87 percent of the mining GDP reported by BEA, while the 0.13 percent is attributed to agriculture (as shown in Table A1). Similarly, 81 percent of BEA-reported retail GDP is reported as retail's contribution to the state's economy because 19 percent of retail GDP is attributed to grocery stores within the food and fiber system. In practice, the GDP values reported in Figure 2 are calculated by subtracting the FFS portion of each industry's GDP and reporting the difference as the industry's dollar contribution. These industry dollar contributions are then divided by total GDP to obtain the shares displayed in the pie chart.

Contribution of Leading Agricultural Commodities

The economic contributions of leading agricultural commodities are estimated based on cash receipts and government payments for crops and livestock and stumpage value for timber. Cash receipts data are obtained from the USDA Economic Research Service (USDA-ERS) annual cash receipts by commodity, U.S. and States, 2008–2016 and federal government direct farm payments by program, U.S. and States tables, both of which are available from the USDA-ERS Data Files: U.S. and State-Level Farm Income and Wealth Statistics.[1] The ERS cash receipts and government payments data are summed for each commodity and reported as cash receipts in Table 2 of the report.

The ERS data are lagged one year, although current year forecasts are reported. Thus, in 2016, data were reported for 2008 through 2015, and forecasted data were reported for 2016. The Food and Fiber report uses data lagged two years to ensure that the BEA, ERS, and IMPLAN data are all representative of the same year. The ERS data are downloaded in June of each year to coincide with the release of the BEA GDP data. The ERS cash receipts data are compared to other sources to ensure general agreement with similar data, and government payments data are confirmed by staff at the Agricultural and Food Policy Center at Texas A&M. However, published ERS data continue to be revised, and rarely match exactly with reported cash receipts (technically, ERS cash receipts plus government payments). Because ERS continues to revise data for several years, resulting in numerous relatively small changes (in most cases), previous years' data are not updated in the Food and Fiber publication. Once cash receipts are downloaded and verified against other sources, those values become part of the publication's historical data set.

[1] Prior to 2009, cash receipts data were obtained from the USDA National Agricultural Statistics Service (USDA-NASS) statistical bulletin. The NASS series was discontinued, and that data is now provided by USDA-ERS.

Cash receipts for timber are based on stumpage values reported by the Texas A&M Forest Service (TAMFS). The TAMFS Harvest Trends reports are available with a one-year lag. Again, the Food and Fiber report uses a two-year lag to ensure all data are reported for the same year.

Agricultural cash receipts and government payments can vary greatly from year to year as a result of weather and other conditions that affect both statewide production and global prices. Therefore, cash receipts are not reported for individual years but as a four-year average. Averaging the most recent four years of receipts for each commodity is a generally accepted practice among Texas A&M AgriLife Extension Service economists (Salinas and Robinson 2016; Amosson et al. 2015). This practice incorporates trend data but limits the impacts of random fluctuations in production and market conditions.

The Food and Fiber report includes an explanation of how input-output analysis is used to estimate economic impacts of commodities from the farm gate back through the supply chain.[2] The Type SAM multipliers from the IMPLAN system are used to capture these indirect (business to business) and induced (household spending) effects. Type SAM multipliers are deemed appropriate because agricultural production is embedded in the economy over the long term; thus households as well as businesses have ample opportunities to be fully integrated into the economy. IMPLAN's default institutions (i.e., household income groups but not government, corporations, and capital) are included in constructing the social accounting matrix.

To maintain a record of historical cash receipts, direct contributions to GDP, and total contributions to GDP, IMPLAN value added multipliers for Texas agricultural industries are exported to Microsoft Excel. In most years, cash receipts for each major commodity are multiplied by direct value added multipliers for the appropriate production agriculture sector to obtain the direct contribution data in Table 2. Each direct contribution is then multiplied by Type SAM value added multiplier for that sector to obtain the total contribution values in Table 3.

In 2013, the direct value added multiplier for the grain sector was near-zero and slightly negative, which resulted in an extremely large negative total contribution to GDP.[3] For 2013, direct contributions for grains (corn, sorghum, wheat, and rice) were left at zero, and the total contribution was calculated using IMPLAN's total value added contribution multiplier for grain, which is tied directly to the initial change in cash receipts rather than the direct effect on GDP itself. This alternative calculation provides a GDP contribution that more closely matches the value added effects estimated within the IMPLAN system for 2013 grains.

Beginning with the 2016 publication, cash receipts for each year and commodity are multiplied by the IMPLAN value added multipliers for that industry and year. The contributions are then averaged over the four-year period. In earlier years, the four-year average cash receipts for each commodity were multiplied by an industry multiplier from a single recent IMPLAN data set. Matching cash receipts to their IMPLAN data years is expected to provide to a more accurate representation of the state's food and fiber system. Just as averaging reduces year-to-year variation in cash receipts, using multipliers for each year reduces the potential to artificially increase or decrease the GDP contribution based on the economic peculiarities of that year. This is important because multipliers are negatively correlated with price, and when prices are high, multipliers tend to be lower. A greater share of receipts is paid to households in the form of profit and capital, and induced household spending generates less economic activity (lower multipliers) than indirect business-to-business transactions.

[2] More information about economic impact analysis is available from the publication Economic Impact Analysis: A Brief Introduction.
[3] A Type SAM multiplier is calculated as (direct + indirect + induced effects) ÷ direct effect. As the dividend approaches zero, the multiplier approaches infinity.

Although IMPLAN multipliers are not updated as frequently as the USDA-ERS data, both the data and the modeling system are updated periodically. Most IMPLAN data revisions are made within a few months of initial release and prior to the production of the Food and Fiber report. However, revisions to the base data and multipliers make it difficult to replicate results perfectly. The authors note the dates of data downloads and software updates as part of our documentation process.

Table A1. Share of Industry GDP Attributable to the Texas Food and Fiber System

NAICS Code	Industry	FFS Share %
11	Agriculture, forestry, fishing, and hunting	100.00%
2123	Nonmetallic mineral	0.13%
321	Wood product manufacturing	100.00%
327	Nonmetallic mineral product manufacturing	8.90%
333	Machinery manufacturing	1.00%
337	Furniture and related product manufacturing	50.00%
311	Food product manufacturing	100.00%
313,314	Textile and textile product mills	100.00%
315	Apparel manufacturing	50.00%
322	Paper manufacturing	100.00%
324	Petroleum and coal products manufacturing	9.00%
325	Chemical manufacturing	3.00%
42	Wholesale trade	19.00%
44–45	Retail trade	19.00%
48–49	Transportation and warehousing, excluding Postal Service	8.00%
52	Finance, insurance, and real estate	10.00%
521,522	Federal Reserve banks, credit intermediation and related services	10.00%
524	Insurance carriers and related activities	10.00%
531	Real estate	10.00%
532	Rental and leasing services and lessors of intangible assets	10.00%
722	Food services and drinking places	100.00%
	Federal direct payments	100.00%
925	State and local	0.21%

Resources

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