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Gauging the Economic Importance of Mississippi Agricultural and Natural Resources

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Mississippi's agricultural and natural resources commodities were studied and ranked by seven economic indicators for 2019. Four were direct effects of operations—employment, farm gate receipts, gross value added, and final demand sales; two were economic multipliers for gross value added along with a value added, base export multiplier; and the economic export base contributions. Six different commodities occupied the number one ranking for at least one indicator. Broilers and eggs (total receipts and employment) and soybeans (final demand sales and economic base contributions) were commodities that repeatedly ranked first. Mississippi's base economic contributions from agriculture and natural resources totaled $2.22 billion. Three commodities—cotton, horticultural plants, and broilers and eggs—were key to bringing new money into the state, while others provided support to downstream processors and manufacturers, as well as other commodities. Across all indicators, soybeans, cotton, timber, broilers and eggs, and catfish were state leaders.

Key words: Economic Contributions, Export Base, Farm, Forestry, IMPLAN, Value Added

A recent report to the U.S. Congress found Mississippi possessed the most concentrated bioeconomy in the United States (Golden et al., 2015). The state's agricultural and natural resources complex—farming, forestry, fishing and wildlife, service providers, along with downstream processors and manufacturers—supported 113,900 jobs and returned $8.40 billion in value added on sales of $26.4 billion in 2014 (Henderson et al., 2016). Farm-gate receipts surpassed $7.0 billion in 2019 and an early projection placed the 2020 value at $7.35 billion (Mississippi State University, Division of Agriculture, Forestry, and Veterinary Medicine (MSU DAFVM), 2021).

In Mississippi, farms are still largely family-owned with 95% of the state's 34,700 enterprises falling into this category (Bigelow, Borchers, and Hubbs, 2016; MSU DAFVM, 2021). Forestlands are predominately owned by nonindustrial private forest landowners, but over one-fourth of Mississippi's productive timberland acreage is maintained by institutional corporate ownerships (Oswalt et al., 2019). Many of the

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state's commercial fishers are single-firm enterprises[1] (Posadas, 2015). Fee-access hunting has become an established market, particularly among large-tract landowners, in Mississippi. Bottomland hardwoods along the Mississippi River command a premium lease rate (Hussain et al., 2007). Collectively, farming, forestry, fishing, and hunting account for approximately two to three percent of Mississippi's economy (IMPLAN LLC, 2020a).

Policy decisions, unfortunately, often result in winners and losers. Limited funding means a dollar allocated to assist agriculture is one not provided to oil and gas. Similarly, funding a crop initiative leaves less dollars for backing similar programs that could support retention and expansion among the livestock community. Ordinances restricting transportation to maintain road and bridge quality can produce unintended consequences that adversely affect supply chains for some on-farm commodities, such as timber (Gilliland et al., 2003). Policymakers, therefore, pursue statistics regarding commodity value and industry size to gauge economic importance when seeking to define their region's profile or guide development strategies (Cooke et al., 2015). Producer groups and trade associations also rely on these data when formulating policy positions. This knowledge becomes critical intelligence when one commodity clientele group must jockey for significance among other industries (Waters, Weber, and Holland, 1999).

The objective of this work was to highlight seven statistics representing the value, size, and contributions of 19 Mississippi commodities. Background is provided on the economic metrics, some of which are relatively easy for users and practitioners to comprehend. Others are more complex in their derivation. The commodities' rank positions were then established for each indicator, as this information is often requested by interested parties. Because a product's rank according to one indicator can vary significantly from that of another indicator, two measures of center, the mean and median, were calculated from these ranks. The indicators discussed were not intended to be exhaustive, but rather to highlight economic importance across multiple perspectives.

[1] Family ownership implies the farm operator and relatives own the majority stake in the farm business. Nonindustrial private forest landowners can include individuals, families, hunting and fishing clubs, nongovernmental organizations, non-corporate trusts, and estates (Oswalt et al., 2019). While individuals and families often incorporate farms and forest operations for business and legal purposes, they are not considered corporate in the sense of owning land to supply raw materials for a processing plant. Institutional corporate owners from a forestry perspective include timberland investment management organizations, real estate investment trusts, and forest products manufacturing firms. A single-firm enterprise is one business comprised of only one establishment with only one predominant activity.

Background

Commodity value and industry size can be determined in several ways. Four such statistics essentially provide "headcounts" regarding size. Each has its own strengths and weaknesses. Employment provides an accounting of jobs for the area of study. Jobs are often equated to people; however, one individual can hold multiple jobs.[2] Farm gate receipts are gross sales analogous to industry gross output. While gross output is relatively straightforward for clientele to understand, gross output is a duplicative statistic that, unfortunately, plagues the agriculture and natural resources complex. For example, totaling the outputs of lumber and stumpage (standing timber) counts the timber's value two times (McConnell, Tanger, and Henderson, 2019). A similar analogy can be made for feed crops and livestock, where the feed crops' outputs serve as inputs for livestock production (McKeever and Howard, 1996). Gross value added measures income accumulated along each production step and guards against the double-counting that often occurs with output (Pelkki and Sherman, 2020). Final demands, or final outputs, is a less-used statistic by practitioners. It describes exogenous sales, or industry sales resulting from the demands of buyers located beyond the region of interest's boundaries (i.e., importers). Sales to final users provide the basis for economic activity within a region (Watson et al., 2015).

Beyond the farm gate are allied industries that depend on agricultural and natural resources production to generate demand for their businesses' outputs. The allied industries, in turn, create demand for their suppliers' outputs. These series of exchanges continue until local enterprises are no longer able to meet local demand. The supply chain linkages over many rounds of transactions create a multifaceted economic network of buyers and sellers, whose activities are collectively instigated by meeting the final demands for agricultural and natural resources products. The economy-wide contributions agriculture and natural resources provide across all industries are often greater than straightforward direct measures by a factor of two or more (Golden et al., 2015).

More comprehensive and computationally expensive statistics are required, though, to describe the supply chain linkages discussed above. The procedure in matrix format simultaneously tracks purchased inputs, when read down columns, and output sales,

[2] Some agencies, like the Office of Management and Budget, seek to overcome this limitation by instead reporting full-time equivalents (Jennings and Nagel, 2020), but full-time equivalents are a less-reported statistic in the popular literature on this topic. Examples from forestry can be found at https://www.forestryimpacts.net/reports. To the author's knowledge, these state reports do not report forest-based employment in full time equivalents.

when read across rows. Following a series of mathematical steps, the resulting "multiplier" matrix equates to an inventory of connectivity shared between industries and the outputs they produce. Each cell of the matrix describes the output from industry i needed as input to produce one dollar of column commodity j output. This connectivity provides industries, producer commodity groups, and other stakeholders both breadth and depth regarding their positions and roles in driving economic activity.

The catalyst for intraregional activity was described by Waters, Weber, and Holland (1999) as basic, i.e., driven by final demands from buyers located outside the study region. Basic activities bring new money into the region via exporting. Sales of basic goods and services subsequently trigger additional activities backward through the economy in support of the original basic endeavor. This new money allows businesses to purchase goods and services, pay incomes and taxes, and support jobs. Cotton purchased by a gin is the farmer's sales. The farmer, in turn, purchases seed, fertilizer, fuel, and pesticides for the upkeep of the farm. Employees of both the gin and the farm spend portions of their earnings on local goods and services, such as groceries, health care, etc.

However, some of those new dollars also leave the state to purchase inputs from other regions or countries to fully satisfy the demand generated by the initial export sale. A new harvester for the farm may be purchased from an overseas manufacturer. Perhaps the tractor's diesel fuel was refined elsewhere or an employee's mortgage is held by an out-of-state bank. Eventually, the new money's exit from the state, or leakage, due to purchasing imports is complete. The support provided to the economy by the export sale, or the base contributions, are the sum of the locally linked activities generated across all industries over all rounds of spending.

Methods

For the State of Mississippi, agriculture farm-gate receipts data (commodity value at the first point of processing) for 2019 were obtained from the U.S. Department of Agriculture (USDA) Quick Stats (2021) for the following commodities: broilers and eggs, catfish, cattle, corn, cotton, hay, hogs, horticultural plants, milk, peanuts, rice, soybeans, sweet potatoes, tree fruits and nuts, vegetables, and wheat. Production values in 2019 for Mississippi commercial freshwater and saltwater fish along with wild game, pelts, and furs were taken from IMPLAN, an economic impact analysis system (IMPLAN LLC, 2020a). Timber values for 2019 were obtained from the Mississippi State University Extension Service *Harvest of Forest Products* report (Auel, 2020). This report calculates timber volumes from state timber severance tax receipts and subsequently

values the timber product output based on price data collected throughout the year from sales reported by forestry clientele.

Farm and natural resources employment figures were recorded from the Quarterly Census of Employment and Wages (QCEW) provided by the U.S. Department of Labor, Bureau of Labor Statistics (2021). The QCEW employment data are sourced from mandatory reporting by businesses regarding unemployment insurance along with firms that provide the Bureau data (USDL, Bureau of Labor Statistics, 2021). The QCEW data "represent the number of covered workers who worked during, or received pay for, the pay period that included the 12th day of the month. Covered private-industry employees include most corporate officials, all executives, all supervisory personnel, all professionals, all clerical workers, many farmworkers, all wage earners, all piece workers, and all part-time workers…QCEW excludes proprietors, the unincorporated self-employed, unpaid family members, [and] certain farm and domestic workers from having to report employment data…" (USDL, Bureau of Labor Statistics, 2021, Handbook of Methods, p. 3). As stated earlier, 95% of Mississippi's farms are family-owned and unincorporated, and over 21,000 farm owners listed farming as their primary occupation in 2017 (USDA, 2019). This means QCEW data will most likely always undercount agricultural- and natural resources-based employment. Another issue is disclosure concerns that prevent open access to much of the agricultural QCEW data reported at state and local levels.

Additional employment data were recorded from two proprietary databases. IMPLAN (2020a) constructs regional models using either national trade flows or econometric regional purchase coefficients, though the trade flows approach is more commonly used by analysts (Joshi et al., 2017). Gross output is the model's basis, and employment is derived from its relationship to output by using QCEW as one of the sources. IMPLAN's data are largely available to the North American Industry Classification System's (NAICS) 4- or 5-digit level. Economic Modeling Specialists International (Emsi) pairs QCEW data with national staffing patterns from the Bureau's Occupational Employment Statistics to develop regionalized job counts statistically by industry (Emsi, 2020). Both IMPLAN and Emsi attempt to account for non-QCEW jobs. This includes those who identify as self-employed and what Emsi terms "Extended Proprietors," which can include certain farms and tax-exempt nonprofit cooperatives. While Emsi reports natural resources jobs data, it limits its agricultural-related data to the equivalent of the 3-digit NAICS 111 "Crop Production" and 112 "Animal Production." Thus, employment was obtained from both IMPLAN and Emsi for these two aggregated sectors, plus a combined natural resources sector (timber, fresh- and saltwater fish, and wild game, pelts, and furs).

The QCEW employment data for Mississippi were largely available to the 6-digit NAICS level. Where data were suppressed, they could be derived by subtraction from 4-digit NAICS codes to obtain a missing commodity's data. This enabled the parsing of IMPLAN and Emsi data using shares calculated from QCEW. The QCEW employment shares were calculated by dividing employment for each commodity by total QCEW employment for either crop, animal, or natural resources employment as appropriate. The QCEW shares were next multiplied by Emsi's and IMPLAN's 3-digit employment figures for crop, animal, and natural resources. The midpoint between the IMPLAN and Emsi weighted averages was considered employment by commodity for Mississippi in 2019.

Gross value added was calculated based on its share of industry output in the IMPLAN database, which was then multiplied by the farm-gate receipts data for each commodity. Value added here was considered in gross terms because it was based on gross output of commodity sales. Value added is composed of labor income (employee compensation plus proprietor income), other property income, and taxes on production and imports, less subsidies (TOPI).[3] As an example, value added payments comprised 91% of oilseed farming's total commodity output. That share was multiplied by the value of production for soybeans to arrive at that commodity's gross value added. An important note is that gross value added collectively was negative for the grain farming industry. Value added can be negative because of its TOPI component when government payments to an industry exceed the taxes collected from that industry that year (IMPLAN LLC, 2020b). The USDA Economic Research Service's (ERS) Farm Income and Wealth statistics indicated $599 million in direct government payments were made in 2019 (USDA ERS, 2021), but this value was not parsed out by commodity. Final demand was calculated by a two-step process. First, a final output share was calculated. This was a ratio of IMPLAN's final demand and industry output values. The final output share was then multiplied by the commodity's value of production obtained from USDA to estimate the commodity's final demand.

Economic multipliers were calculated on an industry by commodity basis. The multipliers for each commodity represented the total economic change in Mississippi resulting from a one-dollar change in final demand for that product. The total effects gross value added multiplier is illustrated by Equation 1

1) $Mv_{Gross} = \langle v_c \rangle (I-S)^{-1}$

[3] Taxes on production and imports, less subsidies (TOPI) are taxes collected for governments by businesses. They include sales taxes, excise, taxes, property taxes, severance taxes, motor vehicle taxes, along with additional fees, licensures, and fines. Taxes on profits and income are not included.

where Mv_{Gross} is the gross value added total effects multiplier matrix, $\langle v_c \rangle$ is the diagonal matrix of value added direct requirements, and $(I-S)^{-1}$ is the output total requirements matrix. The total requirements matrix captures both the indirect effects of supply chain spending as well as the induced effects of households recirculating the labor income portion of value added back to industries. Summing the respective commodity j's column of multipliers will provide the gross value added total effects multiplier for that commodity.

Pre-multiplying Mv_{Gross} by a row vector of 1s, which is i' in Equation 2, followed by a post-multiplication by a diagonal matrix of commodity final demands $\langle f \rangle$ provided the value added base contributions, v', of a Mississippi commodity

2) Value Added Base Contributions = $v' = i' \, Mv_{Gross} \langle f \rangle$

An adjusted, base export value added multiplier can be further calculated

3) $Mv_{Base} = i' \, Mv_{Gross} \langle v_c \rangle^{-1} \langle f_c \rangle = v' / v$

where Mv_{Base} is the base export value added multiplier, $\langle v_c \rangle^{-1}$ is the inverse of the gross value added direct requirements placed along a diagonal, and $\langle f_c \rangle$ is the diagonal matrix of final demands to the commodity receipts ratios. Thought of another way, the base export value added multiplier is simply the ratio of value added base contributions divided by gross value added v. The base export multiplier is a measure of dependency, with an inflection point at 1.0. Commodities with an export base multiplier greater than 1.0 interact with the rest of the world at above-average levels. Those commodities with export base multipliers below 1.0 minimize leakages from the economy, retaining dollars within the state for further spending.

Results and Discussion

Agricultural and natural resources employment in Mississippi was 47,530 jobs in 2019 (Table 1). Employment ranged from 150 to 8,980 jobs across commodities. Broilers and eggs was the leading employer, followed by cotton, timber, soybeans, and catfish rounding out the top five (Table 2). Together, these products accounted for 60% of total sector employment. Farm-gate receipts found two commodities—broilers and eggs along with timber—each exceeding $1 billion (Tables 1 and 2). A second tier of agronomic crops—soybeans, cotton, and corn—rounded out the top five. Together, the top five products comprised 82% of total gross farm sales in the state.

Table 1. Production Figures for Mississippi Agricultural and Natural Resources Commodities (alphabetically) and Their Percent Contribution to Sector's Totals, 2019. Employment Values Rounded to Nearest 10 Jobs. Dollar Values Rounded to Nearest $1,000. Rounding May Prevent Totals from Summing.

Commodity	Employment	Employment, %	Gross Value Added	Gross Value Added, %	Receipts	Receipts, %	Final Demand	Final Demand, %	Value Added Total Effects Multiplier	Value Added Base Export Multiplier	Value Added Base Contributions	Value Added Base Contributions, %
Broilers and Eggs	9,980	18.99	$185,817,000	7.26	$2,571,113,000	38.69	$591,449,000	21.55	0.3179	1.0117	$187,997,000	8.46
Catfish	3,120	6.56	$205,109,000	8.01	$214,596,000	3.23	$105,791,000	3.85	1.2100	0.6241	$128,002,000	5.76
Cattle	1,460	3.09	$135,564,000	5.31	$249,086,000	3.75	$97,883,000	3.57	0.9489	0.6801	$92,396,000	4.16
Corn	1,930	4.07	($42,668,000)	-1.9	$431,526,000	6.49	$187,891,000	6.85	0.4255	0.0000	$79,938,000	3.6
Commercial Fresh and Saltwater Fish	1,440	3.04	$132,112,000	5.16	$139,617,000	2.1	$93,006,000	3.39	1.0189	0.7173	$94,765,000	4.26
Cotton	5,920	12.45	$263,447,000	10.29	$541,137,000	8.14	$449,492,000	16.38	0.911	1.5543	$409,475,000	18.43
Hay	1,800	3.78	$54,611,000	2.13	$136,091,000	2.05	$60,964,000	2.22	0.7708	0.8625	$45,992,000	2.11
Hogs	1,910	4.02	$39,253,000	1.53	$41,062,000	0.62	$21,182,000	0.77	1.2100	0.6529	$25,690,000	1.15
Horticultural Plants	2,960	6.23	$24,907,000	0.97	$55,906,000	0.84	$36,777,000	1.34	0.8025	1.182	$29,440,000	1.32
Wild Game, Pelts, and Furs	150	0.31	$9,685,000	0.38	$11,331,000	0.17	$2,284,000	0.08	0.5726	0.135	$1,308,000	0.06
Milk	390	0.82	$5,341,000	0.21	$24,696,000	0.37	$9,452,000	0.34	0.5935	0.9386	$5,613,000	0.23
Peanuts	210	0.44	$5,672,000	0.22	$14,136,000	0.21	$6,332,000	0.23	0.7708	0.8625	$4,881,000	0.22
Rice	1,230	2.6	($21,652,000)	-0.85	$95,473,000	1.44	$41,570,000	1.51	0.4255	0.000	$17,686,000	0.8
Soybeans	5,100	10.75	$663,586,000	25.92	$725,350,000	10.91	$602,165,000	21.94	1.0754	0.9759	$647,585,000	29.14
Sweet Potatoes	2,130	4.49	$30,104,000	1.18	$75,021,000	1.13	$33,607,000	1.22	0.7708	0.8625	$25,994,000	1.17
Timber	5,810	12.23	$303,006,000	32.03	$1,195,762,000	17.99	$361,370,000	13.17	1.0899	0.4823	$395,875,016	17.72
Tree Fruits and Nuts	440	0.92	$9,128,000	0.36	$16,714,000	0.25	$6,145,000	0.22	0.7861	0.5292	$4,831,000	0.22
Vegetables	2,310	4.87	$46,608,000	1.82	$102,481,000	1.54	$33,304,000	1.39	0.7253	0.5493	$25,604,000	1.15
Wheat	215	0.45	($1,141,000)	0.04	$5,034,000	0.08	$2,192,000	0.08	0.4255	0.0000	$933,000	0.04
Total Agriculture and Natural Resources	47,530	100	$2,559,788,000	100	$6646,134,000	100	$2,744,859,000	100	—	—	$2,222,255,000	100

Table 2. Rankings of Mississippi Agricultural and Natural Resources Commodities by Economic Indicators, 2019.

Ranking	Employment	Value Added	Receipts	Final Demands	Value Added Total Effects Multiplier	Value Added Base Export Multiplier	Base Contributions
1	BroilersEggs	Timber	BroilersEggs	Soybeans	Catfish T	Cotton	Soybeans
2	Cotton	Soybeans	Timber	BroilersEggs	Hogs T	Hortplants	Cotton
3	Timber	Cotton	Soybeans	Cotton	Timber	BroilersEggs	Timber
4	Soybeans	Catfish	Cotton	Timber	Soybeans	Soybeans	BroilersEggs
5	Catfish	BroilersEggs	Corn	Corn	Fishing	Milk	Catfish
6	Hortplants	Cattle	Cattle	Catfish	Cattle	Hay (T)	Fishing
7	Vegetables	Fishing	Catfish	Cattle	Cotton	Peanuts (T)	Cattle
8	SwPotatoes	Hay	Fishing	Fishing	Hortplants	SwPotatoes (T)	Corn
9	Corn	Vegetables	Hay	Hay	TreeFruitNuts	Fishing	Hay
10	Hogs	Hogs	Vegetables	Rice	Hay (T)	Cattle	Hortplants
11	Hay	SwPotatoes	Rice	Hortplants	Peanuts (T)	Hogs	SwPotatoes
12	Cattle	Hortplants	SwPotatoes	Vegetables	SwPotatoes (T)	Catfish	Hogs
13	Fishing	HuntTrap	Hortplants	SwPotatoes	Vegetables	Vegetables	Vegetables
14	Rice	TreeFruitNuts	Hogs	Hogs	HuntTrap	TreeFruitNuts	Rice
15	TreeFruitNuts	Peanuts	Milk	Milk	Milk	Timber	Milk
16	Milk	Milk	TreeFruitNuts	Peanuts	Corn (T)	HuntTrap	Peanuts
17	Wheat	Wheat	Peanuts	TreeFruitNuts	Rice (T)	Corn (T)	TreeFruitNuts
18	Peanuts	Rice	HuntTrap	HuntTrap	Wheat (T)	Rice (T)	HuntTrap
19	HuntTrap	Corn	Wheat	Wheat	BroilersEggs	Wheat (T)	Wheat

BroilersEggs = Broilers and Eggs; Fishing = Commercial Fresh and Saltwater Fish; HortPlants = Horticultural Plants; HuntTrap = Wild Game, Pelts, and Furs; SwPotatoes = Sweet Potatoes; TreeFruitNuts = Tree Fruit and Nuts. Ties are noted in parentheses.

Timber was the number one gross value added-producing commodity (Tables 1 and 2). It was most responsible for keeping money in the state. Other top commodities in this category included soybeans, cotton, catfish, and broilers and eggs. The perspective of value added highlighted how employment and gross farm receipts may be misleading statistics. Broilers and eggs fell from number one in farm-gate receipts to number five for gross value added. Timber returned 69% of its gross farm value to the state as income, while broilers and eggs only returned 7%. Value added as a percent of farm gate receipts exceeded 90% for some commodities, including catfish and soybeans. Wheat, rice, and corn produced negative gross value added due to the grain farming industry's receiving direct government payments that exceeded tax collections. Gross value added for agriculture and natural resources in Mississippi summed to $2.56 billion. Final demands totaled $2.75 billion (Table 1). The top five of soybeans, broilers and eggs, cotton, timber, and corn comprised 80% of total final demands (Table 2). A great deal of Mississippi farm and natural resource products' final demands consisted of domestic and foreign exports. This is a common occurrence for these commodities (Watson, Taylor, and Cooke, 2008).

The value added total effects multipliers highlighted the linkages that commodities possessed with other industries throughout the state (Table 1). Interestingly, broilers and eggs, which was a state leader in terms of direct effects, possessed the least multiplier to

other industries. Broilers and eggs only generated $0.32 of gross value added for every dollar of final demand. This was likely owing to integrators supplying many growers with the inputs they require from out of state. While corn, rice, and wheat generated negative value added due to government payments, they did have a positive total effect on value added for the state. Catfish produced $1.21 of total gross value added per dollar of final demand. Catfish farming is locally concentrated in the Mississippi delta, with a smaller pocket of producers found in the northeast. Many of the feed inputs needed by catfish producers are procured from corn and soybean product outputs. Timber produced $1.09 of total gross value added for every dollar of final demand. Loggers and foresters tend to cluster within the woodsheds of large forest products mills. Hogs and commercial fresh and saltwater fish were two other commodities that generated more than one dollar of total value added multiplier effects for every dollar of final demand.

Value added base contributions comprehensively capture the supply chain spillover effects required to satisfy the final demands. Mississippi agricultural and natural resources commodities generated $2.22 billion total value added economic base contributions in 2019 (Table 1). The final demands for soybeans in conjunction with all the backward linked goods and services required to produce soybeans for export made soybeans the largest base-contributing agricultural commodity (Table 2). The other top five contributors were cotton, timber, broilers and eggs, and catfish. All but one product generated at least $1 million in total value added economic base contributions. Cotton experienced the greatest relative increase in base value added contributions compared to its directly generated percentage. Cotton's base contributions comprised 18.43% of total agriculture and natural resources contributions versus 10.29% in direct terms, which was a difference of 79%.

The value added base export multipliers elucidated the degree to which Mississippi was dependent upon commodities to bring new money into the state. Commodities possessing value added base export multipliers greater than 1.0 can be considered as base commodities (Table 1). Three commodities exhibited this quality—cotton, horticultural plants, and broilers and eggs. Timber and catfish produced sizable value added contributions for the state's export base, but they were not considered base commodities due to their export base multiplier being less than 1.0. This indicated these commodities remain in the state for further downstream processing by manufacturers, which, in turn, increases those industries' economic multipliers. As suggested by transportation theory, timber deliveries are constrained due to roundwood's heavy and bulky nature. Generally, this is within 100 miles. Logs are sold to local mills that convert them into wood and paper products. Likewise, catfish processing plants are located near the farms (Hansen,

Dean, and Spurlock, 2004). In Mississippi, it is these converted products that are exported across the country and around the world.

Taken together, six different commodities occupied the number one ranking for at least one indicator (Table 2, note catfish and hogs tied in one category). Soybeans and broilers and eggs were the only repeat commodities to rank first. Soybeans led final demand sales and value added economic base contributions, while broilers and eggs led employment and total farm receipts. Across all indicators, soybeans achieved the higher average ranking (2.71), followed by cotton (3.14), timber (4.43), broilers and eggs (5.00), and catfish (5.71) (Table 3). Median rankings concluded soybeans, cotton, and timber were leading commodities, all with median ranks of 3.00. Ranges between commodities' rankings varied from as little as two places for wheat, to as many as 18 places for broilers and eggs.

Table 3. Summary Statistics for Rankings by Seven Economic Indicators of Mississippi Agricultural and Natural Resources Commodities, 2019. Commodities Sorted by Average Rank.

Commodity	Average Rank	Median Rank	High Rank	Low Rank	Range
Soybeans	2.71	3	1	4	3
Cotton	3.14	3	1	7	6
Timber	4.43	3	1	15	14
Broilers and Eggs	5.00	4	1	19	18
Catfish	5.71	5	1	12	11
Cattle	7.71	7	6	12	6
Commercial Fresh and Saltwater Fish	8.00	8	5	13	8
Hay	8.86	9	6	11	5
Horticultural Plants	8.86	10	2	13	11
Sweet Potatoes	10.14	11	6	13	7
Hogs	10.29	11	1	14	13
Vegetables	11.00	12	7	13	6
Corn	11.29	9	5	19	14
Milk	13.86	15	5	16	11
Peanuts	14.00	16	6	18	12
Rice	14.29	14	10	18	8
Tree Fruits and Nuts	14.57	15	9	17	8
Wild Game, Pelts, and Furs	16.57	18	13	19	6
Wheat	17.71	17	17	19	2

Summary and Implications

Mississippi agricultural and natural resources commodities were quantified and ranked by seven economic indicators. Some statistics, including employment and farm receipts, can be gathered from government sources. Unfortunately, number of jobs in the agriculture and forestry sectors can be an imprecise statistic that also provides no indication of income. Gross farm receipts can reflect double counting if one commodity's output is used as another's input. Gross value added and final demand avoid double counting, yet they still only provide direct measures of size. Broilers and eggs were leaders in terms of employment and farm gate value. From a gross value added perspective, timber was the top commodity. Soybeans led final demand sales.

More comprehensive definitions of importance included economic multipliers and the economy-wide value added contributions provided to Mississippi by agricultural and natural resources product sales injecting new money into the state. The value added total effects multipliers illustrated that catfish and hogs were the more assimilated commodities within Mississippi's economy. Buying and selling between catfish and hog farmers and other Mississippi industries occurred at greater marginal rates than for the other commodities studied. During times of economic expansion, catfish and hogs will benefit at greater marginal rates compared to other commodities (Coronado, McConnell, and Matthews, 2015). However, during economic recession, these same commodities would face greater marginal losses in gross value added due to their higher levels of dependency on the overall Mississippi economy. Multiple recessions over the past 20 years have particularly hurt catfish markets (Kumar et al., 2019). Although broilers and eggs possessed the lower value added total effects multiplier among all commodities, this also signified these products were more resistant to recessionary effects than others.

The value added base contributions accumulate all the dollars across all industries a commodity is responsible for bringing into Mississippi. Final demand sales, driven by exports, are re-spent to pay down loans; purchase fuel, equipment and implements, and services from allied providers; as well as pay workers. The value added base contributions capture not only the gross value added associated with export sales, but also all the additional indirect and induced value added generated by backward-linked industries. By this overarching measure, soybeans generated $647 million of activity in Mississippi.

The value added base export multipliers provided a standardized measure of dependency, centered on 1.0, that identified base commodities quantitatively and objectively. Mississippi depended on cotton, horticultural plants, and broilers and eggs to bring new money into the state. Other commodities were more dependent on base

industries to spur their activities. This did not mean commodities with value added base export multipliers well below 1.0 were unimportant. Indeed, their production and sales to local buyers retained dollars within Mississippi for further spending.

Overall, soybeans possessed the higher average ranking across all economic indicators. However, the median suggested cotton and timber along with soybeans retained the higher rankings. Regardless of the statistic, all products provided important contributions to the state on their own merits. Some are geographically constrained due to environmental factors and, therefore, concentrated in a smaller number of counties. These commodities did not produce high values or rankings at the state level, but their worth to Mississippi likely extended beyond the economics of jobs and dollars to the environmental goods and services farmlands and forestlands provide. These sustainability concerns motivate public support for the furthering of agricultural and natural resources conservation (Kline, Alig, and Garber-Yonts, 2004).

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