

POLICY ANALYSIS REPORT

April 2013



The Impact of Agriculture on Maryland's Economy

Jeffrey Ferris | Lori Lynch



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Jeffrey Ferris
PhD Student
Agricultural & Resource
Economics

Authors

Jeffrey Ferris is a graduate student at the University of Maryland where he is pursuing a Ph.D. in agricultural and resource economics. He attained his Bachelor of Science degree in economics from the University of Washington in 2008. Between 2008 and 2010, he worked as a research assistant at Resources for the Future (RFF) in Washington, D.C.



Lori Lynch
Professor
Extension Economist

Lori Lynch is a Professor in the Department of Agricultural and Resource Economics and Director of the Center for Agricultural and Natural Resource Policy at the University of Maryland. Dr. Lynch specializes in agricultural and resource policy analysis. Her research has examined issues such as critical mass, farm transition plans and estate planning, farmland preservation, income diversification through conservation practice adoption, and a variety of tax-related issues. Current research includes economics experiments to examine the impacts of different policy designs. She holds a Ph.D. degree in agricultural and resource economics from the University of California, Berkeley (1996), and a Master's degree from the University of California, Davis (1989)



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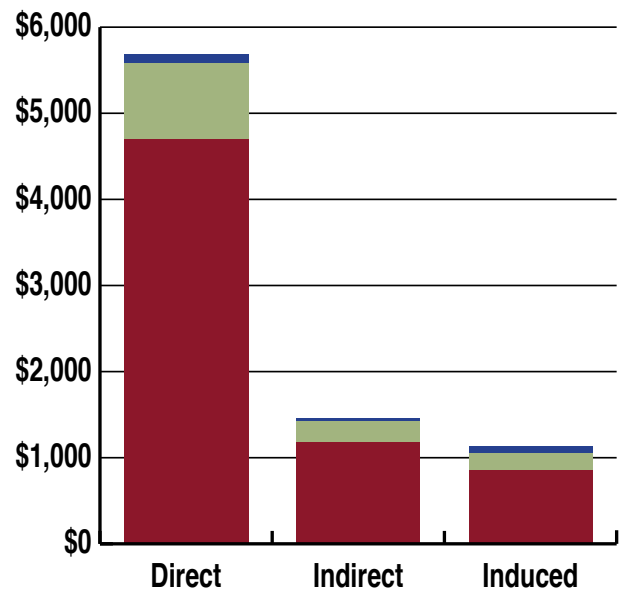
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The Impact of Agriculture on Maryland's Economy

- The total impact of agriculture, forestry and agricultural services was almost \$8.25 billion in total output and nearly \$3 billion in value added.
- In 2010, the agricultural sector accounted for over \$4.7 billion in direct output and over 22,000 jobs. Indirect and induced impacts from the agricultural sector added another \$2.03 billion to the Maryland economy.
- Agriculture's \$4.7 billion in output revenue was split between crops (49.6 percent) and animals (50.4 percent), and between production (42 percent) and processing (58 percent).
- In 2010, the forestry sector accounted for over \$877.5 million in direct output and over 2,000 jobs. Indirect and induced impacts from the forestry sector added another \$446 million to the Maryland economy.

2010 Total Direct, Indirect, and Induced Impacts of Agriculture and Forestry on the Maryland Economy (millions of dollars)



Agriculture had \$4.7 billion in output revenue in 2010. Crop revenues comprise roughly fifty percent of Maryland's agricultural output revenue; Animal related output comprising the other half.

	Direct	Indirect	Induced
■ Agriculture	\$4,700.60	\$1,175.40	\$857.00
■ Forestry	\$877.50	\$248.50	\$197.60
■ Ag-Related Services	\$104.90	\$14.90	\$72.70



Employment

- Agriculture, forestry, and the agricultural support sectors employ 28,573 workers directly and stimulate another 17,025 jobs, for a total employment of 45,600 workers throughout Maryland.
- Agriculture alone employs over 22,000 workers directly and stimulates additional employment for a total employment of over 36,000 workers in the state of Maryland.
- The average yearly income and value added for an agricultural employee was \$27,000 and \$47,000, respectively, and for an employee in the forestry industry was \$58,500 and \$108,000. In part this is due to some agricultural employment being part-time and/or seasonal, which decreases the average yearly income.
- The average indirect and induced yearly income and value added for the created employment was close to twice the agricultural industry average, at \$50,400 and \$92,000, respectively.



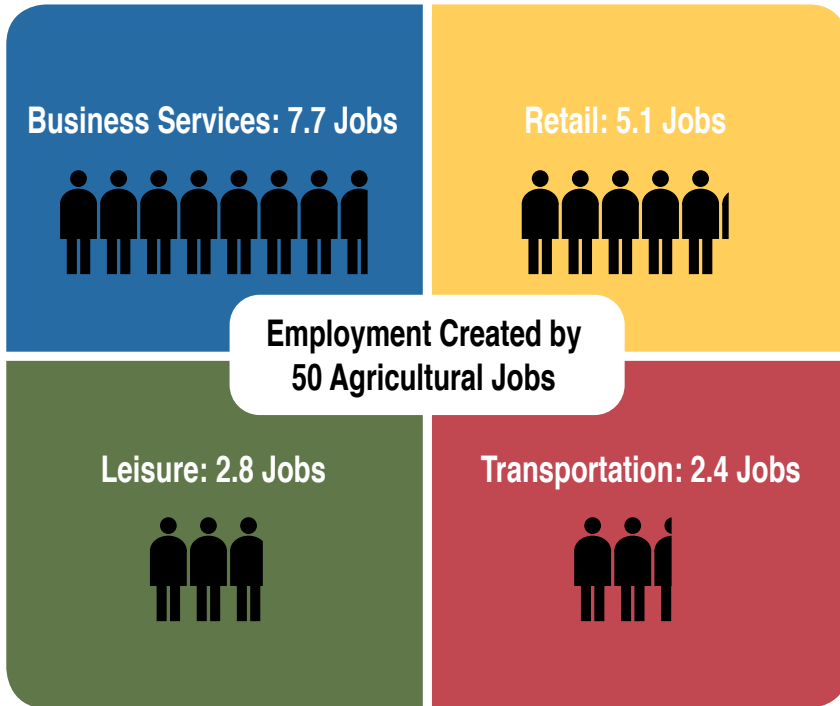
More than 12,000 families live and work on farms. Farms average 160 acres in the state.

- The 2010 Average Yearly Income per Worker Resulting from Indirect and Induced Employment from the Manufacturing, Agriculture, Leisure, and Construction Sectors ranged from \$47,000 to \$51,000.

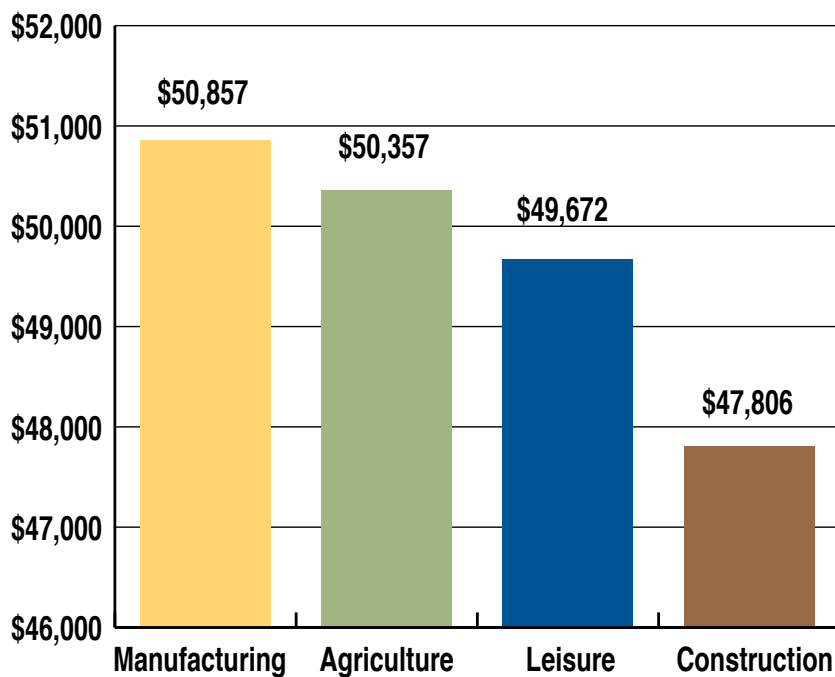
As of 2007, agricultural land occupied one-third of the total land composition. Farmland is primarily allocated towards crops with pasture land use occupying the remaining share.



Employment Generated in Business Services, Retail, Leisure, and Transportation per 50 Agricultural Jobs



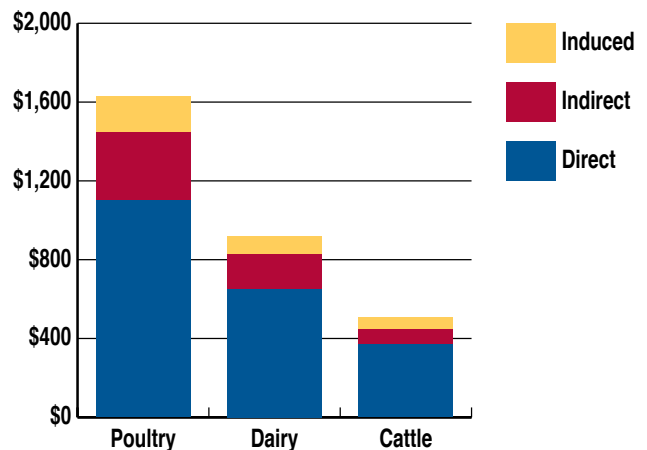
2010 Average Yearly Income per Worker Resulting from Indirect and Induced Employment from Four Sectors of the Maryland Economy



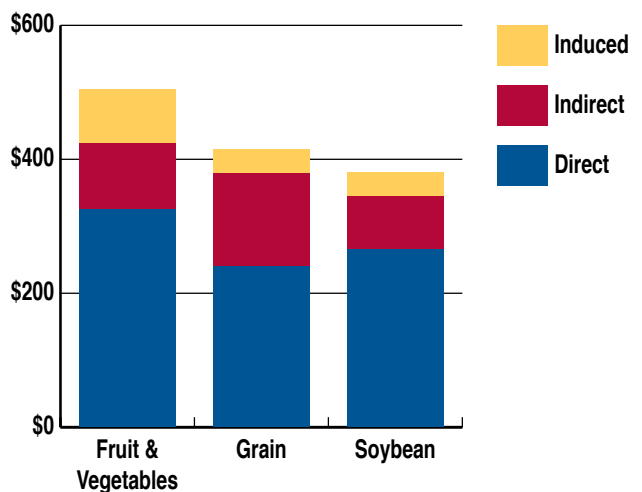
Selected Industries

- Poultry is the largest animal and agricultural industry in Maryland, with over \$1.7 billion in total output, almost 7,000 individuals employed, and \$500 million in value added.
- The dairy and cattle industries are also important animal-based production industries. Dairy produces \$1.1 billion in output, employs almost 4,255 individuals and contributes \$328.4 million in value added to the Maryland economy. The Cattle sector produces almost \$650 million in output, employs almost 4,255 individuals and contributes \$328.4 million in value added.
- Fruit and vegetable production is the most valuable crop industry in the state of Maryland, with \$539 million in total output and employing 2,200 people.
- Grain and soybeans yield \$444 million and \$415 million in total output, respectively. The grain industry is the biggest crop employer with over 5,800 jobs. The soybean industry employs 3,100 people.

2010 Total Impacts of Poultry, Dairy, and Cattle Industries on the Maryland Economy (millions of dollars)



2010 Total Impacts of Fruit and Vegetable, Grain, and Soybean Industries on the Maryland Economy (millions of dollars)



Key Findings

Agriculture is a strong and vibrant sector within the Maryland economy. More than 12,000 families



live and work on farms. Over 2 million acres—almost one-third of the state’s land—is farmed. The 2007 Census of Agriculture, conducted and published by the U.S. Department of Agriculture, documented 12,834 farms in Maryland, with an average size of 160 acres. The total market value of

agricultural products topped \$1.8 billion in 2007, up almost 42 percent since 2002. In the 2007 Census, crops, including nursery and greenhouse, accounted for over \$600 million; livestock, including poultry and its products, accounted for over \$1.2 billion. Poultry and eggs alone accounted for sales of more than \$900 million.

Employment in the agricultural industry and the \$1.8 billion in farm-gate market value stimulates further employment and further market value across the Maryland economic landscape, resulting in an economic impact of Maryland agriculture of almost \$8.25 billion annually.

Part of this \$8.25 billion pays the wages and salaries of Maryland agricultural and forestry employees and farm owners. Agriculture employs over 22,000 workers directly in the production activities and processing and packaging industries, with average annual salaries of \$27,000 (production) and \$47,000 (processing) in the agriculture sector, and average salaries of \$58,500 (production) and \$108,000 (processing) in the forestry industry. In addition, agriculture and forestry purchase inputs,

such as pickup trucks, fencing materials, and cardboard boxes, to produce and process its products. The employment generated in these non-agricultural industries are called indirect jobs – jobs that are derived from agricultural and forestry’s demand for inputs.

The indirect and agricultural workers then spend their paychecks and profits in the Maryland economy on goods and services, such as housing, medical care, and haircuts – generating what we term “induced” jobs. The average annual salary of these indirect and induced jobs is \$55,000 and \$92,000, respectively – almost twice the agricultural industry average. When we add these all together (the direct, indirect, and induced), we find that agricultural employment and economic activity generates over 36,000 more jobs within the state; when we add in forestry and agricultural support services, this number climbs to 45,600.

Poultry is the largest animal and agricultural industry in Maryland, with over \$1.7 billion in total output, almost 7,000 individuals employed, and \$500 million in value added. The dairy, cattle and equine industries are also important animal-based production industries. Dairy produces \$1.1 billion in output, employs almost 4,255 individuals and contributes \$328.4 million in value added to the Maryland Economy. The Cattle sector produces almost \$650 million in output, employs almost 4,255 individuals and \$328.4 million in value added.

Fruit and vegetable production is the most valuable crop industry in the state of Maryland, with \$539 million in total output and 2,200 people employed. Grain and soybeans yield \$444 million and \$415 million in total output, respectively. The grain industry employs over 5,800 people, and soybeans 3,100 people.

Introduction

Understanding Agriculture in Maryland

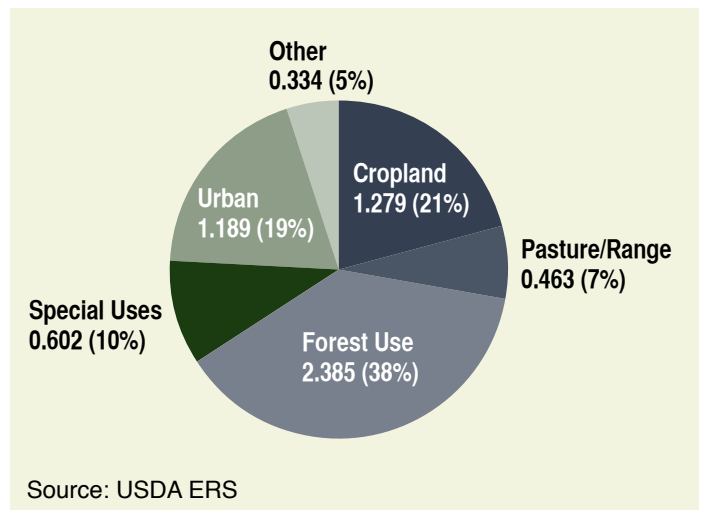
The Maryland agriculture sector is a modern and highly efficient industry. According to the 2007 Census of Agriculture, agricultural entities generate farm-gate receipts with a market value of \$ 1.8 billion. Maryland has 12,834 farms, which cover 2,051,756 acres – about one-third of the state’s 6.3 million-acre landscape. Figure 1 illustrates land use in the state for the year 2007, according to USDA’s Economic Research Service. Within the resource lands, we find 1.28 million acres of crop, 0.46 million acres of pasture, and 2.39 million acres of wooded land, all of which generate a vibrant landscape for farms in the state. About 1.2 million acres are used for urban purposes. Agriculture and forestry land uses will continue only if farm families are able to operate profitable businesses.

Figure 2 illustrates how land use has changed since 1945. One can see the increase of urban and special uses contrasting with the loss of both forest and agricultural land. This change in land use can be attributed to an increase in Maryland’s population and thus the need for housing; an increase in median income, allowing families to demand larger houses on larger acreage; a competitive agricultural sector throughout the nation; and innovation in production technologies that increase agricultural productivity and yields per acre.



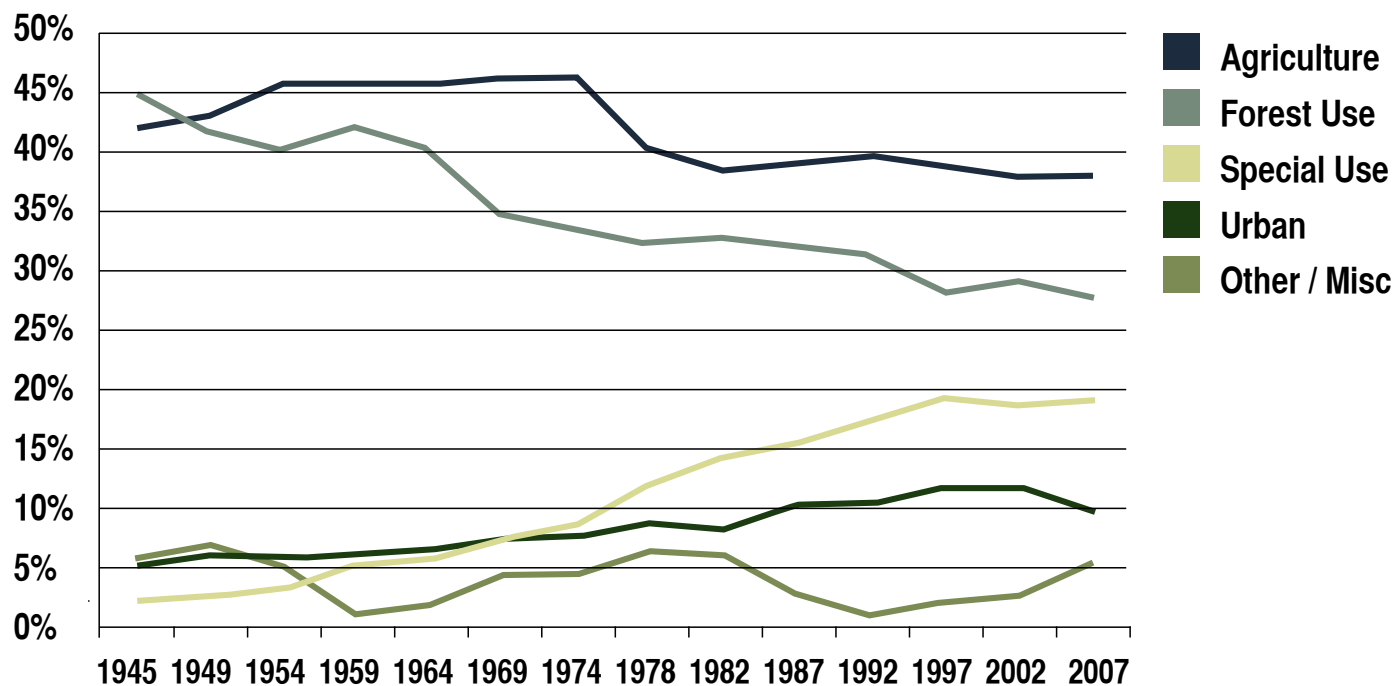
In 2007, 38 percent, or 2.39 million acres, of Maryland’s land was allocated to forestry.

Figure 1
Land Use Composition in Maryland by Acreage (millions) and by Percentage, 2007¹



¹ In 2007, a methodological change in the Census of Agriculture reclassified some cropland pasture to permanent grassland pasture and range. Cropland and pasture are 28 percent of Maryland’s area. “Special Uses” includes rural transportation, parks and wildlife areas, defense installations, and farmsteads. “Urban” consists of contiguous and adjacent densely settled Census block groups that together encompass a population of at least 50,000 people. “Other” is miscellaneous areas such as marshes, open swamps, bare rock areas, deserts, rural residential areas, and other uses.

Figure 2.
Changes in Maryland Land Use by Percentage, 1945–2007



Source: USDA ERS.

In a direct sense, agricultural production contributes only a tiny share to the state’s employment and gross domestic product (GDP). In 2010, agriculture accounted directly for 0.2 percent of the GDP, 0.2 percent of the employment, and 0.1 percent of the income in Maryland. The high degree of competition that agriculture faces both with other geographic regions and with competing uses of the land has stimulated innovation and has resulted in more output being produced with less input. These gains in efficiency and productivity of workers, due in particular to development of equipment and machines, have resulted in fewer workers needed for many farm tasks. However, through agriculture’s expenditures on transportation, real estate, manufacturing, equipment sales, and many other inputs, the sector stimulates a myriad of business activity and employment in other sectors within the state. As such, the true magnitude of the role agriculture plays in a strong Maryland economy is challenging to quantify.

We hope through this project to provide a better understanding of the impact of the agricultural sector on the Maryland economy. To accomplish this effort, we will go beyond the direct impact of the agricultural sector. How do we define the agricultural sector?

Figure 3.
Agricultural Industry Value Chain Sectors³

SUPPORT ACTIVITIES	PRODUCTION PROCESSES	PROCESSING AND PACKAGING	DISTRIBUTION
related to agriculture, including farming, veterinary services, implement manufacturing, irrigation, and technical consulting	are specific to the commodity raised, but include crop, vegetable and animal farming, poultry and egg production, and aquaculture	includes packaging fresh produce for transportation, canning, manufacturing, and viticulture	includes the process that gets products to store shelves. Includes logistics and warehousing, sales, and import/export

We broaden our outlook to include not just the farm-gate products (\$1.8 million) but also the related input/support and output/processing industries that provide the supplies and services and accomplish the processing, manufacturing, and packaging of the products grown and harvested from Maryland’s working lands.² In addition, we include forestry industries. All the individuals in the agricultural value chain are part of the agricultural sector even if they do not till the land. Figure 3 depicts the chain to include the industry clusters “support,” “production,” “processing and packaging,” and “distribution.”

We will also model the agricultural system following a strategy used frequently in the community economics field. Using this approach, we look at how agriculture has added value to the Maryland economy – both by creating employment in other sectors and by stimulating production in other sectors. Using IMPLAN to conduct an input-output analysis to assess the dynamic flow of goods and services between sectors of an economy, we will estimate both the direct and indirect contribution of agriculture using an input-output analysis model.

First, we examine the farm-gate receipts or the market value of farm production as reported by the Census of Agriculture. We then examine the inter-industry linkages within the general economy from these agricultural and forest sectors. The inter-industry impacts stem from each dollar spent in employment and other expenditures within the agricultural and forestry sectors. We use “multipliers” to determine how these dollars ripple through the economy, creating additional

² Figure 3 depicts the chain to include the industry clusters “support,” “production,” “processing and packaging,” and “distribution.”

³ Adapted from the Centers of Excellence’s “Agricultural Value Chain for California,” Research Brief 2011, www.coeccc.net. Viewed on February 29, 2012

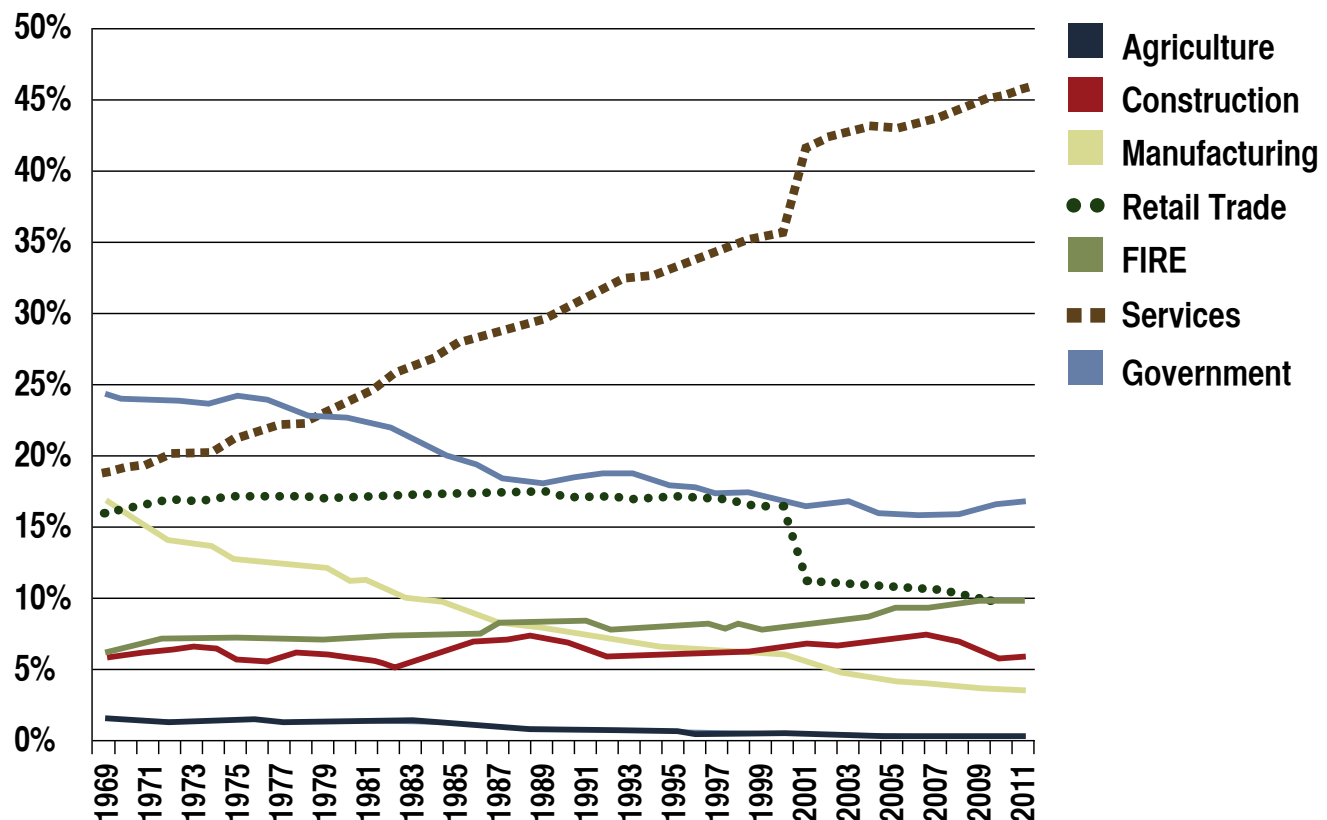
employment and more dollars spent on expenditures. We find that agriculture has a much larger impact on the Maryland economy than its market sales suggest.

Agriculture in Maryland

The Maryland agriculture sector has modernized, while at the same time retaining much of its cultural and historical value. The total value of agricultural production continues to increase annually despite declines in acreage devoted to agricultural production. In this respect, the farm economy has become more efficient. These gains stem in large part from research and innovation within the agricultural sector. Another noteworthy trend, observed over the past century, has been a decline in the number of farms. And yet, between 2002 and 2007,

⁴ Industry classifications for this measure changed between 2000 and 2001, causing a shift in employment among some industries.

Figure 4.
Maryland Employment in Key Industries from 1969 to 2011 (percentage of total)⁴

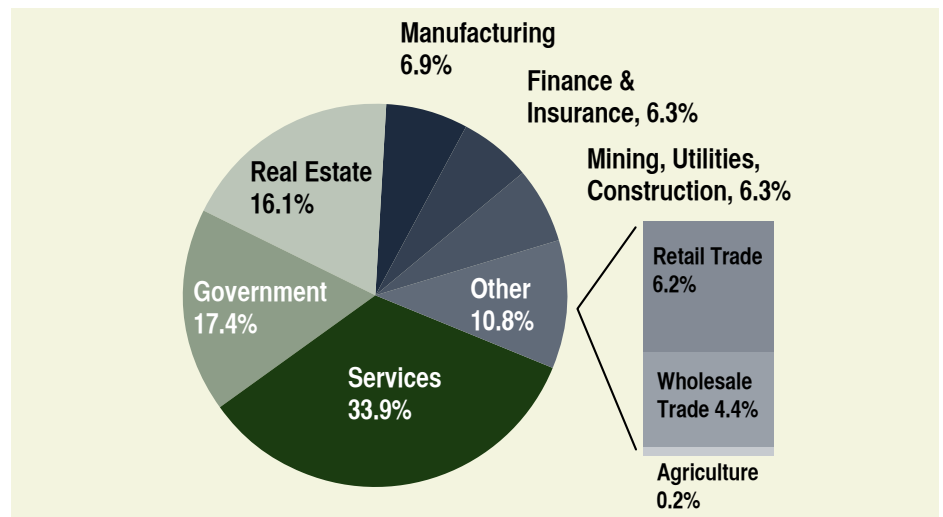


Source: BEA, Regional Economic Accounts, BEA, Table CA25 Total Employment by Industry.

Maryland gained 636 new farms. And while the average farm size has increased, the median acreage has been on the decline.

Figures 4 and 5 illustrate the relative contribution of agriculture (defined only by activity involved with production on the farm) to employment and gross domestic product (GDP) for Maryland. Between 1972 and 2007, employment in agricultural production, along with several other industries, showed a decline as a percentage of total employment. The biggest change over this time period was observed in the manufacturing sector, which declined rapidly, whereas the services and finance, insurance, and real estate (FIRE) industries observed the largest gains as shares of total employment.

Figure 5.
The Relative Components of Maryland's GDP by Sector, 2010



Source: BEA, Regional Economic Accounts, BEA, Real Gross Domestic Product by State.

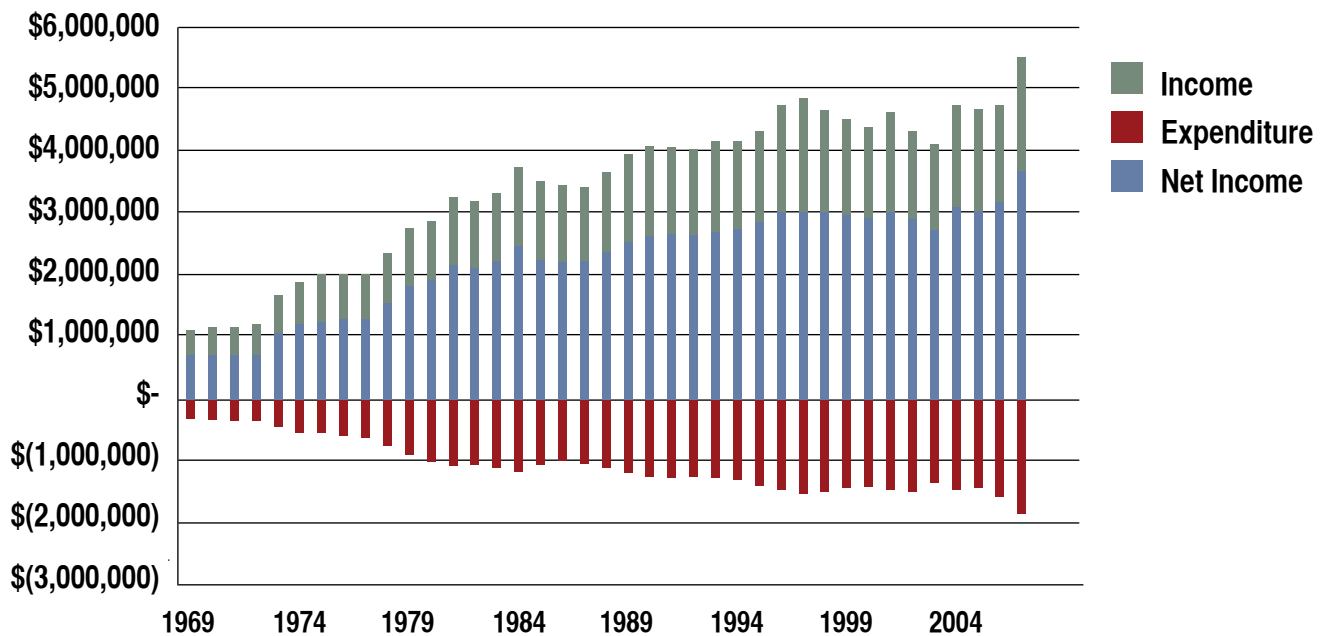
With total economic output, the market sales of agricultural products account for less than 1 percent of 2010 GDP. According to Figure 5, agriculture's contribution is tiny relative to all other sectors, especially services, government, and real estate, which together account for two-thirds of 2010 GDP. We expect, however, that by accounting for the input/support sector and the output/processing and packaging sectors, as well as the ripple effects generated from all this economic activity, the story will look somewhat different. Maryland agriculture plays a substantially large role in the state's economy despite what one might perceive initially from the GDP numbers.

Changes in Maryland Agriculture

The family farm is much more than a historical trademark of Maryland’s past that waxes one nostalgic. Farmers have adapted to the modern economic climate by operating as twenty-first century business owners. Farm operations require the input of land, labor, and capital to produce goods for local, regional, national, and international markets. Profits are necessary to prevent them farm operations from shutting down.

Like other businesses, farmers make decisions under conditions of uncertainty about the greater macro economy, including interest rates, exchange rates, policy changes, environmental and industry regulations, and trade agreements and restrictions. Like many other businesses, the impact of the 2008–2009 recession was felt by many agricultural producers. For the period 1969 to 2007, we see that input costs or expenditures increased over time, as depicted by the red bars in Figure 6. Fortunately, income has had the same trend as shown by the green line. And Maryland producers’ balance sheet shows a positive net income for the state.

Figure 6.
Balance Sheets for Maryland Agriculture, 1969–2007



Source: USDA ERS.

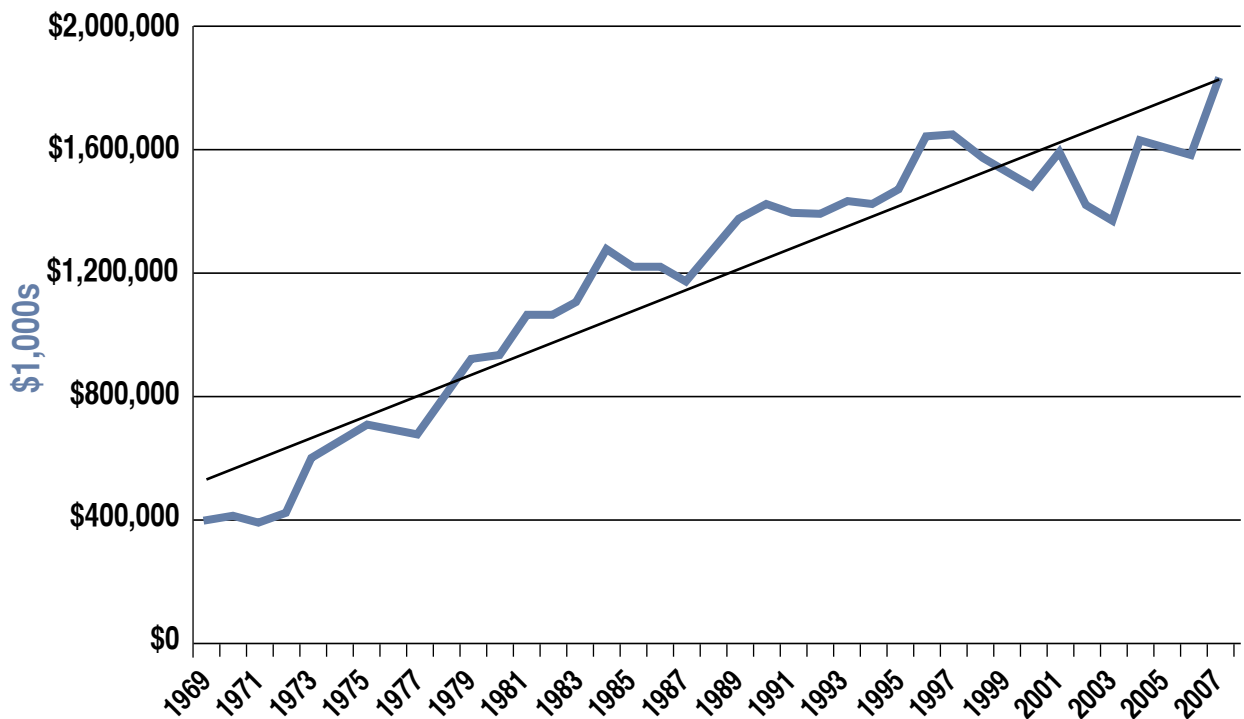


To manage risk and uncertainty from the weather and economic climate, farmers use risk management tools, including crop insurance, options trading, product diversification, and contracting with output processors.

Farmers also face uncertainty about weather conditions. Fluctuations in temperature and rainfall can be problematic for their bottom line production, given the sensitivity of their yields to such. Given the changes in production decisions resulting from these uncertainties, as well as the fluctuations in commodity prices, farm-gate receipts vary from year to year, as illustrated by Figure 7 for 1969 through 2007. And although overall receipts have had an upward trend, in the past decade alone, total receipts have varied from year to year by as much as \$260 million. Farmers use risk management tools to manage these revenue fluctuations – including futures and options, product diversification, crop insurance, and contracting with output processors. However, given increased cost for inputs, the marketing receipt fluctuation can be more problematic than in the past.

To help mitigate these extra uncertainties particular to agriculture due to weather patterns and other causes, the federal government subsidizes

Figure 7.
Maryland Farm Marketing Receipts, 1969–2007

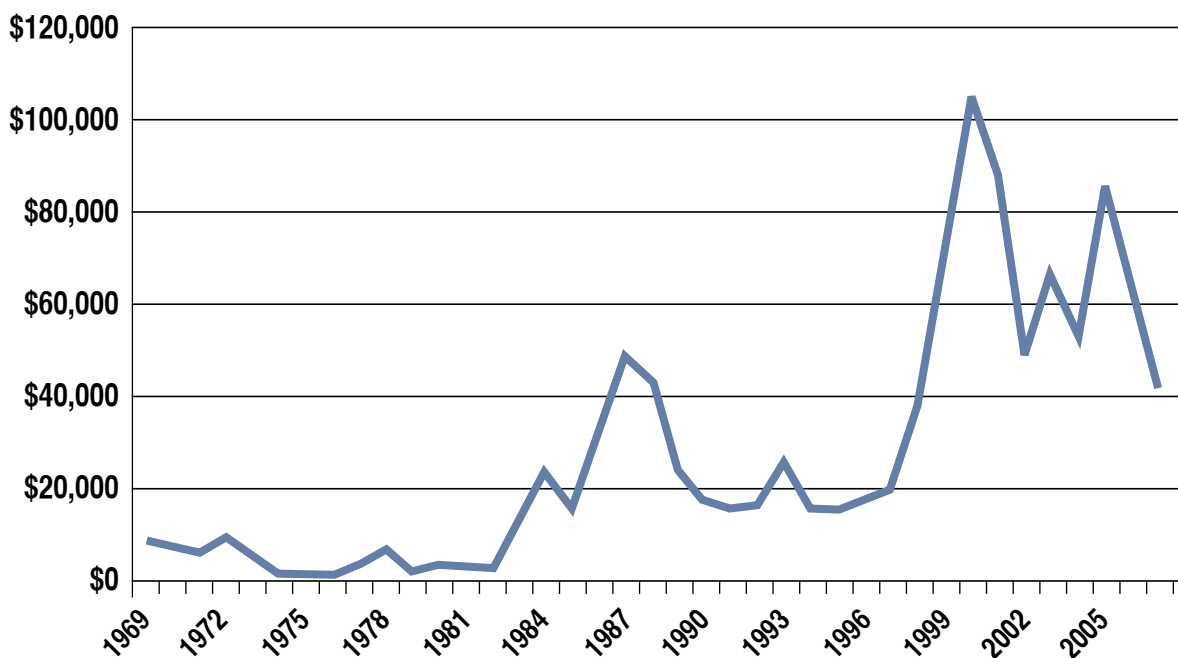


Source: USDA ERS, Annual Cash Receipts from Commodity Groups and Selected Commodities, by State.



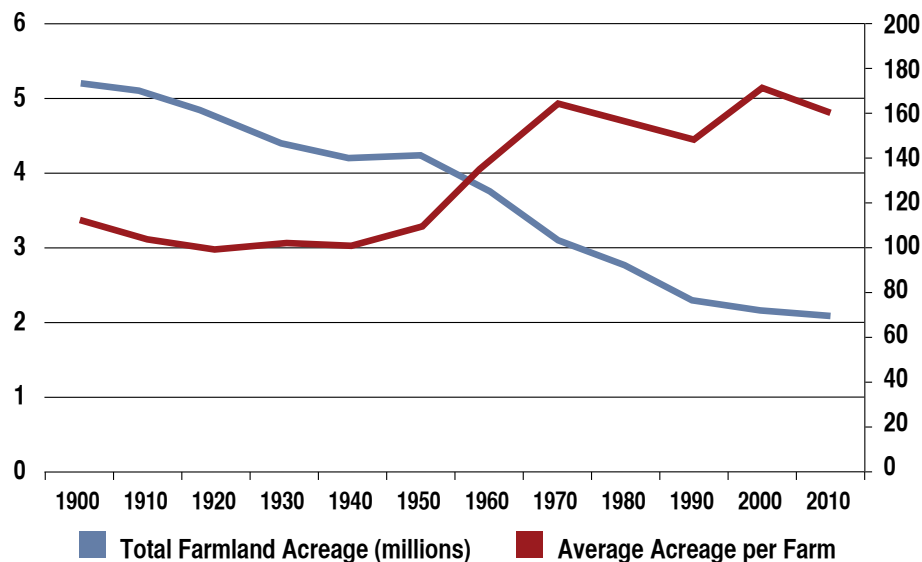
the premiums offered by private insurance companies so that farmers can purchase crop insurance policies in various forms. In addition, about 40 percent of Maryland farmers receive support from the government in the form of commodity program payments and incentive payments to adopt certain land conservation practices. These payments provide a safety net when market receipts fall. From 1997 to 2007, government payments ranged from a state-wide low of \$19.5 million in 1997 to a high of \$104.4 million in 2000 (Figure 8). While heavily variant from year to year, the general trend has been one of increasing payments. In 2007, the average payment to farms was \$19,178. At this point, it is uncertain what will happen to these government programs in the coming years.

Figure 8.
Total Direct Government Payments in Maryland: 1969–2010 (thousands)



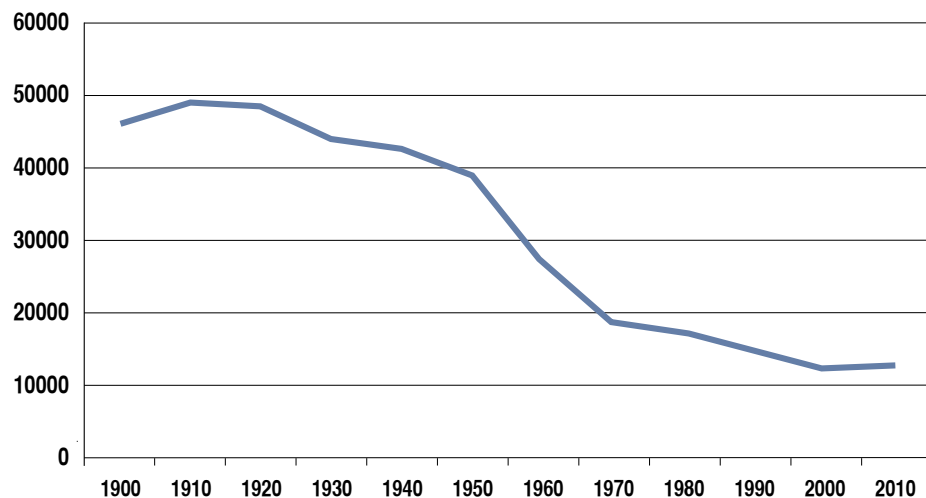
Source: USDA ERS, Value of Total Direct Government Payments by State.

Figure 9.
Total Farmland Acreage and Average Acreage per Farm in Maryland, 1900–2010



Source: USDA ERS, NASS Farms, Land in Farms, and Livestock Operations 2011 Summary; Statistical Abstracts of the United States.

Figure 10.
Number of Farms in Maryland, 1900–2010



Source: USDA ERS, NASS Farms, Land in Farms, and Livestock Operations 2011 Summary.

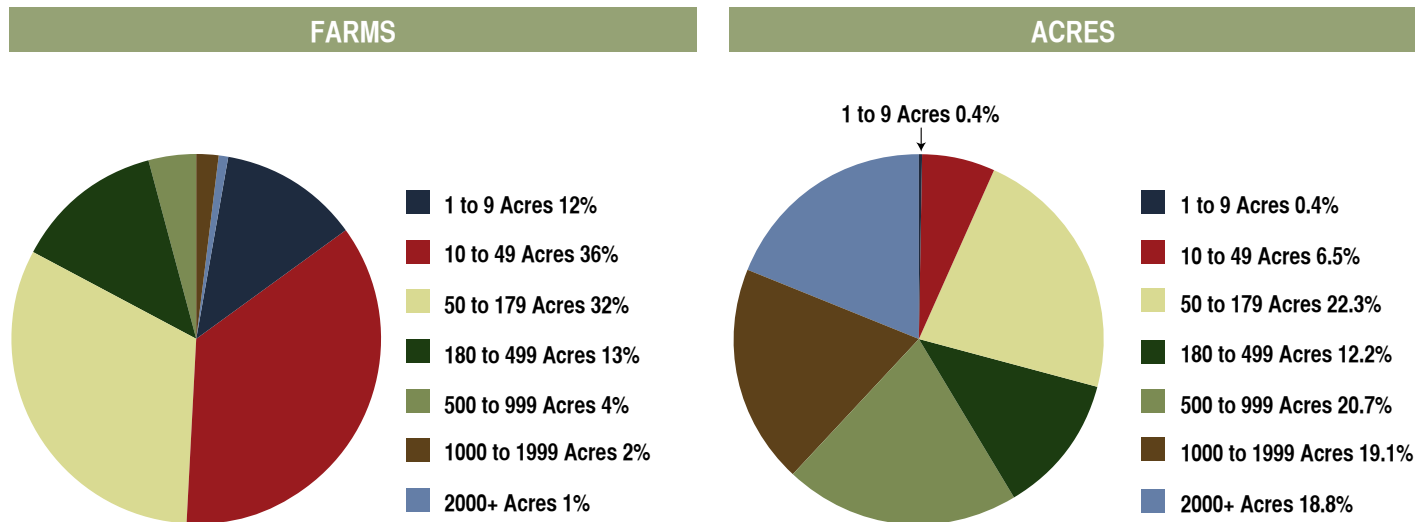
Farmland has been declining in the state. As shown in Figure 9, in 1900, farmland encompassed over 80 percent of Maryland’s 6.3 million acres of land. By 2010, this area had declined to about one-third. This trend is comparable to those observed in other Mid-Atlantic states, many of which have also observed declining farmland acres. As of 2007, Maryland ranked fifth nationwide in terms of density of developed land.

As earlier noted, farm size has been growing as the number of farms declines. The general trend over the twentieth century has been farmers leaving the sector and others buying their acreage to expand their own operations. Figure 9 illustrates the increase in farm size; Figure 10 illustrates the decline in the number of farms through 2010. The average farm size in 1900 was 112.4 acres; by 2010 average farm size had climbed to 160.2 acres. Such increases have resulted from advances in farm inputs like machinery, chemical fertilizers, pesticides, and production technologies, which have enhanced the efficiency of operations and allowed farmers to manage larger operations.

While the average size of farms has increased, stabilizing in the 1970s, the distribution of

Figure 11.

Composition of Total Farms and Acreage in Maryland by Farm Size Category, 2007



Source: Agricultural Census, 2007: Volume 1, Chapter 1, State Level Data, and Table 8.

farm size within the state remains quite bimodal. Maryland has a small number of large farms (only 20 percent have more than 180 acres) and a large number of small farms (47 percent have fewer than 50 acres). Figure 11 illustrate the distribution of farms by size category, and their respective shares of the total number of farms (left pie chart) contrasted with their share of total farmland acres in the state (right pie chart). In 2007, Maryland more than

12,000 farms, with the median number of acres per farm being 52. This is more than 100 acres below the average acreage per farm (160 acres), indicating that the majority of farms in the state have relatively small acreage. Seven percent of farms exceed 500 acres in size. These seven percent of farms though, operate almost 60 percent of the farmland in the state and thus comprise the largest portion of farm-gate production.



Despite observed declines in acreage used for agricultural purposes, production continues to increase annually. This increase in efficiency is made possible, in part, by innovation and research within the agricultural sector.

Empirical Results: The Overall Impact of the Value Chain of Agriculture

Direct Effects

The Maryland agriculture sector is a multi-billion dollar industry that employs thousands of workers in support of agricultural production and processing. Before continuing to discuss the overall impact of agriculture on the broader Maryland economy, it is useful to observe the direct contribution of agriculture to the State economy. In Tables 1a and 1b below, the direct contributions of the Maryland agriculture, forestry, and agricultural services sectors are summarized for the year 2010. Each industry is summarized by employment, labor income, value added, and value of output.

In 2010, agriculture and forestry industries accounted for over \$5.68 billion in direct output, 28.6 thousand jobs, and \$1.41 billion in value added. Agricultural production and processing alone accounted for roughly \$4.7 billion in revenue, and the sector was roughly evenly split between crops and animal production. Major crops in the state of Maryland included fruit and vegetables, grain, and soybeans. Animal

Table 1a.
2010 Direct Effects of Agriculture and Forestry on the Maryland Economy

	EMPLOYMENT	LABOR INCOME (MILLION \$)	VALUE ADDED (MILLION \$)	OUTPUT (MILLION \$)
AGRICULTURE	22,669.0	620.0	1,076.4	4,701.9
PRODUCTION	16,931.0	338.3	654.7	1,982.1
PROCESSING	5,738.0	281.6	421.6	2,719.7
FORESTRY	2,351.0	137.6	254.4	877.5
PRODUCTION	669.0	19.4	23.6	63.1
PROCESSING	1,682.0	118.2	230.8	814.4
AG-RELATED SERVICES	3,554.0	79.8	78.1	104.9
GRAND TOTAL	28,574.0	837.4	1,408.9	5,684.3

production was dominated by poultry, but the dairy industries and cattle production and processing are also significant contributors to the Maryland economy.

Overall Effects

The economic importance of the Maryland agricultural industry is augmented when considering the total direct, indirect, and induced impacts on the Maryland economy. In terms of total impact, agriculture, forestry, and agricultural services account for over \$8.25 billion in total output. This includes nearly \$3 billion in value added.⁵ If these sectors

Table 1b.
2010 Direct Effects of Agriculture and Forestry on the Maryland Economy

	EMPLOYMENT	LABOR INCOME (MILLION \$)	VALUE ADDED ⁵ (MILLION \$)	OUTPUT (MILLION \$)
AGRICULTURE	22,669.0	620.0	1,076.4	4,701.9
PRODUCTION	16,931.0	338.3	654.7	1,982.1
ANIMAL	6,931.0	116.7	335.2	1,205.0
CROPS	10,000.0	221.7	319.5	777.1
PROCESSING	5,738.0	281.6	421.6	2,719.7
ANIMAL	3,713.0	141.9	168.1	1,125.9
CROPS	2,025.0	139.7	253.5	1,593.9
FORESTRY	2,351.0	137.6	254.4	877.5
PROCESSING	1,682.0	118.2	230.8	814.4
LUMBER	775.0	34.0	38.3	168.5
PULP	62.0	6.4	11.3	43.6
PAPER	846.0	77.9	181.1	602.2
GRAND TOTAL	28,574.0	\$837.4	\$1,408.9	\$5,684.3

⁵“Value added” in this sense is an alternative income multiplier that measures the total impact of a \$1 change in agricultural output on employee compensation, the business owners’ income, other property income, and any indirect business tax.

are further disaggregated, agriculture accounts for over 80 percent of total agricultural and forestry activities, with \$6.7 billion in total output. Figure 12 illustrates the total impact and value added for the agriculture, forestry, and agricultural related services sectors on the Maryland economy in 2010. These are also broken up by direct, indirect, and induced impacts. The direct value added was \$1.4 billion and value added through indirect and induced

impact added another \$1.5 billion to the number. This suggests that if agriculture were to leave the state and nothing replaced it – i.e., if there were no other companies that purchased pickup trucks, cardboard, etc. – the economy would be \$3 billion worse off. For a full accounting of the impacts of agriculture by employment, labor income, value added, and output in 2010, please refer to Appendix 3.

What Are Multipliers?

Say demand for chicken increased in the U.S. retail market. This demand would result in chicken processors needing more employees to work in the processing plants and more bags, labels, and boxes to produce more chickens to satisfy this increasing demand. Similarly, chicken producers would produce more chickens to sell to the processors – they would increase their employees' hours or hire new ones. They would need inputs as well. Farmers would have to produce more corn and soybeans for feed and thus would need more inputs. All these new employees would then spend their money for non-agricultural goods and services, inducing more employment in these other sectors. Multipliers track how an additional \$1.00 in increased final demand impacts employment, labor income, output, and value added.

Employment Multipliers: These measure the change in Maryland employment resulting from a change in the agricultural employment as a result of a change in agriculture's final demand.

Labor Income Multipliers: These represent the change in Maryland's household labor income resulting from a \$1.00 change in agricultural



Maryland's single largest agriculture industry is poultry production and processing. Poultry represents over 20% of total agricultural output and 15% of all agricultural employment. Within agriculture, these employees earn the highest average salaries and have high value added.

labor expenditures in response to a change in demand for agricultural goods.

Value Added Multipliers: These are alternative income multipliers that measure the total impact of a \$1 change in output on employee compensation, plus proprietary income, plus other property income, plus indirect business tax. This is how IMPLAN incorporates all other income within the state beyond that of agricultural workers.

Employment

The agriculture and forestry sectors stimulate job creation throughout the state of Maryland, employing a total of nearly 46,000 workers around the state. Agriculture alone employs over 22,000 workers directly. With the indirect and induced jobs created, this climbs to a total of over 36,000 workers employed in the state of Maryland. This additional employment is spread across all major sectors of the economy. Major industries with jobs created from the presence of the agriculture and forestry sectors include: real estate, food services, wholesale trade, transportation, building services, and medical services, among many others. Among the broader sectors of the economy, employment in business services, retail, leisure and hospitality, and transportation benefit most from having an agricultural sector. Figure 14 depicts the number of jobs created per 50 agricultural employees in 2010 for the four leading recipient industries in the state of Maryland. For a more detailed breakdown of stimulated employment in the state of Maryland as a result of agriculture and forestry related activities, please refer to Appendix 4.

Figure 13.

2010 Total Direct, Indirect, and Induced Value Added from Agriculture and Forestry to the Maryland Economy (millions of dollars)

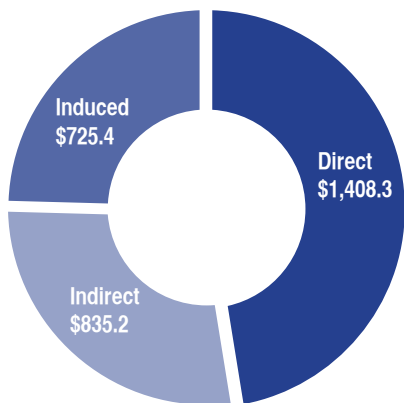
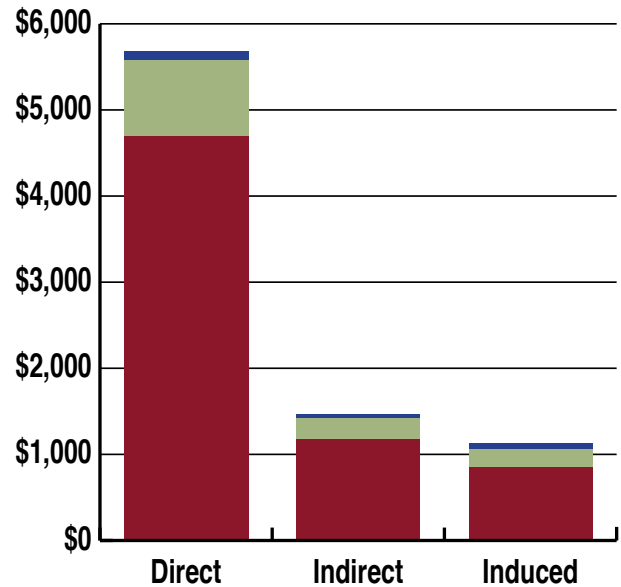


Figure 12.

2010 Total Direct, Indirect, and Induced Impacts of Agriculture and Forestry on the Maryland Economy (millions of dollars)



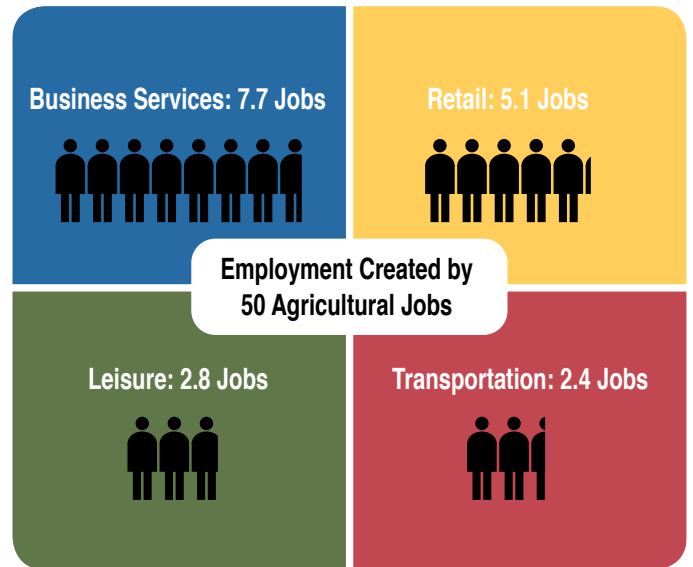
	Direct	Indirect	Induced
Agriculture	\$4,700.60	\$1,175.40	\$857.00
Forestry	\$877.50	\$248.50	\$197.60
Ag-Related Services	\$104.90	\$14.90	\$72.70



Maryland agricultural employees earn on average \$27,000 annually. These employees have a value added of \$47,000 per year. Some agricultural employment is part-time and/or seasonal which decreases the annual average salary.

Additional employment, as a result of agricultural and forestry production, stimulates income growth as well as value added per worker. These two measures provide useful signals regarding the vitality and importance of the agricultural and forestry sectors to business around the state of Maryland. Income and value added per worker varied considerably between agricultural industries in 2010. For the agriculture industry the average yearly income was \$27,000 and the value added per employee was \$47,000; for the forestry industry, it was \$58,500 and \$108,000. Although the average yearly income and value added per worker were relatively low for the agriculture industry, the average indirect and induced yearly income and value added was close to twice the industry average, at \$55,000 and \$92,000, respectively. Figures 15 and 16 report average yearly income and value added for the agriculture, forestry, and agricultural services industries in 2010.

Figure 14.
**Employment Generated in Business Services,
 Retail, Leisure, and Transportation per
 50 Agricultural Jobs**



For each 50 jobs in agriculture, 7.7 jobs are created in business services; 5.1 jobs in the retail sector; 2.8 jobs in the leisure sector; and 2.4 jobs in the transportation sector.

Figure 15.

2010 Average Yearly Direct, Indirect, and Induced Incomes for the Agriculture and Forestry Industries

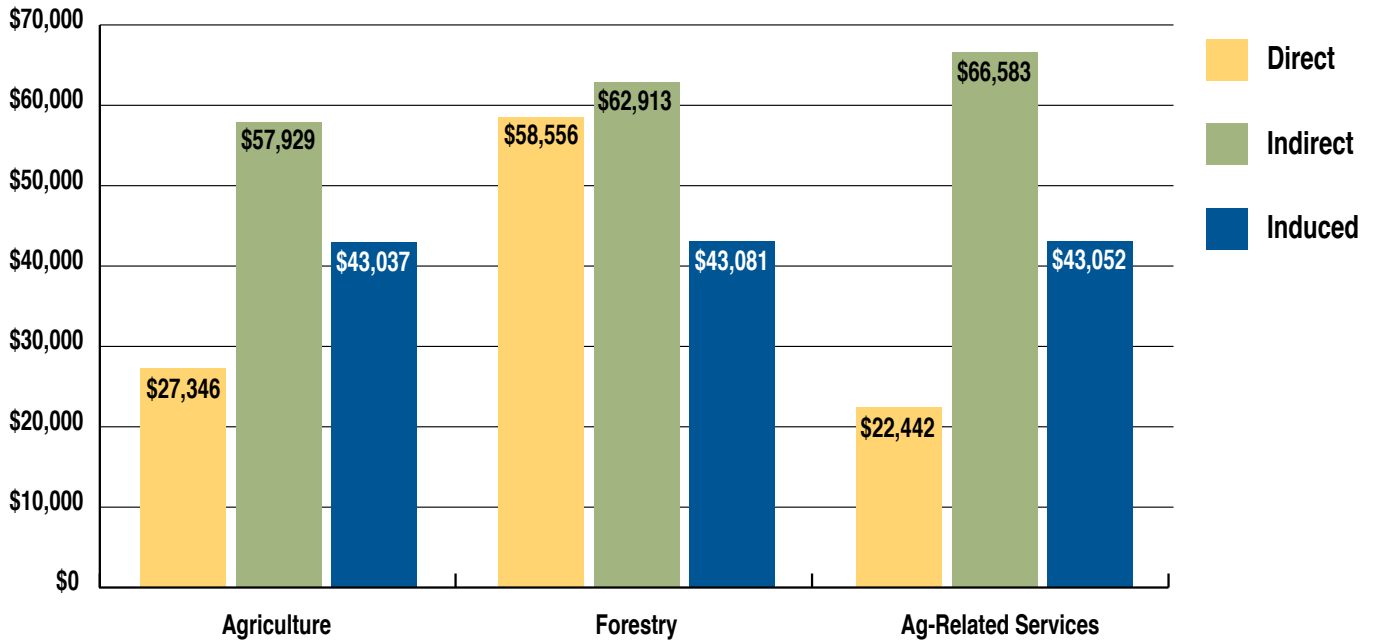
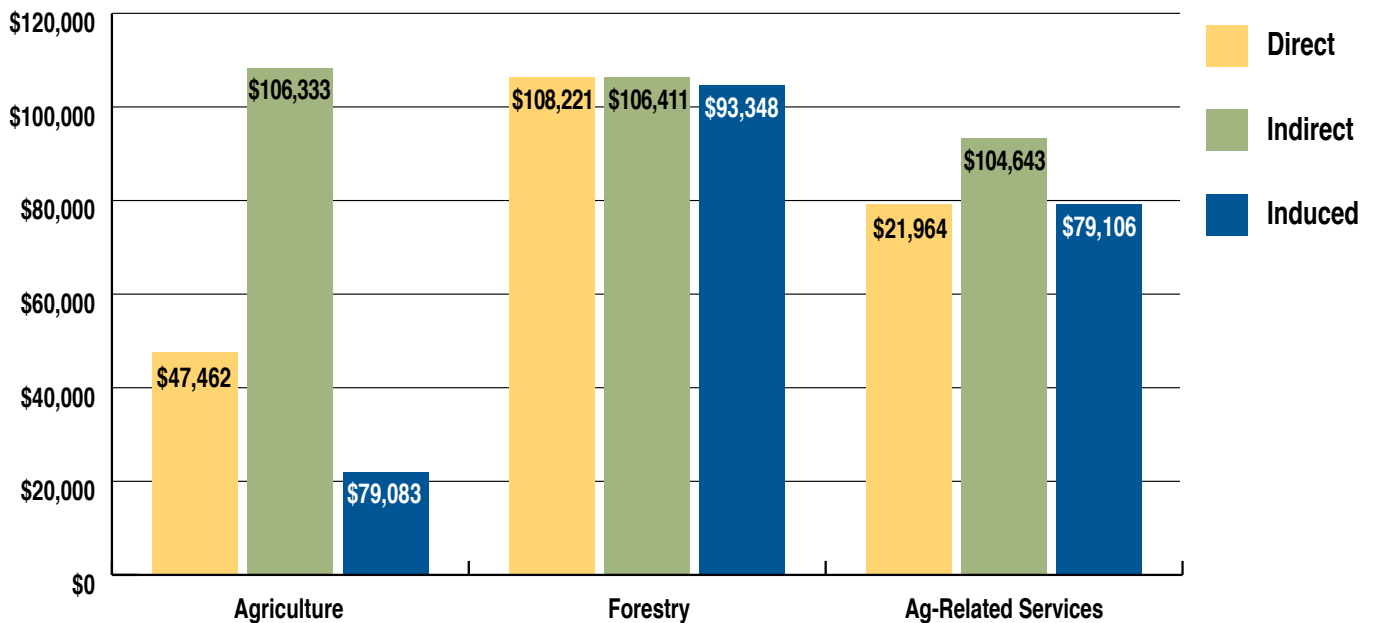


Figure 16.

2010 Average Yearly Direct, Indirect, and Induced Value Added per Worker for the Agriculture and Forestry Industries



Comparison to Other Industries

Given the diversity and size of the Maryland economy, a direct comparison of the agricultural economy to other leading industries and sectors in the state of Maryland is challenging. In the modern economy, agriculture represents only a small fraction of total output and employment. However, utilizing IMPLAN data and software, we may



In 2010, among indirect and induced jobs, Maryland agriculture generated the second highest income per worker and value added of all sectors of the economy, behind only manufacturing for income, and leisure for value added.

compare the relative performance of agriculture to other major sectors of the economy through calculated economic multipliers for employment, labor income, value added, and output. Economic multipliers are calculated as the sum of the direct, induced, and indirect effects, divided by the direct effect. Thus, an employment multiplier of 1.60 for the agricultural industry in 2010 implies that when additional agricultural products were demanded and thus one more agricultural worker was added to the payroll, another 0.60 of a worker was added elsewhere in the economy.

For the purposes of this analysis, thirteen sectors of the Maryland economy are identified: agriculture, government, business services, finance, health and education, information services, manufacturing, retail, construction, leisure, transportation, natural resource extraction, and other industries.

Utilizing the exact same methodology, the IMPLAN industry impact analysis may be estimated for each of these sectors. In this way, we may compare the performance of the agricultural sector relative to the other major sectors of the Maryland economy through calculated economic multipliers. Overall the agricultural and forestry sectors were very competitive relative to other sectors of the economy in 2010. Table 2 summarizes the employment, labor income, value added, and output multipliers for the thirteen major sectors of the Maryland economy. Of all the sectors included in the analysis, the agriculture and forestry industries reported the highest labor income and value added multipliers, and placed eighth in employment and tenth in output multiplier.

Table 2.**Thirteen Major Sectors of the Maryland Economy: 2010 Employment, Labor Income, Value Added and Output Multipliers**

	EMPLOYMENT	LABOR INCOME	VALUE ADDED	OUTPUT
AGRICULTURE AND FORESTRY	1.60	2.02	2.11	1.45
BUSINESS SERVICES	1.45	1.36	1.33	1.32
GOVERNMENT	1.69	1.33	1.51	1.75
HEALTH AND EDUCATION	1.67	1.58	2.00	1.93
FINANCIAL SERVICES	1.79	1.57	1.62	1.48
MANUFACTURING	2.50	1.90	1.98	1.50
INFORMATION SYSTEMS	2.26	1.80	1.52	1.45
CONSTRUCTION	1.84	1.72	1.99	1.76
RETAIL	1.42	1.47	1.56	1.62
LEISURE	1.28	1.65	1.80	1.69
TRANSPORTATION	1.54	1.52	1.65	1.62
NATURAL RESOURCE EXTRACTION	2.58	1.47	1.22	1.29
OTHER	1.53	1.59	2.03	1.89
AGRICULTURE AND FORESTRY RANKING	8	1	1	10

Interestingly, agriculture generated the second highest income and value added per worker for each dollar of final demand of all sectors of the economy in 2010. Agriculture generates employment in a wide range of high paying jobs and remains a competitive and integral part of the modern Maryland economy. Figures 17 and 18 display income and value added per worker in the induced and indirect employment

resulting from the top four sectors in Table 2. For example, agriculture created employment in sectors supporting agricultural production and employment. In the indirect and induced jobs created to support the agricultural sector, workers earned an average of \$50,357, whereas the jobs created to support the leisure sector had an average annual income of \$49,672.

Figure 17.

2010 Average Value Added per Worker Resulting from Indirect and Induced Employment from Top Four Sectors from Table 2

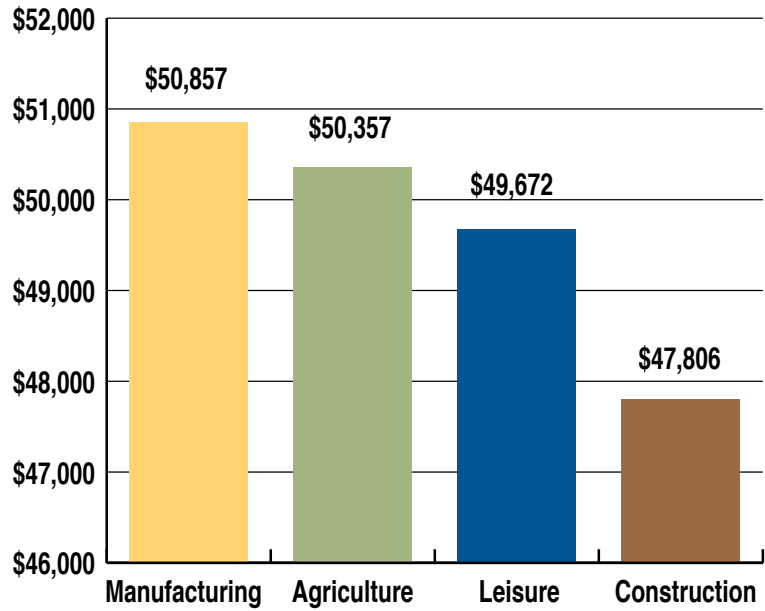
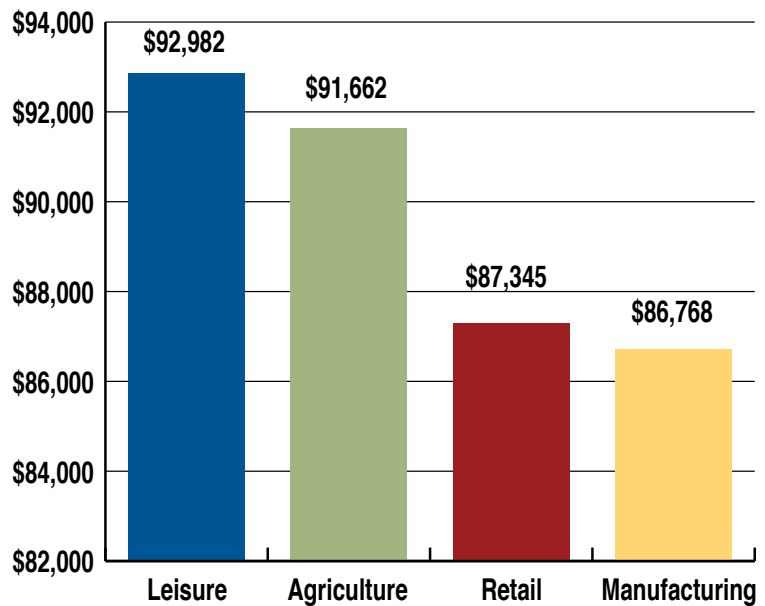


Figure 18.

2010 Average Value Added per Worker Resulting from Indirect and Induced Employment from Four Sectors of the Maryland Economy



Select Industry Overview

Poultry, Dairy, and Cattle

Maryland has a lot of diversity in its many agricultural sectors, including substantial animal production and processing and select crop and nursery sectors. An overview of the six largest agricultural industries – poultry, dairy, cattle, fruits and vegetables, grain, and soybeans in the state of Maryland in 2010 – can be found in Appendix 5. We have highlighted the main results here.

Poultry is the largest agricultural sector in the state of Maryland, with over \$1.7 billion in total output, almost 7,000 individuals employed, and \$500 million in value added. The dairy, cattle and equine sectors are also important animal-based production industries. Dairy has \$1.1 billion in output, 2,500 workers and \$328 million in value added. The Cattle sector has almost \$650 million in output, almost 2,700 workers, and \$166 million in value added. Figures 19 and 20 compare output and employment for the poultry, dairy, and cattle industries in Maryland for the year 2010.

Figure 19.

2010 Total Impacts of Poultry, Dairy, and Cattle Industries on the Maryland Economy (millions of dollars)

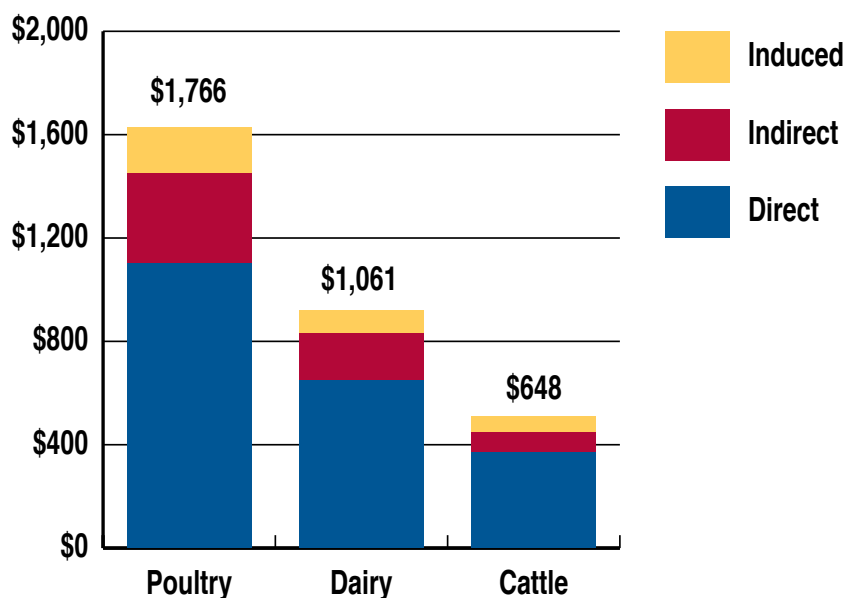
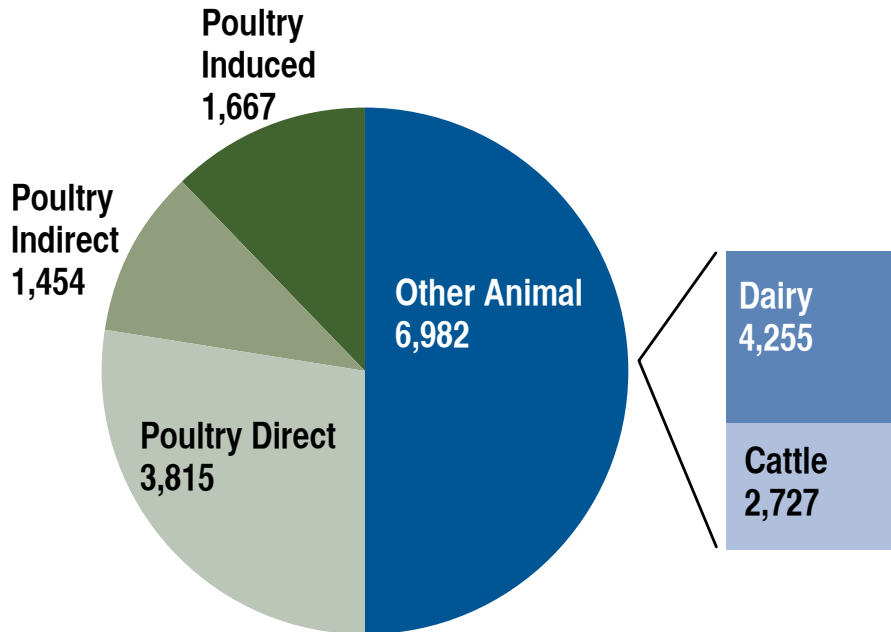


Figure 20.

Total Employment in the Poultry, Dairy, and Cattle Industries



Poultry is by far the largest animal- and crop-based industry in terms of both total employment and output. Poultry alone represents over 15 percent of total employment and over 21 percent of total output for the agricultural and forestry sectors. Furthermore, poultry employees earn the highest average salaries, with an average direct annual income of \$38,600. They are also the most productive agricultural employees, with direct value added of \$58,000 in 2010, well above the agricultural sector average. Poultry production and processing also generates thousands of jobs throughout the Maryland economy. These indirect and induced jobs have an average annual income of \$52,000. Figure 21 displays the number of jobs generated per fifty poultry employees in the four largest recipient sectors. For a more detailed breakdown of stimulated employment in the state of Maryland as a result of poultry production and processing, please refer to Appendix 5.

Figure 21.

Employment Generated in Business Services, Retail, Health and Education, and Transportation Sectors per 50 Poultry Jobs

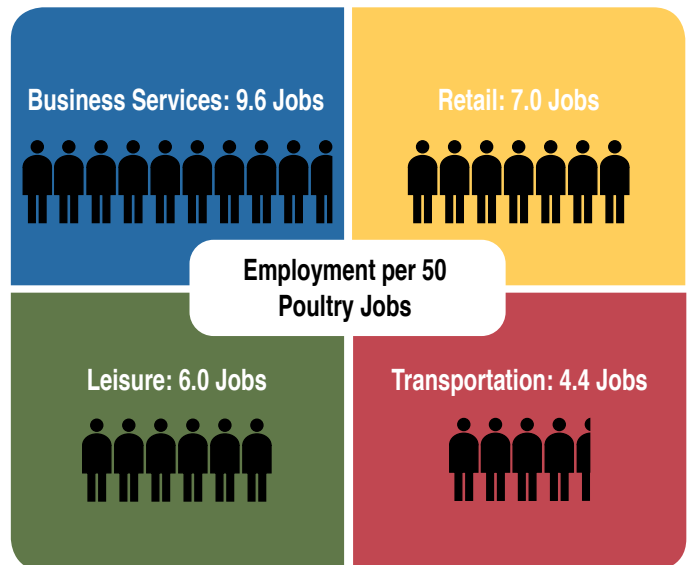
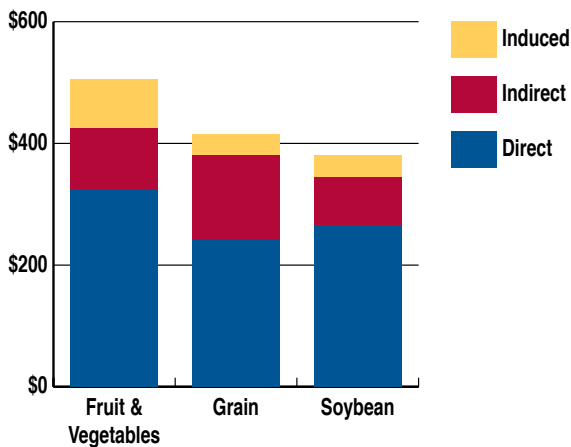


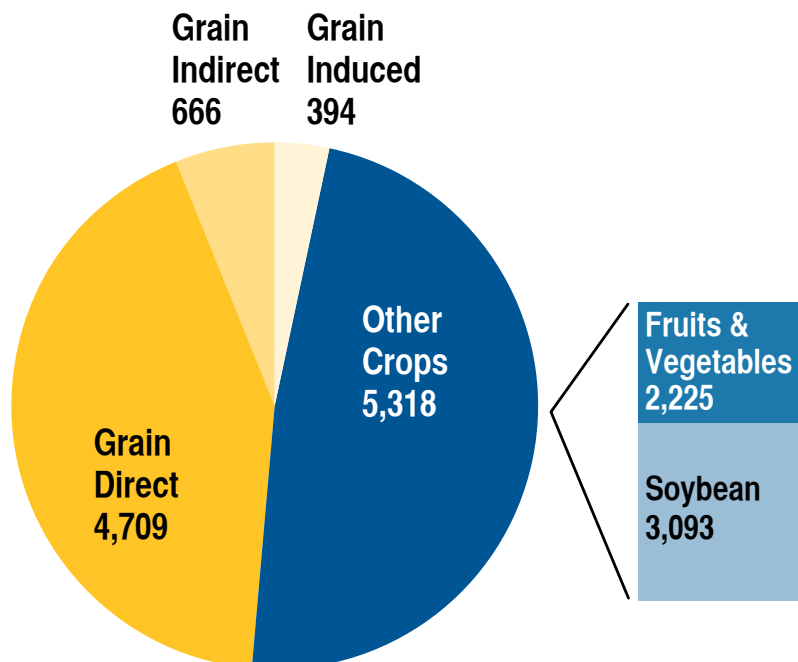
Figure 22.
**2010 Total Impacts of Fruit and Vegetables,
 Grain, and Soybean Industries on the Maryland
 Economy (millions of dollars)**



Fruits and Vegetables, Soybeans, and Grain

Among crop and nursery industries, Maryland’s leading crops include fruits and vegetables, grain, and soybeans. Fruit and vegetable production has the highest crop value in the state of Maryland, with \$539 million in total output. As a comparison, grain and soybeans yield \$444 million and \$415 million in total output, respectively. By contrast, the grain industry employs the most workers among the three sectors, with over 5,800 people employed. The soybean sector employs 3,100 workers, and the fruit and vegetable sector employs 2,200 workers in Maryland. Figures 22 and 23 compare output and employment for the fruit and vegetables, grain, and soybean industries in Maryland for the year 2010. For a more complete analysis of the crop and nursery industries, please refer to Appendix 5.

Figure 23.
**2010 Total Employment by the Grain, Soybean,
 and Fruit and Vegetable Industries in the Maryland Economy**



Comparing the 2010 UMD Results to the 2005 Salisbury University Report⁶

Other researchers have considered the impact of agriculture on the Maryland economy. In 2005, a study conducted by researchers at Salisbury University examined the importance of Maryland resource-based industries to the state economy using IMPLAN data from 2004. Many similarities exist between the methodologies and findings of the 2005 Salisbury University report and the results generated by our most recent analysis, using 2009 and 2010 data. There are also some important differences between these reports that shed light on recent economic developments in the Maryland agriculture industry.

Both the 2005 Salisbury University study and our own most recent study utilize the IMPLAN database and software⁷ for the analysis of the Maryland agricultural economy. The Salisbury University report utilized data from 2004, the most recent year available at the time of publication, whereas our report was conducted using 2010 data. IMPLAN releases new annual databases every year and periodically releases updates to its software package.⁸ Between the release of the Salisbury University Report and our report there have been a few changes in data construction as well as software format. The 2005 Salisbury report included slightly different agricultural industries and an expanded number of forestry industries. In addition, it included the mineral extraction industry, which was entirely absent from our report. For a more detailed discussion of the precise differences between the sectors included in our reports, please see Appendix 1.

The results presented focus on the contribution from sectors and industries that are common to both the 2005 Salisbury report and our report. These



sectors include: total agriculture, poultry, dairy, cattle, grain, and soybeans. Since the magnitude of indirect and induced effects are impacted by the number of sectors included in the IMPLAN analysis, only the direct contribution from each sector will be compared.

In the period from 2005 to 2010, the agricultural industry in the state of Maryland went through a period of contraction that mirrored economic trends in the broader Maryland and U.S. economy. Direct agricultural employment declined by approximately 2,000 jobs and output declined by approximately \$1 billion in inflation-adjusted 2010 dollars. Dairy, cattle and equine were by far the hardest-hit sectors during this time period. Dairy, cattle and equine lost almost 4,000 jobs and \$600 million in output value. Declining global demand for dairy products

⁶ One important difference between our report and the 2005 Salisbury University report is the number and type of sectors included in the regional analysis of the Maryland agriculture economy. See Appendix 7

⁷ For a more detailed discussion of the IMPLAN database report and software, please refer to Appendix 6.

⁸ The most recent software update occurred in 2009.

and lower milk prices have contributed to a prolonged contraction in the Maryland dairy industry.

However, despite the overall decline in agricultural output and employment, a few industries have expanded substantially. Poultry added over 2,000 jobs and expanded its output by over \$450 million, nearly offsetting the declines in the dairy, cattle and equine industry. The grain and soybean sectors also expanded substantially, adding 2,500 jobs and \$120.2 million in output. High crop prices and growth in international demand for U.S. poultry products have contributed to a significant increase in employment and output in these two key agricultural industries.

Conclusion

We have examined the importance of agriculture in the Maryland economy. This report helps to illuminate the important ways in which agriculture continues to contribute to the Maryland economy, not only in terms of output, but employment as well. The agricultural and forestry industry have far-reaching economic impacts in the state of Maryland. For instance, for every dollar in output generated directly by agriculture or forestry industries, forty-five cents in output is added to other industries in the state of Maryland; and, for every five jobs generated in these industries, three jobs are added around the state.

Overall, the agriculture and forestry industries contribute a total of \$8.25 billion to the Maryland economy, \$1.7 billion in labor income, and \$3 billion in value added in 2010. These industries generate almost 46,000 workers throughout the state. The single largest agriculture industry in the state is poultry production and processing, which represents over 20 percent of total agricultural output and 15 percent of all agricultural employment. In the absence of the agricultural and forestry sectors then, the Maryland economy would suffer a loss of employment for these 46,000 workers until and if other industries moved in to take agriculture and forestry's place. Similarly, the \$3 billion in value added to the economy would disappear. Thus the decline of the agricultural and forestry sectors would have an impact on not just farm families and agriculturally based businesses. It would ripple out to the entire economy, causing distress to workers in many sectors, and losses to taxpayers, businesses, and others who benefit from a strong Maryland economy.

Appendices

Appendix 1.

List of Sectors Included in Analysis

AGRICULTURE CROPS: PRODUCTION		
IMPLAN INDUSTRY	2002 NAICS CODE	DESCRIPTION
Oilseed Farming	11112	Oilseed (Except Soybean) Farming
	11111	Soybean Farming
Grain Farming	11113	Dry Pea and Bean Farming
	11114	Wheat Farming
	11115	Corn Farming
	11116	Rice Farming
	11119	Other Grain Farming
Vegetable and Melon Farming	1112	Vegetable and Melon Farming
Tree Nut Farming	111335	Tree Nut Farming
Fruit Farming	11131	Orange Groves
	11132	Citrus (Except Orange) Groves
	111331	Apple Orchards
	111332	Grape Vineyards
	111333	Strawberry Farming
	111334	Berry (Except Strawberry) Farming
	111336	Fruit and Tree Nut Combination Farming
	111339	Other Non-Citrus Fruit Farming
Greenhouse and Nursery Production	1114	Greenhouse, Nursery, and Floriculture Production
Tobacco Farming	11191	Tobacco Farming
Cotton Farming	11192	Cotton Farming
Sugarcane and Sugar Beet Farming	11193	Sugarcane Farming
	111991	Sugar Beet Farming
All Other Crop Farming	11194	Hay Farming
	111992	Peanut Farming
	111998	All Other Miscellaneous Crop Farming
Wineries	31213	Wine and Brandy Production

AGRICULTURE CROPS: PROCESSING

IMPLAN INDUSTRY	2002 NAICS CODE	DESCRIPTION
Flour Milling	311211	Flour Milling
Rice Milling	311212	Rice Milling
Malt Manufacturing	311213	Malt Manufacturing
Wet Corn Milling	311221	Wet Corn Milling
Soybean and Other Oilseed Processing	311222	Soybean Processing
	311223	Other Oilseed Processing
Fats and Oils Refining and Blending	311225	Fats and Oils Refining and Blending
Sugar Manufacturing	31131	Sugar Manufacturing
Frozen Food Manufacturing	31141	Frozen Food Manufacturing
Fruit and Vegetable Canning and Drying	31142	Fruit and Vegetable Canning, Pickling, and Drying
Fluid Milk Manufacturing	311511	Fluid Milk Manufacturing
Creamery Butter Manufacturing	311512	Creamery Butter Manufacturing
Cheese Manufacturing	311513	Cheese Manufacturing
Dry, Condensed, and Evaporated Dairy Products	311514	Dry, Condensed, and Evaporated Dairy Product Manufacturing

AGRICULTURE ANIMAL: PRODUCTION

IMPLAN INDUSTRY	2002 NAICS CODE	DESCRIPTION
Cattle Ranching and Farming	11211	Beef Cattle Ranching and Farming, Including Feedlot
	11213	Dual Purpose Cattle Ranching and Farming
Dairy Cattle and Milk Production	11212	Dairy Cattle and Milk Production
Poultry and Egg Production	1123	Poultry and Egg Production
Animal Production, Except Cattle and Poultry and Eggs	1122	Hog and Pig Farming
	1124	Sheep and Goat Farming
	1125	Animal Aquaculture
	1129	Other Animal Production
Fishing	1141	Fishing
Hunting and Trapping	1142	Hunting and Trapping

AGRICULTURE ANIMALS: PROCESSING

IMPLAN INDUSTRY	2002 NAICS CODE	DESCRIPTION
Animal, Except Poultry, Slaughtering	311611	Animal (Except Poultry) Slaughtering
Meat Processed From Carcasses	311612	Meat Processed From Carcasses
Rendering and Meat Byproduct Processing	311613	Rendering and Meat Byproduct Processing
Poultry Processing	311615	Poultry Processing
Seafood Product Preparation and Packaging	3117	Seafood Product Preparation and Packaging
Leather and Hide Tanning and Finishing	3161	Leather and Hide Tanning and Finishing

FORESTRY: PRODUCTION

IMPLAN INDUSTRY	2002 NAICS CODE	DESCRIPTION
Logging	1133	Logging
Forestry, Forest Products, and Timber Tract Production	1131	Timber Tract Operations
	1132	Forest Nurseries and Gathering of Forest Products

FORESTRY: PROCESSING

IMPLAN INDUSTRY	2002 NAICS CODE	DESCRIPTION
Sawmills	321113	Sawmills
Pulp Mills	32211	Pulp Mills
Paper Mills	32212	Paper Mills
Paperboard Mills	32213	Paperboard Mills

AGRICULTURAL SERVICES

IMPLAN INDUSTRY	2002 NAICS CODE	DESCRIPTION
Agriculture and Forestry Support Activities	115	Support Activities for Agriculture and Forestry

Appendix 2.

2010 Total Impact of Agriculture on the Maryland Economy

	EMPLOYMENT	LABOR INCOME (MILLION \$)	VALUE ADDED (MILLION \$)	OUTPUT (MILLION \$)
OVERALL TOTAL				
Direct	28,572.90	837.30	1,408.30	5,683.00
Indirect	7,854.80	462.60	835.20	1,438.80
Induced	9,171.50	394.80	725.40	1,127.40
TOTAL	45,599.10	1,694.70	2,969.00	8,249.20
Multiplier	1.60	2.02	2.11	1.45
BY MAJOR CATEGORIES				
AGRICULTURE				
Direct	22,668.00	619.90	1,075.90	4,700.60
Indirect	6,381.00	369.60	678.50	1,175.40
Induced	6,973.00	300.10	551.50	857.00
TOTAL	36,022.00	1,289.60	2,305.80	6,733.00
Multiplier	1.59	2.08	2.14	1.43
FORESTRY				
Direct	2,351.00	137.60	254.40	877.50
Indirect	1,409.00	88.70	150.00	248.50
Induced	1,607.00	69.20	127.20	197.60
TOTAL	5,366.00	295.50	531.50	1,323.60
Multiplier	2.28	2.15	2.09	1.51
AG-RELATED SERVICE				
Direct	3,554.00	79.80	78.10	104.90
Indirect	64.00	4.30	6.70	14.90
Induced	592.00	25.50	46.80	72.70
TOTAL	4,210.00	109.50	131.60	192.60
Multiplier	1.18	1.37	1.69	1.84

Appendix 3.

Indirect and Induced Employment Breakdown for the Agriculture and Forestry Sectors

SECTOR	INDIRECT EMPLOYMENT	INDUCED EMPLOYMENT	TOTAL EMPLOYMENT
Business Services	3,080	1,332	4,411
Retail	949	1,938	2,887
Health and Education	133	2,192	2,325
Leisure	365	1,238	1,603
Transportation	1,208	214	1,422
Other	316	1,067	1,383
Financial	566	752	1,318
Manufacturing	398	64	462
Construction	362	76	438
Information Services	164	146	310
Government	151	121	272
Natural Resource Extraction	162	31	194
TOTAL	7,854	9,171	17,025

2010 Indirect and Induced Employment Resulting from the Agriculture and Forestry Sectors for Select Industries

INDUSTRY	INDIRECT EMPLOYMENT	INDUCED EMPLOYMENT	TOTAL EMPLOYMENT
Real Estate Establishments	773	491	1,265
Food Services and Drinking Places	259	933	1,192
Wholesale Trade Businesses	884	235	1,118
Transport by Truck	706	49	755
Services to Buildings and Dwellings	451	143	594
Offices of Physicians, Dentists, and Other Health Practitioners	0	546	546
Private Hospitals	0	514	514
Management of Companies and Enterprises	426	30	456
Non-Depository Credit Intermediation and Related Activities	221	221	442
Maintenance and Repair Construction of Nonresidential Structures	358	48	406
TOTAL	4,078	3,210	7,288

Appendix 4.

Comparison of Income and Value Added per Worker

SECTOR	DIRECT YEARLY INCOME PER WORKER	INDIRECT AND INDUCED INCOME PER WORKER	DIRECT VALUE ADDED PER WORKER	INDIRECT AND INDUCED VALUE ADDED PER WORKER
Agriculture and Forestry	\$29,304	\$50,357	\$49,288	\$91,662
Business Services	\$55,245	\$45,124	\$88,907	\$64,999
Government	\$91,346	\$43,403	\$106,616	\$79,576
Health and Education	\$51,931	\$44,672	\$55,875	\$83,149
Financial Services	\$61,512	\$44,530	\$102,067	\$79,344
Manufacturing	\$84,983	\$50,857	\$132,986	\$86,768
Information Systems	\$71,748	\$45,716	\$186,100	\$77,482
Construction	\$55,924	\$47,806	\$68,260	\$80,555
Retail	\$41,539	\$46,611	\$65,247	\$87,384
Leisure	\$21,379	\$49,672	\$32,583	\$92,982
Transportation	\$46,785	\$45,527	\$66,294	\$80,304
Natural Resource Extraction	\$152,166	\$45,569	\$564,684	\$80,195
Other	\$40,037	\$44,771	\$42,521	\$82,555
Agriculture and Forestry Ranking	12	2	11	2

Appendix 5.

Select Industry Impacts on the Maryland Economy

2010 Poultry Industry Impact on the Maryland Economy

	EMPLOYMENT	LABOR INCOME (MILLION \$)	VALUE ADDED (MILLION \$)	OUTPUT (MILLION \$)
POULTRY TOTAL				
Direct	3,815.00	147.30	221.30	1,248.90
Indirect	1,454.00	90.00	152.10	312.00
Induced	1,667.00	71.80	131.90	205.10
TOTAL	6,937.00	309.10	505.40	1,766.00
Multiplier	1.82	2.10	2.28	1.41
POULTRY PRODUCTION				
Direct	1,621.00	75.40	135.20	740.70
Indirect	755.00	46.00	83.90	199.10
Induced	857.00	36.90	67.70	105.2
TOTAL	3,232.00	158.20	286.80	1,045.10
Multiplier	1.99	2.10	2.12	1.41
POULTRY PROCESSING				
Direct	2,195.00	71.90	86.10	508.20
Indirect	700.00	44.00	68.20	112.80
Induced	811.00	35.00	64.20	99.80
TOTAL	3,705.00	150.90	218.50	720.90
Multiplier	1.69	2.10	2.54	1.42

2010 Indirect and Induced Employment Resulting from the Poultry Industry

SECTOR	INDIRECT EMPLOYMENT	INDUCED EMPLOYMENT	TOTAL EMPLOYMENT
Business Services	491	243	733
Retail	180	352	532
Health and Education	21	438	459
Transportation	295	39	333
Leisure	70	225	296
Financial Services	84	137	221
Government	48	154	201
Manufacturing	110	12	122
Construction	76	14	90
Information Services	31	27	58
Other	25	22	47
Natural Resource Extraction	25	6	31
TOTAL	1,454	1,667	3,122

2010 Indirect and Induced Employment Resulting from the Agriculture and Forestry Sectors for Select Industries

INDUSTRY	INDIRECT EMPLOYMENT	INDUCED EMPLOYMENT	TOTAL EMPLOYMENT
Food Services and Drinking Places	48	170	218
Wholesale Trade Businesses	169	43	212
Transport by Truck	184	9	193
Real Estate Establishments	59	90	149
Management of Companies and Enterprises	112	6	117
Offices of Physicians, Dentists, and Other Health Practitioners	0	99	99
Private Hospitals	0	94	94
Services to Buildings and Dwellings	64	26	90
Maintenance and Repair Construction of Nonresidential Structures	75	9	84
Non-Depository Credit Intermediation and Related Activities	36	40	76
TOTAL	747	586	1,332

2010 Dairy Industry Impact on the Maryland Economy

	EMPLOYMENT	LABOR INCOME (MILLION \$)	VALUE ADDED (MILLION \$)	OUTPUT (MILLION \$)
DAIRY TOTAL				
Direct	2,406.00	61.80	155.60	775.80
Indirect	1,001.00	59.30	105.70	181.30
Induced	848.00	36.60	67.20	104.40
TOTAL	4,255.00	157.70	328.40	1,061.50
Multiplier	1.77	2.55	2.11	1.37
DAIRY PRODUCTION				
Direct	1,531.00	10.00	68.00	187.00
Indirect	221.00	12.00	27.00	51.00
Induced	157.00	7.00	12.00	19.00
TOTAL	1,909.00	29.00	108.00	258.00
Multiplier	1.25	2.82	1.58	1.38
DAIRY PROCESSING				
Direct	875.00	51.40	87.20	589.00
Indirect	780.00	47.30	78.20	129.90
Induced	691.00	29.80	54.70	85.10
TOTAL	2,346.00	128.50	220.20	803.90
Multiplier	2.68	2.50	2.52	1.36

2010 Cattle Industry Impact on the Maryland Economy

	EMPLOYMENT	LABOR INCOME (MILLION \$)	VALUE ADDED (MILLION \$)	OUTPUT (MILLION \$)
CATTLE TOTAL				
Direct	1,540.00	47.00	59.70	479.60
Indirect	613.00	34.90	60.80	97.90
Induced	574.00	24.70	45.40	70.60
TOTAL	2,727.00	106.70	165.90	648.10
Multiplier	1.77	2.27	2.78	1.35
CATTLE PRODUCTION				
Direct	617.00	4.60	11.00	66.10
Indirect	85.00	4.10	10.00	16.00
Induced	61.00	2.60	4.80	7.50
TOTAL	762.00	11.30	25.90	89.70
Multiplier	1.24	2.45	2.35	1.36
CATTLE PROCESSING				
Direct	923.00	42.40	48.70	413.50
Indirect	528.00	30.90	50.70	81.90
Induced	513.00	22.10	40.60	63.10
TOTAL	1,965.00	95.40	140.10	558.50
Multiplier	2.13	2.25	2.88	1.35

2010 Fruit and Vegetable Industry Impact on the Maryland Economy

	EMPLOYMENT	LABOR INCOME (MILLION \$)	VALUE ADDED (MILLION \$)	OUTPUT (MILLION \$)
FRUIT AND VEGETABLE TOTAL				
Direct	1,012.00	64.00	110.40	353.80
Indirect	533.00	32.50	57.30	101.80
Induced	680.00	29.30	53.80	83.60
TOTAL	2,225.00	125.70	221.50	539.30
Multiplier	2.20	1.97	2.01	1.52
FRUIT AND VEGETABLE PRODUCTION				
Direct	506.00	31.40	40.70	79.50
Indirect	106.00	5.30	12.50	20.30
Induced	263.00	11.30	20.70	32.20
TOTAL	875.00	48.00	73.90	132.00
Multiplier	1.73	1.53	1.82	1.66
FRUIT AND VEGETABLE PROCESSING				
Direct	506.00	32.50	69.70	274.30
Indirect	427.00	27.10	44.80	81.50
Induced	418.00	18.00	33.10	51.40
TOTAL	1,350.00	77.70	147.60	407.20
Multiplier	2.67	2.39	2.12	1.48

2010 Grain Industry Impact on the Maryland Economy

	EMPLOYMENT	LABOR INCOME (MILLION \$)	VALUE ADDED (MILLION \$)	OUTPUT (MILLION \$)
GRAIN TOTAL				
Direct	4,709.00	23.60	49.90	267.90
Indirect	6660.00	32.10	80.60	127.40
Induced	394.00	16.90	31.10	48.40
TOTAL	5,769.00	72.60	161.60	443.70
Multiplier	1.23	3.08	3.24	1.66
GRAIN PRODUCTION				
Direct	4,662.00	20.60	42.80	210.30
Indirect	526.00	22.70	64.00	102.40
Induced	308.00	13.20	24.30	37.70
TOTAL	5,495.00	56.50	131.00	350.50
Multiplier	1.18	2.75	3.06	1.67
GRAIN PROCESSING				
Direct	46.00	3.00	7.10	57.60
Indirect	140.00	9.30	16.60	25.00
Induced	87.00	3.70	6.90	10.70
TOTAL	273.00	16.10	30.60	93.20
Multiplier	5.88	5.35	4.30	1.62

2010 Soybean (And Other Oilseeds) Industry Impact on the Maryland Economy

	EMPLOYMENT	LABOR INCOME (MILLION \$)	VALUE ADDED (MILLION \$)	OUTPUT (MILLION \$)
SOYBEAN TOTAL				
Direct	2,372.00	20.60	75.80	303.30
Indirect	426.00	20.90	48.90	75.90
Induced	295.00	12.70	23.30	36.20
TOTAL	3,093.00	54.20	148.00	415.40
Multiplier	1.30	2.63	1.95	1.37
SOYBEAN PRODUCTION				
Direct	2,338.00	17.80	67.80	164.60
Indirect	308.00	13.30	36.40	55.90
Induced	222.00	9.50	17.50	27.20
TOTAL	2,868.00	40.60	121.70	247.70
Multiplier	1.23	2.28	1.79	1.51
SOYBEAN PROCESSING				
Direct	34.00	3.00	8.00	139.00
Indirect	118.00	8.00	13.00	20.00
Induced	73.00	3.00	6.00	9.00
TOTAL	225.00	14.00	26.00	168.00
Multiplier	6.69	4.76	3.30	1.21

Appendix 6.

Overview of Input-Output Analysis & Data

So how did we come up with these numbers for agriculture? We used an input-output analysis to assess the dynamic flow of goods and services between sectors of an economy. This approach models the many interactions and interconnections between agriculture and other industries in Maryland. Nobel Prize winning economist Wassily Leontief developed this methodology to model the U.S. economy in 1949. It continues to be used in prominent economic studies today. This methodology treats industries as both producers (of output) as well as consumers of goods and services (of inputs). With data tables accounting for the demand and supply of products between each sector, an entire economy can be analyzed at the global, national, and even state level.

Resulting analyses measure the direct, indirect, and induced economic impact of an industry. Here, direct effects are defined as the value of economic activity in agriculture. Indirect effects take into account the impact of agriculture on other local industries such as pick-up dealers, fencing materials manufacturing, and container makers. Induced effects refer to the impact of the wages paid to agricultural workers on other industries. For example, an agricultural worker takes his income and buys clothes, food, cars, and haircuts, and employs other people. Taken together, these three measures represent the total impact of agriculture on the Maryland economy.

We will utilize an input-output model to measure the impact of agriculture on the Maryland economy. This model utilizes state and national level data to generate a table of economic transactions between various sectors of the economy that are impacted by agricultural production. These data are necessary to simulate industry output and connections within a state and regional economy as well as industry-level economic multipliers.

Industry multipliers are the key to understanding the complex relationships between sectors of an economy. When employment or economic activity expands in agriculture, agricultural support and processing firms demand additional products and services from their intermediate suppliers, which has an impact on those other sectors of the economy. Furthermore, as agricultural workers see increased income from agriculture's economic expansion, they increase their demand for goods and services (i.e., consumer demand), increasing economic growth further. In this way, economic activity within agriculture is "multiplied" by the resulting expansion of other sectors of the economy and by growth in agricultural and other workers' consumer spending.

In order to accurately estimate the total impact of agriculture on the Maryland economy, industry multipliers must be carefully calculated so as to represent the appropriate industry linkages. One also wants to ensure agriculture's impact is not counted twice – i.e., that the multipliers are not double counting the increased economic activity from other sectors in the economy. To this end, we utilize a nationally recognized software program called IMPLAN (Impact Analysis Planning). IMPLAN was originally developed by the University of Minnesota, in 1976, to help the U.S. Forest Service analyze the impact of its policies on local communities. The IMPLAN database is now available to the general public and has grown to include county-level data for every U.S. state. In the following, a brief description of the IMPLAN data will be provided.

This modeling approach allows us to incorporate the inter-industry activities and determine how much value agriculture adds to the Maryland economy.

IMPLAN Database

The IMPLAN database is produced by MIG (formerly the Minnesota IMPLAN Group) and is available at the U.S. county and state level. MIG compiles sector- and county-specific data from various state and national economic reports. Data for the agricultural industry are assembled primarily from the National Agricultural Statistics Service as well as the Census of Agriculture.

Researchers have a great degree of flexibility when utilizing the IMPLAN database. Data are categorized using the North American Industry Classification System (NAICS) categories. These categories allow for a great deal of specificity when modeling an entire sector of the economy.

In this analysis, we consider both the production and the processing of agricultural and forestry goods. However, only primary processing is considered for each industry. For example, we would include the production of flour in the state of Maryland, but not the production of bread, as bread combines already processed agricultural ingredients to produce a finished product. For a full list of industries included in our analysis, please refer to Appendix 1.

For each county and state region, IMPLAN constructs balanced Social Accounting Matrices (SAM) which are used to produce predictive input-output multipliers for estimating economic impacts. Industry SAM multipliers are calculated as the sum of direct, indirect, and induced effects, divided by the direct effect. IMPLAN uses SAM multipliers to divide an industry's impact on an economy into four distinct categories, defined in the box on the next page.

Employment measures the change in Maryland employment resulting from a change in the agricultural employment as a result of a change in agriculture's final demand

Labor Income represents the change in Maryland's household labor income resulting from a \$1.00 change in agricultural labor expenditures in response to a change in demand for agricultural goods.

Value Added acts as an alternative income multiplier that measures the total impact of a \$1 change in output on employee compensation, plus proprietary income plus other property income plus indirect business tax. This is how IMPLAN incorporates all other income within the state beyond that of agricultural workers.

Industry Outputs represents the total dollar value of output within the Maryland economy resulting by a \$1.00 change in final demand for agricultural products.

Other Data

In addition to the data used in the IMPLAN software, we also employed data from the Census of Agriculture, which was conducted by the Department of Commerce Bureau of Census and then transferred to the Department of Agriculture. For many reasons, the definition of a farm has changed over time in the Census of Agriculture. The current definition of a farm is "any place from which \$1,000 or more of agricultural products were produced and sold or normally would have been sold during the census year." In 2002, the USDA Census of Agriculture modified the Census data it reported for the first time due to under-reporting. Therefore, the data collected on the surveys were adjusted by the perceived under-reporting. Therefore, the data before 2002 and after 2002 should be compared with thoughtfulness.

Appendix 7.

Differences Between the 2013 College of Agricultural and Natural Resources, UMD, Report and the 2005 Salisbury University Report

One important difference between our report and the 2005 Salisbury University report is the number and type of sectors included in the regional analysis of the Maryland agriculture economy. The Salisbury University report studies all Maryland resource-based industries, which include contributions from the agriculture, forestry, and mining industries. By contrast, our report focuses on agriculture and forestry production and processing.

The agricultural industries included in our report versus the Salisbury University study varied. A few minor changes due to changes in IMPLAN data design and researcher preference are noted. Within the agriculture sector, our report includes 31 independent industries, whereas the Salisbury University report had 22 sectors. The table below provides a list of agricultural sectors included in our analysis that were not included in the 2005 study by Salisbury University.

Agricultural Sectors Not Included in the 2005 Salisbury Report

- Wineries
- Tree Nut Farming*
- Cotton Farming*
- Sugarcane and Sugar Beet Farming*
- Frozen Food Manufacturing
- Soybean and Other Oilseed Processing
- Wet Corn Milling
- Seafood Product Preparation and Packaging
- Dairy Cattle and Milk Production†

* Indicates a sector with no reported output or employment during study year

† Dairy and cattle were combined into the same category in the 2004 IMPLAN database

The Salisbury University report was much more inclusive in regards to the forestry sector. These industries ranged from forestry production and processing as well as forestry and wood-derivatives manufacturing. In our report, we define forestry more narrowly as industries exclusively involved in forestry production and primary forestry processing. We include a total of six forestry-related industries in our report. In addition to forestry and manufacturing, the Salisbury University study also included 10 additional mining and mineral extraction industries.