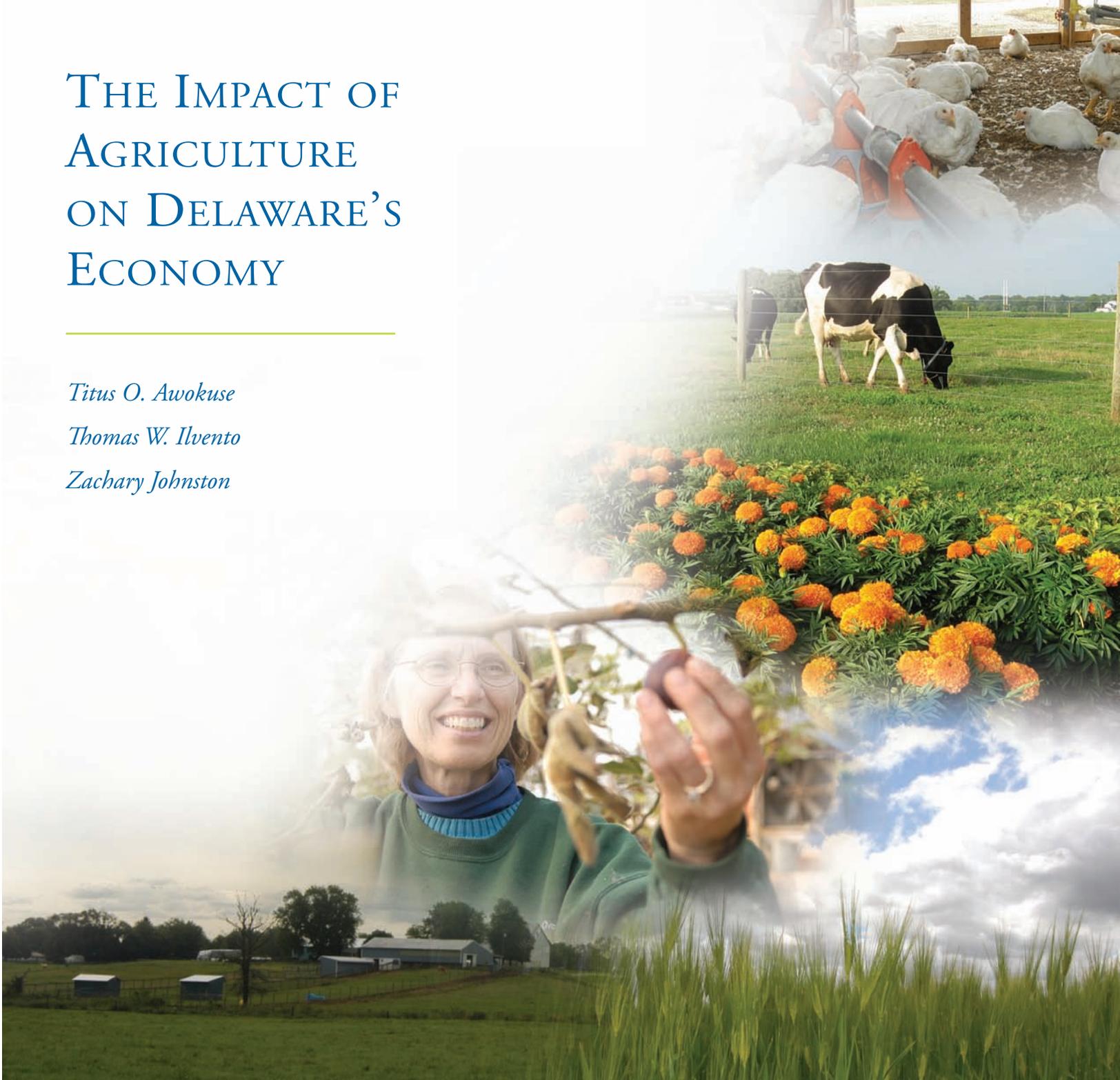


THE IMPACT OF AGRICULTURE ON DELAWARE'S ECONOMY

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December 2010

ACKNOWLEDGEMENTS

We especially thank Dean Robin Morgan of the College of Agriculture and Natural Resources at the University of Delaware and Mr. Ed Kee, Delaware State Secretary of Agriculture, for their invaluable moral and financial support for the project. We also appreciate the inputs from various stakeholders across Delaware agriculture and support from our colleagues in the Department of Food and Resource Economics at the University of Delaware.

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The Impact of Agriculture on Delaware's Economy

EXECUTIVE SUMMARY

Agriculture is a very important economic sector nationally and it makes a notable contribution to the overall economy of Delaware. In recent decades, the agricultural industry has experienced dynamic changes in response to new developments of innovative production technologies that have affected agricultural productivity and yield. Furthermore, agriculture as a business has faced new challenges from persistent changes in consumers' perception and demand for various attributes of agricultural and food products. In the changing landscape of agriculture it is important to take a closer look at recent trends in the industry and develop an accurate accounting of the economic value and contribution of agriculture to the rest of the state economy.

The purpose of this project is two-folds. First, this study provides an overview of the business of agricultural production and provides a historical perspective of some of the major trends in production, land use, and the structure of agriculture. Second, an economic impact analysis of Delaware's agricultural industry was conducted to better account for inter-industry linkages and to determine how much value the agricultural industry adds to the rest of Delaware's economy. In addition to conventional production agriculture's contribution, we also examined the impact of other agriculture-based subsectors such as food processing/manufacturing, forestry activities and agricultural related services. This analysis used state and national level economic data from various industries. In order to analyze all the economic transactions generated by the impacted industries in Delaware, a quantitative

economic model (i.e., input-output model) was used. The analysis generated a set of multipliers that represent a quantitative measure of agriculture's impact through employment and expenditures throughout the economy. Multipliers are often called estimators of the "ripple" effect of an industry.

KEY FINDINGS:

In 2008, the total economic contribution of all categories of agriculture in Delaware is \$7.95 billion in industry output. A portion of this amount goes to Delaware workers and agricultural producers in the form of wages, salaries, and profits. In addition to agricultural business expenditures, income by operators and workers in the sector are also spent in purchasing product and services from other Delaware businesses. The agricultural industry contributes \$2.5 billion in value added activity, and \$1.6 billion in labor income. The total value is the sum of direct, indirect, and induced effects. The estimated total number of jobs supported by the agricultural industry is about 30,000 jobs in 2008. The employment figures include full-time, part-time, and seasonal employ-



ment. The agricultural industry as a whole generates a job multiplier of 1.8 and an output multiplier of 1.4.

In addition to the total industry impact results, separate results are also provided for various categories by sub-sectors, by counties and for seven key agricultural industry categories (poultry, dairy, fruits and vegetables, corn, soybeans, wheat, greenhouse, nursery and horticultural products). The majority of the economic value of the agricultural sector comes from the production and processing of poultry products. This sub-sector produces an industry output of \$3.2 billion and a total of 13,437 jobs. These output figures translate to a total effect of \$646 million in labor income. This sub-sector generates a job multiplier of 2 and an output multiplier of 1.34.

In summary, the impact of agriculture on Delaware's **Delaware Land Use, 2007**

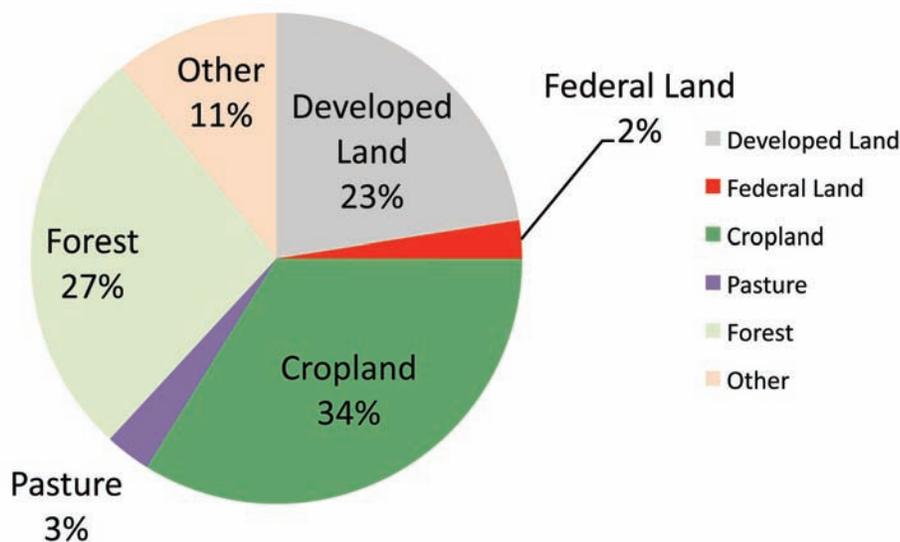


Figure 1. Land Use by Type in Delaware, 2007
Source: 2007 Natural Resources Inventory, USDA, NRCS

economy is much larger than the market sales of agricultural products for any given year. Agricultural contributes to the manufacturing and service sectors of the economy and a more complete accounting of its impact is warranted.

1. INTRODUCTION

Agriculture is an important business in Delaware. It generates farm products that have a market value at the farm level of over one billion dollars in 2007 (2007 Census of Agriculture). It shapes the present and future land use in the state, covering over 40 percent of the land area. Figure 1 shows the land use in Delaware in 2007 based on the USDA's Natural Resource Inventory. The 510,023 acres in farms in 2007 included cropland, pasture, and forested lands. Farming provides a living for over 2,500 farm families and it employs many others as full-time and part-time workers. Over time, the size of this industry is smaller when compared to other sectors of the economy, but it still provides a strong foundation that is often undercounted and undervalued in Delaware's economy.

The purpose of this report is to provide a better accounting of the value of the agricultural sector in Delaware's economy. We will accomplish this objective by using



two strategies that are accepted and commonly used within the economic development field. The first strategy is to expand the pie of how we define agriculture to include related industries of forestry (often associated with farm land owners), agricultural supplies and services, and the processing and manufacturing of agricultural products which takes place within Delaware. This approach simply recognizes that farmers are involved with and contribute to the economy in a wider range of activities in the production and marketing of food products.

For example, Perdue AgriBusiness recently announced they will move their corporate headquarters to Seaford, Delaware along with an \$8 million investment and 110 to 120 new jobs. The Delaware Office of Economic Development is supplying a \$1.74 million grant to help in the transition. The News Journal used the following headline to describe the event, Delaware jobs: Perdue subsidiary HQ going to Seaford: Del. welcomes 'great' AgriBusiness jobs (The News Journal, November 17, 2010). This significant activity contributes to the economy in real ways and is related to agriculture. However, if we follow the conventional practice and only focus on agricultural production and farm gate market sales, this agriculture-based economic

activity by Perdue AgriBusiness would not be fully counted as part of the economic contribution of agriculture to Delaware's economy. Such an omission would be inappropriate because it underestimates the total contribution of agriculture to the state's economy.

The second strategy employs the idea that contributions of agricultural production and food processing results in value-added to the economy, which includes multipliers in the labor force and the rest of the economy. Specifically, we conducted a quantitative economic analysis of the contributions of the agricultural industry to Delaware's overall economy. This economic analysis focused on both the direct and indirect contributions of agriculture. This component is estimated from an economic modeling technique called Input-Output Analysis.

A major contention of this report is that we need to consider three main components of agriculture when we think of the contributions of agriculture to the economy of Delaware. The first is the market value of products sold from the production on the farm. This is what has been traditionally reported from the Census of Agriculture over the years. The second component is the revenue from the processing and



other economic sectors within Delaware. Section 4 provides a discussion of results and implications for Delaware agriculture and section 5 concludes the report.

2. THE ROLE OF AGRICULTURE IN DELAWARE'S ECONOMY

In recent decades, the structure of agriculture has changed and is still changing. A major area of change is the significantly higher level of production efficiency and increased diversity in the list of activities that could be classified as agriculture. Due to the limited scope of this study, we will only focus on the implications of the changes in agricultural productivity on farm structure and economics.

2.1 IMPLICATIONS OF A MORE EFFICIENT AGRICULTURE

The increased production efficiency in U.S. agriculture has far-reaching implications for farm size, productivity, income and employment in this sector. By itself, agricultural production will never be a large part of employment, income or GDP of Delaware's economy. The farm sector is very competitive and as a result production efficiency is very high. As noted earlier, the number of producers has steadily declined over the last century, as has the number of acres in production. Yet, farmers are producing and marketing more products than ever before. The tremendous gains in efficiency have resulted in fewer producers and farm laborers, working on larger farms, producing more goods and services. These gains in production efficiency came through innovations, better technology and application of biological scientific discoveries, and increased productivity. As a result, in 2007 agri-

manufacturing of agricultural and forestry products. This component essentially increases the size of the pie by recognizing that the business of agriculture also includes the processing of the agricultural products into the market, such as processed foods or timber. And the third component is the inter-industry linkages of the value-added to the economy from the first two components. The third component uses an economic modeling analysis to estimate the economy-wide multiplier effects of all agricultural-related expenditures and employment.

The remainder of this report is organized as follows. Section 2 contains an overview of the role of agriculture in Delaware's economy with emphasis on a discussion of historical economic statistics and trends in agriculture. Section 3 provides a brief discussion of the methodology and data used in the analysis of the inter-linkages between the agricultural industry and

Delaware Employment By Key Industries, 1978 to 2007

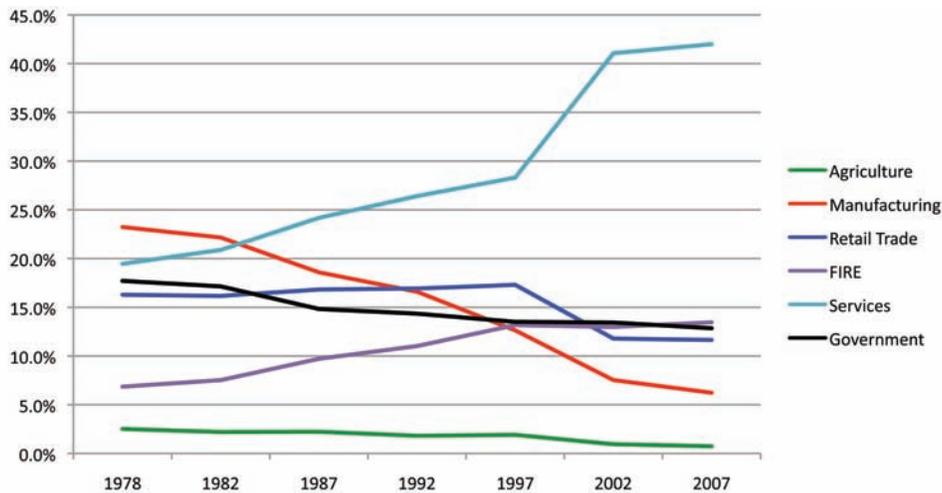


Figure 2. Delaware Employment in Key Industries from 1978 to 2007 (Percent of Total)

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

culture as defined by what is produced on the farm, accounted for 0.8 percent of employment, 0.7 percent of income, and 0.8 percent of GDP (Source: BEA, Regional and Economic Accounts).

Figures 2 and 3 show the relative contributions of the agricultural sectors to employment and GDP for Delaware. Over the 1978 to 2007 time period, em-

ployment in agricultural production showed a slight decline as a percent of total employment, but overall remained relatively flat. The biggest changes over this time period is that percent employed in manufacturing declined rapidly while services and FIRE (Finance, Insurance and Real Estate) showed large gains in the percent of total employment.

In terms of GDP, the market sales of agricultural

Components of Delaware's GDP, 2007

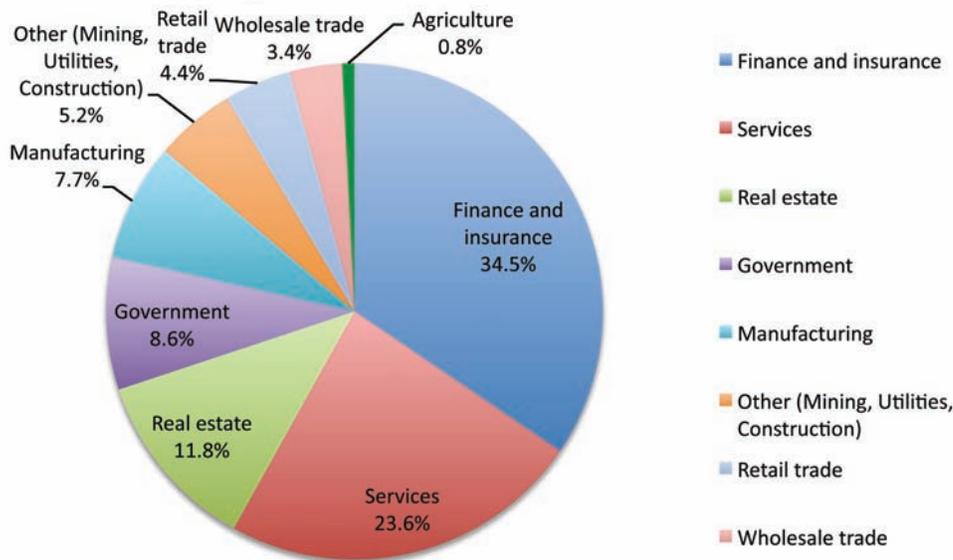


Figure 3. The Relative Components of Delaware's GDP by Sector, 2007

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



products, accounts for less than one percent of Delaware's GDP in 2007 (see Figure 3). Finance and insurance make up the largest contributions (34.5%) followed by services (23.6%), real estate (11.8%), and government (8.6%). Over time we would notice shifts in the relative contributions – a decline in manufacturing, a gain in finance and insurance and the service sectors – but agriculture, as represented by market sales from the farm, would only be a relatively small amount of the state's GDP. However, as we argued earlier and will show later in this report, a fuller accounting of agriculture's contributions to the state will yield a larger and more justified contribution to the economy.

2.2 THE CHANGING NATURE OF AGRICULTURE IN DELAWARE

Without question, agriculture is a major business. The family farm is often seen as a way of life and an historical marker of American past. Nevertheless, it is a business that uses various inputs (e.g., land, capital, labor, etc.) to produce outputs for domestic and international markets. To be economically sustainable, it

must make a profit over most years or the producer will be forced to liquidate. Farmers deal with a considerable amount of risk, just like any other business. However, beyond interest rates, business cycles, trade restrictions, regulations, taxes, and the state of the economy, farmers also endure weather-related risk. Agriculture is a unique sector within the U.S. economy because of yield and total output uncertainties associated with variations in temperature and precipitation levels. Thus, various government agricultural support policies are designed to serve as income safety nets for agricultural producers.

The business of agriculture has been an important component of the history of the United States and served as the foundation of the birth of the nation. The U.S. began as a predominantly agrarian nation, providing one of the few accesses to affordable land in the world in the 17th and 18th centuries. In the distant past, most rural people in America were farmers. It was not until somewhere between the 1910 and the 1920 Censuses that the U.S. first became predominantly urban. And it was not until sometime in the 1930s that the rural population mostly lived off or

was not connected to the farm. Over time agriculture became more productive and capital inputs were substituted for labor, thereby freeing up large pools of surplus rural labor. These labor pools moved into the cities and provided the workforce for an industrial expansion. And while less labor was used on the farm and while other sectors of the economy grew in importance for both employment and income, the agricultural sector still remains a strong foundation of the economy.

What has been true for the nation is also true for Delaware. There is a rich history of agriculture in the First State that has shaped the economy and land use that continues today. The number of farms, the number of families engaged in the business of agriculture, and the amount of land in agriculture have all decreased. However, in its place is a more productive

and efficient agricultural system. Thus while over time that story has changed, agriculture still remains an important pillar of the state economy.

Figure 4 shows the trend over the last 100 years in the number of Delaware farms and the acres in farms. At the turn of the 19th Century, Delaware had 9,687 farms with 1,066,228 acres in farmland. At that time over 85% of the land area in the state was considered agricultural. The number of farms declined more rapidly than the acres in farms over the last century. By 1950, the number of farms declined to 7,448 (a loss of 2239 farms or a 23% decline). At that point in time, about two-thirds of Delaware was in farmland. By the turn of the 21st century, Delaware had 2,546 farms covering 510,023 acres (2007 Census of Agriculture for Delaware). Compared to the numbers in 1900, this represent a decline of 73.7% of farms and 52.1%

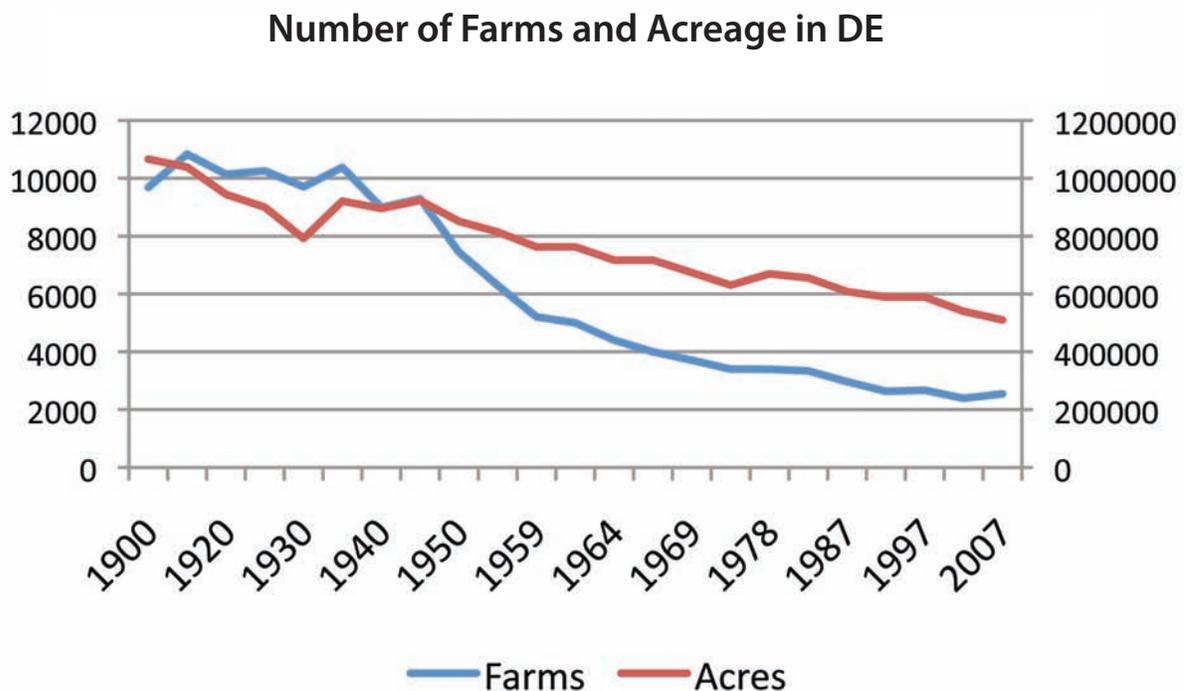


Figure 4. Number of Farms and Acres in Farms in Delaware, 1900 to 2007

Source: Statistical Abstract of the U.S. and the Census of Agriculture



Average Farm Size in DE

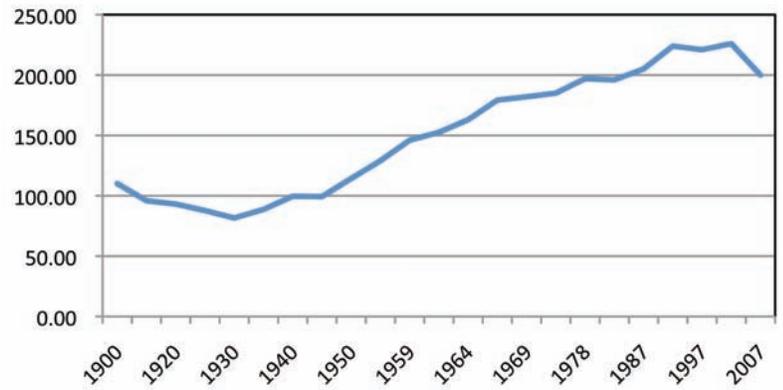


Figure 5. Average Farm Size in Delaware, 1900 to 2007

Source: Statistical Abstract of the U.S. and the Census of Agriculture

in farmland. By 2007, agriculture accounted for 40.8% of all land in Delaware, still a considerable percentage and the dominant form of land use in the state. The national pattern for the U.S. as a whole was very similar.

While the number of farms and the number of acres in Delaware agriculture were declining, the average farm size increased steadily since the 1940s (see Figure 5). In 1900 the average farm size in Delaware was 110 acres and it remained relatively flat until the 1940s. However, following WWII, farm size began to increase rapidly. By 1960, the average farm size was nearly 153 acres, and in 1982 it was 196 acres. Farm size in Delaware peaked at 226 acres and has since declined slightly (possibly due to changes in the definition of a farm which allowed horse farms to be counted in 2007). The increase in farm size reflected both technological and biological innovations within agriculture that allowed a single operator to be more productive and maintain a larger operation. Innovations in farm equipment, the use of fertilizers and pes-

ticides, and agronomic production techniques all contributed to increased efficiency and productivity. Part of the steeper decline in the number of farms relative to the decline in acreage reflected the consolidation of farming in the state. As some producers left farming, others bought their land and increased their acreage. The average farm size in Delaware is nearly half of the U.S. average of 418 acres in 2007. The trend in average farm size in Delaware is consistent with the pattern for the U.S.

If we look at a size breakdown of Delaware farms by the amount of land it is evident that most of the land and production lies with a small number of very large farm operations. Figure 6 shows the breakdown of the number of farms by six size categories. The figure shows the distribution by the percent number of farms and the percentage of acres and the contrast between the two indicates an important point of modern agriculture. While there were 2,546 farms counted in 2007, the majority of them are less than 50 acres in size. Only 5.7 percent of all farms are over 1,000 acres

Percent Number of Farms and Acres By Farm Size, 2007

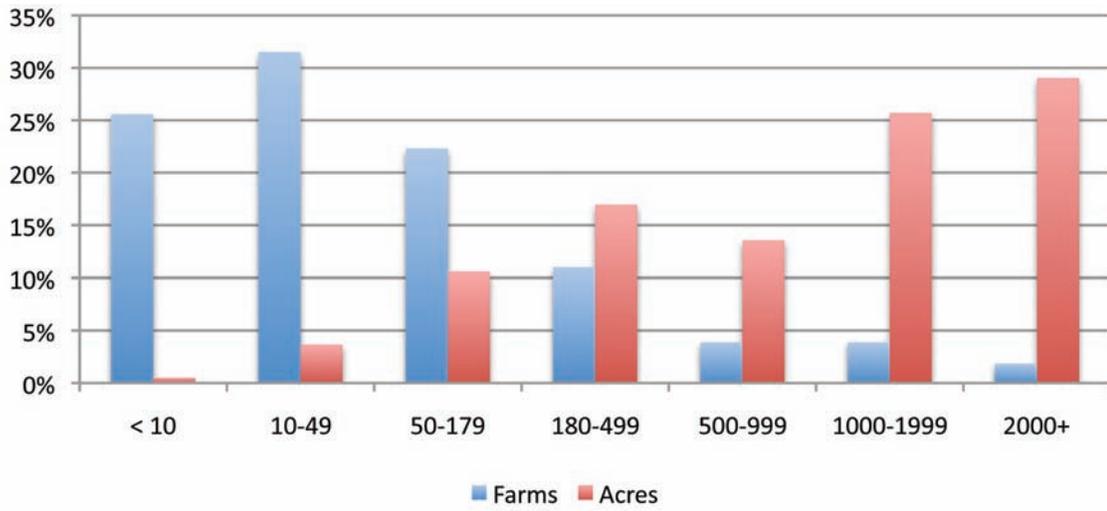


Figure 6. Percent Farms and Acres by Farm Size Category, 2007

Source: 2007 Census of Agriculture





in size, and only 1.8 percent are above 2000 acres. Yet most of the acreage in farmland in Delaware belongs to farm operations that are over 1,000 acres in size. These large farms are responsible for most of the production and market value of products in the state.

The following is a summary of statistics on agricultural production in Delaware from the 2007 Census of Agriculture.

- The number of farms in Delaware in 2007 was 2,546 which covers 510,253 acres, or 41 percent of all state land.
- The average farm size in Delaware is 200 acres. The median size is considerably lower at 31 acres. The median is the middle value, so this means that the majority of farms are small farms.
- Only 9.6 percent of farms are 500 acres or more.
- The total market value of agricultural products sold at the farm in Delaware was \$1,083,035,000 in 2007 (rounded to \$1.1 billion).
- The overwhelming majority of the market sales was poultry (77.3%) followed by corn (6.3%), soybeans (2.9%) and milk and other dairy

products (2.0%).

- It is important to note that while \$837 million of market value is poultry products, the bulk of this revenue went to the integrator company because of the contract nature of poultry production.
- The majority of the farms (54.0%), acreage (52.8%), and market value (78.4%) are located in Sussex County in the southern part of Delaware.
- Nearly 60 percent of Delaware farmers indicated their principle occupation is farming.
- The average age of farmers in Delaware is 55.4 years, a continuing trend of aging of agricultural producers in the state.

3. DATA AND METHODOLOGY

3.1 DATA SOURCES AND ISSUES

Data for this report comes from three main sources. The first is from the Regional Economic Accounts (formally known as the Regional Economic Information System -REIS) of the Bureau of Economic Analy-

sis (BEA). This data are estimates of income and employment based on models using data from administrative records from the Bureau of Census, the USDA, Department of Labor, the Social Security Administration, the IRS, and many other federal agencies. A second source of data is from the Census of Agriculture administered first by the Bureau of Census and later by the Department of Agriculture. Finally, a third major source of data is from records and accounts developed specifically by the Minnesota IMPLAN Economic Modeling System.

Whenever we deal with economic data we have to recognize that definitions for key variables may change over time. This is especially true for agricultural data. According to the USDA Census of Agriculture, the definition of a farm is the following.

The census 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. The definition has changed nine times since it was established in 1850. The current definition was first used for the 1974 Census of Agriculture and has been used in each subsequent agriculture census. This definition is consistent

with the definition used for current USDA surveys.

Source: United States Summary and State Data, Volume 1, Geographic Area Series, Part 51 AC-07-A-51.

Most of the data presented here were from the 1978 to 2007 Censuses of Agriculture where the definition of a farm has remained fairly consistent, although there have been a few changes in the 2002 Census of Agriculture. We used the same dates for data as the Bureau of Economic Analysis (BEA). An important change took place in the BEA Regional Economic Accounts in 2001 when the Standard Industrial Classification system (SIC) changed to the North American Industry Classification System (NAICS).

Two key points about market receipts and income from agriculture are important to note. The first is that the nature of agricultural production is that there is tremendous volatility from year to year due to weather and price fluctuations. Farmers have some tools (e.g., futures and options market) to manage volatility, but it is never fully tamed. Figure 7 shows the volatility of farm marketing receipts from 1969 to 2007. The jagged up and down pattern reflects the volatility of the market.

The second point about agriculture is that as an indus-

Volatility of Delaware Farm Marketing Receipts, 1985 to 2007

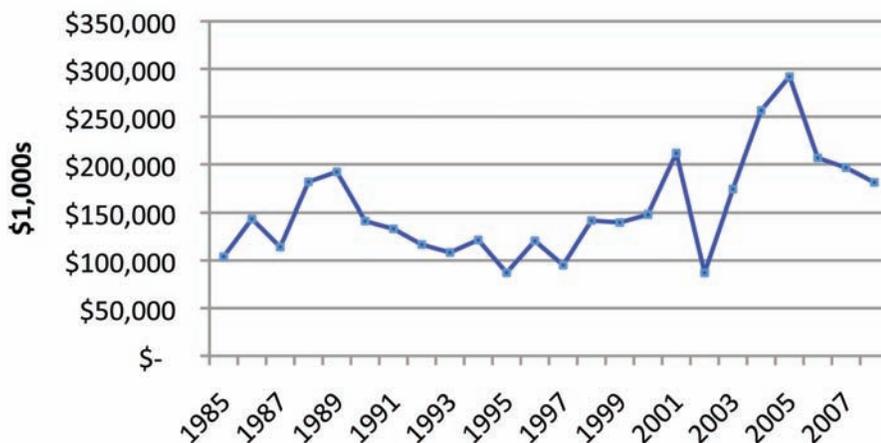


Figure 7. The Volatility of Annual Delaware Farm Marketing Receipts, 1985 to 2007

Source: BEA, Regional and Economic Accounts, CA45 - Farm income and expenses

try, farmers incur a large amount of expenses for labor and other inputs to generate the market value of sales in a given year. Figure 8 shows a rough “balance sheet” for agricultural sales and expenses in Delaware for the years 1978 to 2007. This figures show that the net income to farmers and farm labor cost is relatively small compared to the volume of sales and expenses. In fact, without other income sources in some years the income for proprietors and farm labor would be considerably lower.

government payments, although this amount is less than some might think for Delaware farmers. Over the time period from 1978 to 2007 the percentage from government payments was as low as 1.1% in 1982 to a high of 13.7% in 2002. Some of the variation in payments reflects special programs enacted within a specific time period. The average percentage across the time period was 7.1%.

Another important source of income for farmers is

3.2 METHODOLOGY:

Balance Sheet For Delaware Agriculture, 1978 to 2007

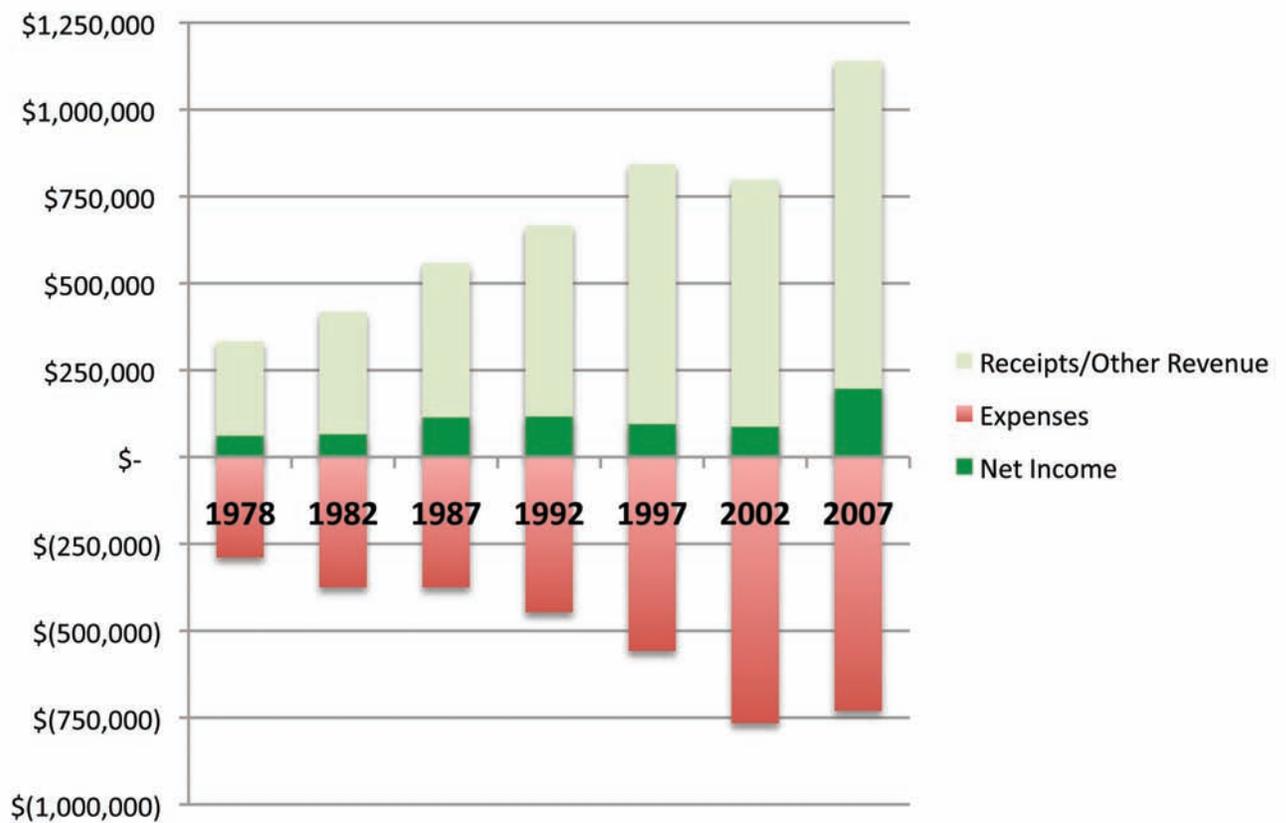


Figure 8. A Rough Balance Sheet for Delaware Agriculture, 1978 to 2007
 Source: BEA, Regional and Economic Accounts, CA45 - Farm income and expenses

OVERVIEW OF INPUT-OUTPUT MODELING

The quantitative analyses were accomplished through the use of the Input-Output Analysis modeling framework, which is a method of quantifying the relationships between sectors of an economy. The economic impact analysis component of the study shows the complex interconnections between agriculture and other industries in the state of Delaware and provides quantitative estimates of direct, indirect and induced effects.

Economic impact analysis involves the development of a detailed accounting of inter-industry activities and linkages. This economic analytical framework is commonly described as input-output analysis. Wassily Leontief, a Nobel Prize winner in economics, developed this method of analysis. Input-output analysis uses a mathematical modeling approach to model the transactions between various industries in the economy. The input-output model requires the collection of economic data for a specific geographic region (county, state, or nation). The main emphasis is on the economic activity of a group of industries that both produce goods (output) and consume goods from other industries (input) in the process of producing the specific industry's output.

The economic impact analysis of Delaware's agricultural sector was done to account for inter-industry activities and determine how much value agriculture adds to the rest of the state economy. This analysis uses state level data and national data for various industries within the economy. The model estimates an



input-output table, which shows all the economic transactions generated by impacted industries in the state of Delaware. The analysis builds a set of outputs, which identifies the purchase and sale transactions between industries within a state system and with neighboring regions (imports and exports). The analysis generates a set of multipliers which represent a quantitative measure of the extent that a change in employment or expenditures is expected to generate in additional effects throughout the economy. Multipliers translate the consequences of change taking into account the complicated linkages in the economy. For example, a state employment multiplier can be estimated which relates a change in agricultural sector employment to the resulting total employment change in the state. In input-output analysis, there are many different multipliers that can be estimated and reported. The most appropriate multipliers are those that do not double-count or overestimate the impacts of changes in employment or expenditures in one industry relative to others. Most studies report the direct, indirect, and induced

multiplier effects of a particular industry on the overall economy's output, income, and employment levels. The direct effect measures the direct contribution of agricultural industry expenditures to Delaware's economy. The indirect effect measures the effect of agricultural industry expenditures on non-agricultural industries that supply inputs and services used by the agricultural industry. Finally, the induced effect measures the impact of expenditures by households that receive income from the agricultural industry – in other words, the effect of household spending as a result of income from agriculture.

The input-output analysis and corresponding multipliers were derived using the nationally accepted software called IMPLAN (Impact Analysis Planning). The IMPLAN model was originally developed at the University of Minnesota for the U.S. Forest Service. Tables 1-7 provide detailed information on the economic impact analysis results and estimates of various multipliers.



3.3 DEFINING ECONOMIC MULTIPLIERS

The multipliers are often described as estimators of the “ripple” effect of an industry's economic activities on the other impacted industries in the economy. The IMPLAN manual recommends the use of the Type SAM multiplier and it is obtained as follows:

Type SAM multiplier = (direct effect + indirect effect + induced effect) / direct effect.

Additional definitions of the terms used in the result tables are given below:

Industry Output Multipliers represent the total dollar value of output generated in the economy by a \$1 change in final demand for the products of a particular sector.

Value Added Multipliers represent the total effect of a \$1 change in output on employee compensation, plus proprietary income plus other property income plus indirect business tax. This is an alternative income multiplier that accounts for other incomes beyond agricultural labor income.

Labor Income Multipliers represent the total change in statewide household labor income due to a \$1 change in the labor expenditure of a given sector in response to change in demand for the sector.

Employment Multipliers measure the total employment change in the state resulting from a change in employment of a given sector as a result of a change in final demand.

4. EMPIRICAL RESULTS

4.1 OVERVIEW

The objective of this section of the study is to estimate the direct, indirect, induced and total impact of the agricultural sector on the economy of in 2008. In order to accurately capture the economic importance of this industry, it is necessary to first discuss the components and linkages that define an integrated economic sector.

In Delaware, the agricultural industry has a far-reaching impact on other industries in the state economy in terms of expenditures on various materials and in-

puts used in the production of animals and crops (e.g., labor, energy, etc.). Non-agricultural industries benefiting from agricultural production and business expenditures include real estate, vehicle and equipment sales, services, wholesale, retail, manufacturing, and other related industries. Delaware's agricultural producers support their business activities with land purchases, capital investments, and equipment purchases and they utilize a variety of other industry support goods and services, many of which help stimulate the economic well-being of other businesses in the state of Delaware.

Table 1. Direct Effects of Delaware Agriculture by Industry Components, 2008.

	Employment	Labor Income (Million \$)	Value Added (Million \$)	Output (Million \$)
Agriculture	13,919	695.8	1,072.0	4,993.0
Production	3,089	176.2	300.3	1,197.2
Crops	1,796	63.8	113.1	297.4
Animal	1,293	109.4	182.4	888.4
Processing	10,829	519.6	771.7	3,795.8
Crops	2,521	178.5	387.6	1,542.1
Animal	8,309	341.1	384.1	2,253.7
Forestry	2,082	132.6	240.5	831.0
Production	38	3.0	4.8	11.5
Processing	2,044	129.7	235.8	819.5
Ag-Related Services	1,090	20.3	15.3	28.7
Total	17,091	845.8	1,323.1	5,841.2

4.2 DIRECT IMPACT OF DELAWARE AGRICULTURE

Table 1 contains data on direct effects of economic activities in agriculture in the state. These data has not been subjected to any transformations or modeling. Rather, they are the reported raw data from national data reporting agencies (e.g., BEA, USDA) summarizing the base value of agricultural economic activities in the state. In 2008, Delaware agriculture

accounted for a total of \$5.8 billion of output, over 17,000 jobs and over \$ 1.3 billion in value added. These aggregate amounts were further disaggregated by the three main sectors (agriculture, Forestry, and agriculture-related services (e.g., crop dusting and ditch digging); by agricultural activities (production and processing), and by sub-sectors within agriculture (animal and crops). For example, the total direct effect of agriculture is \$4.993 billion of which the majority are derived from agricultural and food pro-

Table 2. Total, Direct, Indirect and Induced Impact of Delaware Agriculture, 2008.

	Employment	Labor Income	Value Added	Output
		(Million \$)	(Million \$)	(Million \$)
Overall Total				
Direct	17,091	845.8	1,323.1	5,841.2
Indirect	5,884	400.9	653.7	1,198.9
Induced	6,909	303.1	546.2	906.1
Total	29,884	1,549.8	2,523.0	7,946.2
Multiplier	1.75	1.83	1.90	1.36
By Major Categories				
Agriculture				
Direct	13,919	692.9	1,067.2	4,981.5
Indirect	4,948	337.5	549.3	1,003.1
Induced	5,718	250.8	452.0	749.8
Total	24,584	1,281.2	2,068.4	6,734.5
Multiplier	1.76	1.85	1.93	1.35
Forestry				
Direct	2,082	132.6	240.5	831.0
Indirect	915	61.8	102.3	189.4
Induced	1,068	46.9	84.5	140.2
Total	4,065	241.4	427.3	1,160.6
Multiplier	1.95	1.82	1.78	1.40
Ag-Related Services				
Direct	1,090	20.3	15.3	28.7
Indirect	22	1.5	2.2	6.3
Induced	123	5.4	9.7	16.1
Total	1,235	27.2	27.2	51.1
Multiplier	1.13	1.34	1.78	1.78

cessing activities (\$3.796 billion). The most commonly cited number for the impact of agriculture is the \$1.19 billion derived from production agriculture only. As noted before, the value for production agriculture is only a part of the big picture. As shown from this table, production agriculture only represents about 20 percent of the total direct effect of agricultural activities in the state of Delaware. In addition to the direct effect values provided above, we also need to account for the impact contributed by indirect and induced effects, which are a smaller fraction of the aggregate contribution of agriculture.

4.3 AGGREGATE IMPACT OF DELAWARE AGRICULTURE

the total effect broken down into direct, indirect, and induced contributions of Delaware’s agricultural in-

dustry to the state economy. As shown in Table 2, the aggregate economic contribution of all categories of the agricultural industry is \$7.95 billion in total industry output. The total value of \$7.95 billion in output is the sum of direct, indirect, and induced effects. In addition to agricultural business expenditures, there are also induced effects where income by operators and workers in the sector are also used in purchasing products and services from other Delaware businesses. The industry contributes \$2.5 billion in value added activity, and \$1.6 billion in labor income. The estimated total number of jobs supported by the agricultural industry is almost 30,000 jobs in 2008. The employment figures include full-time, part-time, and seasonal employment. The agricultural industry as a whole generates an employment multiplier of 1.8 and an output multiplier of 1.4.

Table 3. Economic Impact of Delaware Agriculture by Counties.

	Employment	Labor Income (Million \$)	Value Added (Million \$)	Output (Million \$)
New Castle				
Direct	2,341	139.3	230.7	813.6
Indirect	1,016	70.9	115.2	211.9
Induced	1,091	50.8	90.5	150.1
Total	4,448	260.9	436.4	1,175.6
Multiplier	1.90	1.87	1.89	1.44
Kent				
Direct	4,609	246.3	450.4	2,037.0
Indirect	2,004	119.7	191.2	384.6
Induced	1,889	71.6	129.8	217.0
Total	8,502	437.7	771.3	2,638.7
Multiplier	1.84	1.78	1.71	1.30
Sussex				
Direct	9,615	442.2	597.5	2,941.6
Indirect	2,771	155.7	246.2	485.5
Induced	2,992	113.3	221.3	355.1
Total	15,378	711.1	1,064.9	3,782.2
Multiplier	1.60	1.61	1.78	1.29

4.4 ECONOMIC IMPACT OF AGRICULTURE BY CATEGORIES

In addition to the total industry impact results in Table 2, separate results are also provided by industry components. Table 3 contains a breakdown of the economic impact of agriculture by the three Delaware counties. Sussex county is the largest agricultural region of the state in terms of economic value and contribution of to the economy. Sussex county generates a total industry output of \$3.78 billion and a total of 15,378 jobs. These output figures translate to a total effect of \$711 million in labor income. Agriculture in this county also generates output multipliers of 1.3 and an employment multiplier of 1.6. In addition, agriculture in Kent accounts for a total industry output in the amount of \$2.64 billion and a total of 8,502 jobs. In

contrast to the other counties, New Castle agriculture contribute \$1.2 billion in total industry output to Delaware's economy and 4,448 jobs.

Furthermore, Tables 4-7 presents a summary of economic impact estimates for seven key agricultural industry categories (poultry, dairy, fruits and vegetables, corn, soybeans, wheat, greenhouse, nursery and horticultural products). Table 4 contains the economic impact estimates for the poultry sector in Delaware. The results indicate that poultry is the largest agricultural industry in Delaware. Poultry production and processing activities accounts for over \$3.2 billion dollars in industry output, 13,437 jobs, and \$911.6 million in value added. The economic impact of the fruits and vegetables industry is provided in Table 5. The results show that fruits and vegetables production and

Table 4. Economic Impact of Delaware's Poultry Industry.

	Employment	Labor Income (Million \$)	Value Added (Million \$)	Output (Million \$)
Poultry (Total)				
Direct	8,191	368.0	445.4	2,383.9
Indirect	2,249	151.5	238.2	422.3
Induced	2,997	126.5	227.9	376.4
Total	13,437	646.0	911.6	3,182.6
Multiplier	2	1.76	2.05	1.34
Production				
Direct	1,046	104.2	163.7	811.9
Indirect	504	31.5	53.8	104.6
Induced	820	34.4	62.2	102.8
Total	2,370	170.1	279.8	1,019.2
Multiplier	2.27	1.63	1.71	1.26
Processing				
Direct	7,145	263.8	281.6	1,572.0
Indirect	1,746	119.9	184.4	317.7
Induced	2,176	92.1	165.7	273.6
Total	11,067	475.8	631.8	2,163.3
Multiplier	1.55	1.80	2.24	1.38

Table 5. Economic Impact of Delaware's Fruits and Vegetables Industry.

	Employment	Labor Income (\$)	Value Added (\$)	Output (\$)
		(Million \$)	(Million \$)	(Million \$)
Fruits and Veg. Total				
Direct	354	29.8	31.5	115.6
Indirect	163	9.4	18.0	33.6
Induced	237	9.9	17.9	29.6
Total	754	49.1	67.5	178.8
Multiplier	2.08	1.53	2.08	1.61
Production Only				
Direct	282	26.1	24.9	78.6
Indirect	111	5.8	12.2	23.6
Induced	195	8.2	14.8	24.4
Total	587	40.0	51.9	126.5
Multiplier	2.08	1.53	2.08	1.61
Processing Only				
Direct	73	3.8	6.6	37.0
Indirect	53	3.6	5.8	10.0
Induced	42	1.8	3.2	5.3
Total	167	9.1	15.6	52.3
Multiplier	2.08	1.53	2.08	1.61

Table 6. Economic Impact of Delaware's Dairy Industry.

	Employment	Labor Income	Value Added	Output
		(Million \$)	(Million \$)	(Million \$)
Dairy Total				
Direct	157	4.2	13.4	56.3
Indirect	58	3.6	6.3	11.4
Induced	44	1.9	3.4	5.6
Total	260	9.7	23.1	73.3
Multiplier	1.24	3.33	1.35	1.24
Production Only				
Direct	108	0.6	7.7	20.3
Indirect	17	1.0	2.0	3.7
Induced	9	0.4	0.7	1.1
Total	134	1.9	10.3	25.1
Multiplier	1.24	3.33	1.35	1.24
Processing Only				
Direct	50	3.6	5.7	36.0
Indirect	41	2.7	4.3	7.7
Induced	36	1.5	2.7	4.5
Total	126	7.8	12.8	48.1
Multiplier	1.24	3.33	1.35	1.24

Table 7. Economic Impact of Delaware Crops and Horticultural Products.

	Employment	Labor Income (Million \$)	Value Added (Million \$)	Output (Million \$)
Corn				
Direct	657	10.8	35.7	78.8
Indirect	105	5.0	11.4	22.7
Induced	96	4.0	7.3	12.0
Total	858	19.8	54.4	113.6
Multiplier	1.31	1.83	1.52	1.44
Soybeans				
Direct	328	8.2	16.6	51.0
Indirect	89	3.9	9.0	16.9
Induced	75	3.1	5.6	9.3
Total	492	15.3	31.3	77.3
Multiplier	1.50	1.86	1.88	1.51
Wheat				
Direct	366	6.0	19.9	43.9
Indirect	59	2.8	6.4	12.6
Induced	54	2.2	4.1	6.7
Total	478	11.0	30.3	63.2
Multiplier	1.31	1.83	1.52	1.44
Greenhouse, Nursery, and Floriculture Products				
Direct	95	7.4	7.0	15.9
Indirect	14	0.8	1.6	4.0
Induced	50	2.1	3.8	6.3
Total	160	10.4	12.5	26.1
Multiplier	1.31	1.83	1.52	1.44

processing activities accounts for about \$179 million dollars in industry output, 754 jobs, and \$67.5 million in value added activities. Furthermore, Table 6 shows the economic contribution of the dairy industry, which produces \$73.3 million in industry output and provides 260 jobs.

In addition, the breakout of the economic impact results for four other agricultural sectors (corn, soybeans, wheat, greenhouse, nursery and horticultural products) are provided in Table 7. For example, corn production activities generate a total industry output of \$113.6 million and a total of 858 jobs while soybeans produce a total industry output of \$77.3 mil-

lion and a total of 492 jobs. These output figures translate to a total effect of \$19.8 million and \$15.3 million in labor income for corn and soybeans, respectively. Due to the nature of the sector and data limitations on processing activities, only production estimates are reported.

5. CONCLUDING REMARKS

This study provides an overview and analysis of the economic impact of agriculture on the Delaware state economy. While some previous studies have examined the impact of specific sectors or commodities (e.g., equine and poultry sectors), this is the first study

in recent decades that engaged in a comprehensive and thorough investigation of the role and contribution of agriculture as a whole in Delaware. This project is particularly timely because of the recent dynamic changes in the structure and performance of the agricultural industry in Delaware and nationally.

The empirical results indicate that the agricultural industry makes very important contribution to the overall economy of Delaware. Specifically, the total economic contribution of all categories of agriculture in Delaware is \$7.95 billion in industry output in 2008. A portion of this amount goes to Delaware workers and agricultural producers in the form of wages, salaries, and profits. In addition to agricultural business expenditures, income by operators and workers in the sector are also spent in purchasing product and services from other Delaware businesses. The agricultural industry contributes \$2.5 billion in value added activity, and \$1.6 billion in labor income. The total value is the sum of direct, indirect, and induced effects. The estimated total number of jobs supported by the agricultural industry is about 30,000 jobs in 2008. The employment figures include full-time, part-time, and seasonal employment. The agricultural industry as a whole generates a job multiplier of 1.8 and an output multiplier of 1.4.

In addition to the total industry impact results, separate results are also provided for various categories by sub-sectors, by counties and for key industry commodities categories. The majority of the economic value of the agricultural sector comes from the production and processing of poultry products. This sub-sector produces an industry output of \$3.2 billion and a total of 13,437 jobs. These output figures translate to a total effect of \$646 million in labor income. The poultry sector generates a job multiplier of 2 and an output multiplier of 1.34.

The growing importance of the agricultural industry as an invaluable source of food and jobs would continue to make this a growth industry worthy of greater public and private investment. The agricultural sector will play a significant role in the evolution of U.S. agricultural policy targeting the growing national concern over health and nutrition and the resulting government programs addressing these issues. Given the findings of this study, it is important that policy makers in Delaware are proactive in seeking market-based policies to promote the growth of the agricultural industry in the state.



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