

# THE ECONOMIC AND FISCAL IMPACTS OF THE MUSHROOM INDUSTRY

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REPORT SUBMITTED TO:  
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## 1.0 INTRODUCTION

### 1.1 REPORT BACKGROUND

The mushroom sector is a significant portion of the agricultural industry in Pennsylvania and the United States. The American Mushroom Industry (AMI) is a national voluntary trade organization that represents the growers, processors, and marketers of mushrooms nationwide. AMI's work includes supporting and disseminating relevant information including research on the mushroom industry.

As part of this work, AMI hired Econsult Solutions, Inc. (ESI) to measure the economic impact of the mushroom industry in Pennsylvania and nationwide. The purpose of this report is to define and estimate the economic and fiscal impacts of the mushroom industry.<sup>1</sup> This includes total expenditures, employment, labor income, and tax revenues directly or indirectly generated by the mushroom industry, both nationally and at the state-level in Pennsylvania.

### 1.2 OVERVIEW OF REPORT

This report has three sections:

Section 1: Introduction – Section 1 introduces the background for this report and details the methodology used to model the economic impact of the mushroom industry.

Section 2: Economic Impact – This section quantifies the economic and fiscal impact to Pennsylvania of direct and indirect expenditures of the mushroom industry.

Section 3: Fiscal Impact – Section 3 quantifies the economic impact of the mushroom industry nationwide, measuring the direct, indirect, and induced impacts of the mushroom industry in the United States.

### 1.3 INDUSTRY BACKGROUND

In 2017, the value of mushroom production in the United States was \$1.22 billion. This represents an 8 percent increase in value since 2007.<sup>2</sup> The total crop was 929 million pounds, a 2 percent drop from the previous year, but an overall increase of 12 percent over the past decade. Growers in Pennsylvania account for approximately 60 percent of mushroom sales nationwide, a number that has remained steady over the last 10 years.

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<sup>1</sup> Fiscal impacts are generated for Pennsylvania only. This is to anonymize the revenue of individual firms. In Pennsylvania, there are enough firms to present an aggregated, statewide number without sharing identifying information about any individual firms. Outside of Pennsylvania, there are states with only one mushroom firm in operation. Presenting fiscal impacts for these states would enable the extrapolation of revenue data about those firms. Therefore, we produce a nationwide economic impact for non-Pennsylvania firms, but did not include statewide fiscal impacts for those entities.

<sup>2</sup> All prices are calculated in 2017 U.S. dollars.

While the value of production is up, the industry is simultaneously consolidating. The number of agaricus and specialty mushroom growers dropped by 32 percent between 2007 and 2017. Increased production has been driven by growers purchasing existing operations and expanding their own operations, both by building new production facilities and making their existing operations more efficient.

With these changes, it is important to understand the current economic impact of the mushroom industry in the United States. This quantifiable economic data will enable the American Mushroom Institute to better advocate for the industry's needs.

#### 1.4 ECONOMIC BENEFITS DELIVERED BY THE MUSHROOM INDUSTRY

In Pennsylvania, the mushroom industry has a direct impact of \$764 million. This generates a total economic impact of \$1.1 billion, supporting 8,600 jobs with \$287 million in employee compensation. Nationally, the \$1.6 billion industry has a total impact of \$3.1 billion, and supports 21,000 jobs with \$864 million in employee compensation.

#### 1.5 REPORT METHODOLOGY

This report relies on data from the United States Department of Agriculture (USDA) National Agriculture Statistics Service (NASS), interviews with industry leaders, and a survey conducted by ESI of firms involved at various stages of mushroom production. These data sources were combined to estimate the direct footprint of the mushroom industry in Pennsylvania and nationally.

In 2017, ESI conducted a survey of mushroom industry firms. The survey asked respondents about multiple aspects of their business, including organization structure, production levels, employment, and operating costs. Using the survey responses, we estimated the value of inputs required to produce one dollar's worth of mushrooms. The respondents were used as a sample of the broader industry. Ratios of the mushrooms grown by the firms that completed the survey were used to estimate other inputs to the mushroom industry, accounting for differences in firm structure, integration, and production.

With these estimates, we were able to quantify the amount spent on spawn, casing, and compost in order to produce the total amount of mushrooms sold in 2017 (as calculated by the USDA). The direct footprint of the mushroom industry is therefore comprised of four components: spawn, casing, compost, and mushrooms. In order to avoid double counting of the inputs as both direct mushroom industry activity and material purchased by mushroom growers, the value of the inputs were removed from the indirect portion of the model.

Estimates of the economic impact of the mushroom industry are generated using IMPLAN, an input/output modeling software. IMPLAN is industry standard software for assessing the economic and job creation impacts of economic development projects, the creation of new businesses, and public policy changes. IMPLAN translates an initial amount of direct economic activity into the total amount of economic activity that it supports, which includes multiple waves of spillover impacts generated by spending on goods and services and by spending of labor income by employees. Direct economic activity generated by the mushroom industry translates into additional economic activity within Pennsylvania and nationally:

- First, some proportion of the mushroom industry’s direct expenditures that goes to the purchase of goods and services is circulated back into an economy when those goods and services are purchased from local vendors. This represents the “**indirect effect**,” and reflects that local purchases of goods and services support local vendors, that in turn require additional purchasing with their own set of vendors. Note that for the purpose of this report, the major inputs to mushroom production, including spawn, casing, and compost, are considered part of the direct spending of the mushroom industry, and are therefore not included in the purchases of goods and are not counted in indirect effect.
- Second, the salaries firms in the mushroom industry pay to their employees are circulated back into an economy when the employees spend their earnings on various goods and services. This represents the “**induced effect**,” and reflects that some of those goods and services will be purchased from local vendors, further stimulating a local economy.

The total economic impact of the mushroom industry is the sum of its own direct economic footprint and the indirect and induced effects generated by that direct footprint.

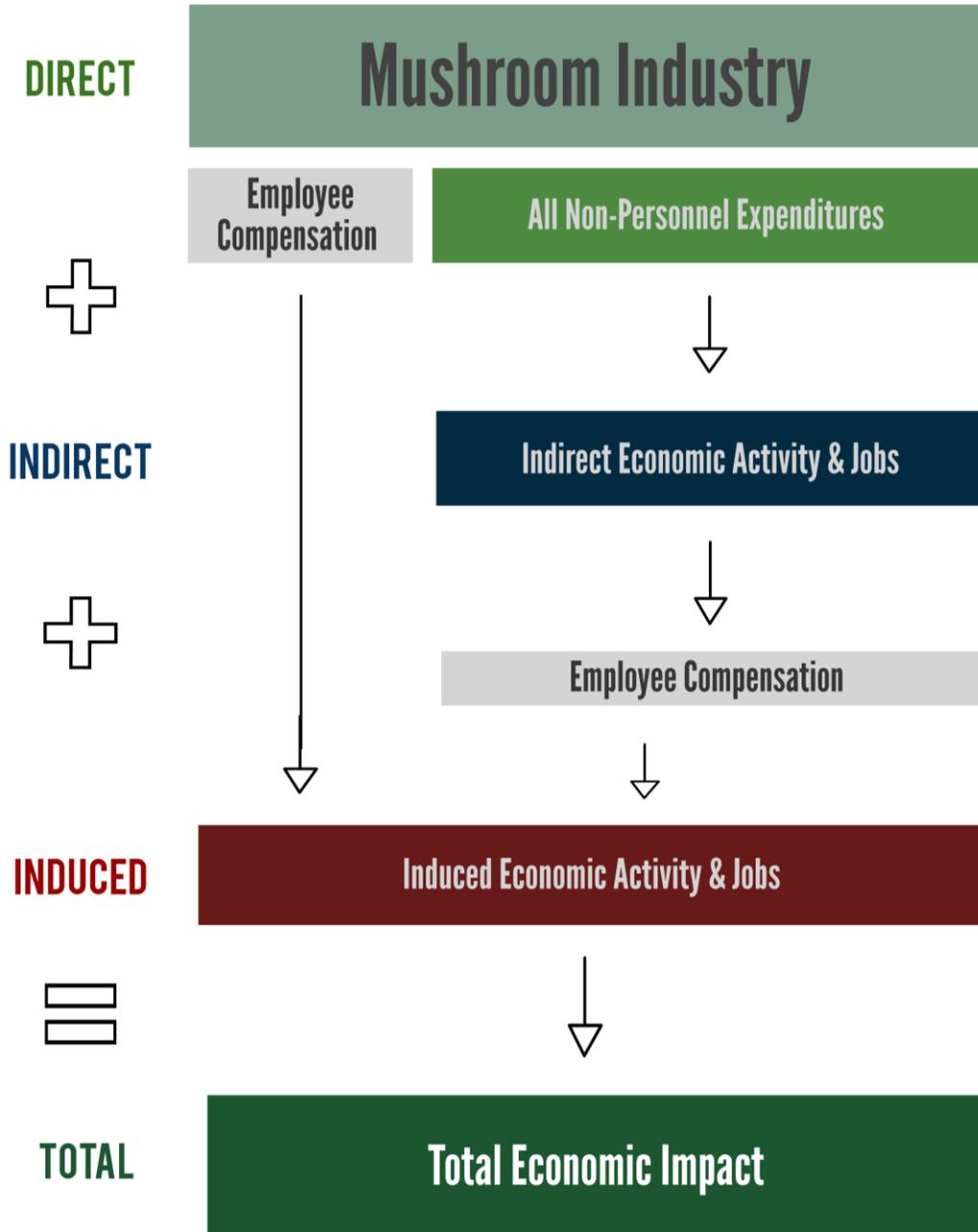
## 1.6 ABOUT ECONSULT SOLUTIONS



This report was authored by Econsult Solutions, Inc., a Philadelphia-based economic consulting firm. It provides businesses and public policy makers with economic consulting services in urban economics, real estate economics, transportation, public infrastructure, development, public policy and finance, community and neighborhood development, and planning, as well as litigation expert witness support services.

## 2.0 ECONOMIC IMPACT OF THE PENNSYLVANIA MUSHROOM INDUSTRY

TABLE 2.1 – ECONOMIC IMPACT METHODOLOGY



## 2.1 ECONOMIC IMPACTS FROM THE PENNSYLVANIA MUSHROOM INDUSTRY

In 2017, the mushroom industry had a footprint of \$764 million in Pennsylvania. Sales of Pennsylvania mushrooms and of the inputs to produce mushrooms – including spawn, casing, and compost – bring money from around the country to Pennsylvania and supports local firms and jobs (see Table 2.1).

**TABLE 2.1 – TOTAL MUSHROOM INDUSTRY SALES, COMMONWEALTH OF PENNSYLVANIA, 2017 (\$M)**

<b>Inputs</b>	<b>Commonwealth of Pennsylvania</b>
Mushroom Sales	\$602.1
Spawn Sales	\$34.0
Casing Sales	\$27.1
Compost Sales	\$100.7
<b>Total Industry Sales</b>	<b>\$763.8</b>

*Source: USDA (2017), ESI (2018), American Mushroom Institute (2018)*

Pennsylvania's \$764 million mushroom industry creates significant economic impacts through the Commonwealth. The industry generates \$322 million in indirect and induced spending. In total, the economic impact of the mushroom industry is \$1.1 billion, supporting 8,600 jobs with \$287 million in employee compensation.

**TABLE 2.2 – ANNUAL ECONOMIC IMPACT OF THE MUSHROOM INDUSTRY, COMMONWEALTH OF PENNSYLVANIA**

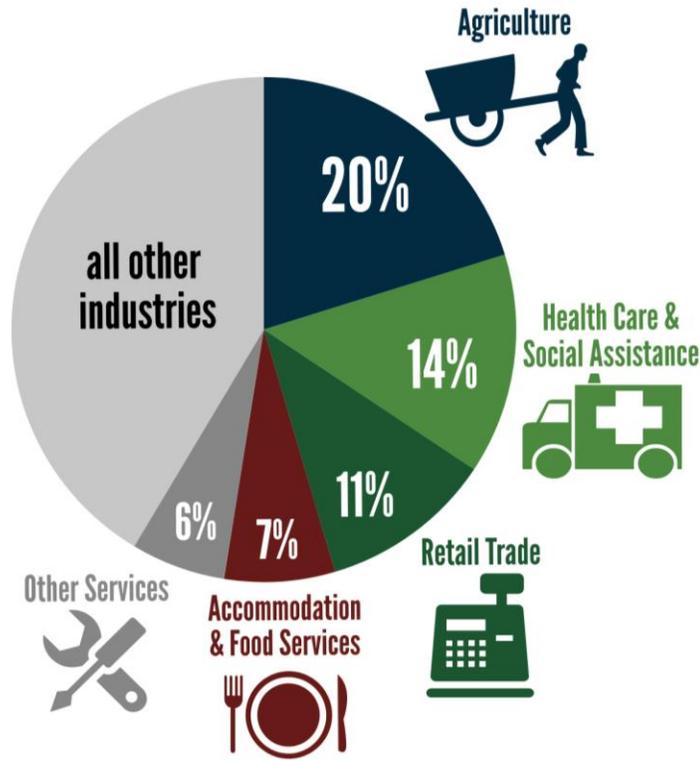
<b>Economic Impact</b>	<b>Commonwealth of Pennsylvania</b>
Direct Output (\$M)	\$764
Indirect & Induced Output (\$M)	\$322
<b>Total Impact (\$M)</b>	<b>\$1,086</b>
<b>Total Employment Supported (FTEs)</b>	<b>8,600</b>
<b>Employee Compensation (\$M)</b>	<b>\$287</b>

*Source: IMPLAN (2015)*

## 2.2 INDUSTRIES SUPPORTED

The mushroom industry supports jobs throughout the economy. In Pennsylvania, 75 percent of the total jobs impact is direct. The other 25 percent of indirect and induced job creation is felt across numerous sectors. The top sectors include agriculture, health care, retail, accommodation and food services, and other professional services.

**FIGURE 2.2 – ANNUAL INDIRECT AND INDUCED JOBS SUPPORTED BY THE MUSHROOM INDUSTRY, COMMONWEALTH OF PENNSYLVANIA**



Source: IMPLAN (2015), Piktochart (2018)

### 2.3 FISCAL IMPACT

In addition to the direct, indirect, and induced impacts, the mushroom industry also generates considerable tax revenue to the Commonwealth of Pennsylvania. This includes income tax from direct, indirect, and induced jobs. Business taxes are generated from mushroom firms and the additional firms they support through indirect and induced impacts. This direct, indirect, and induced economic activity also generates significant sales tax revenue for the Commonwealth. In total, the mushroom industry in Pennsylvania generates an estimated \$16 million in tax revenue for the Commonwealth annually.

**TABLE 2.3 – ANNUAL FISCAL IMPACT OF THE MUSHROOM INDUSTRY IN PENNSYLVANIA (\$M)**

<b>Fiscal Impact</b>	<b>Commonwealth of Pennsylvania</b>
Income Tax	\$4.9
Sales Tax	\$8.7
Business Tax	\$2.9
<b>Total Tax Revenue</b>	<b>\$16.4</b>

Source: ESI (2018)

## 3.0 ECONOMIC IMPACT OF THE UNITED STATES MUSHROOM INDUSTRY

### 3.1 ECONOMIC IMPACTS FROM THE UNITED STATES MUSHROOM INDUSTRY

The direct economic impact of the mushroom industry nationwide is more than \$1.6 billion. Mushroom sales generated more than \$1.2 billion in impact in 2017. The inputs for mushroom production – spawn, casing and compost – generated an additional \$300 million in impact.

**TABLE 3.1 – TOTAL MUSHROOM INDUSTRY SALES, UNITED STATES, 2017 (\$M)**

<b>Inputs</b>	<b>United States</b>
Mushroom Sales	\$1,222.0
Spawn Sales	\$85.0
Casing Sales	\$55.0
Compost Sales	\$204.3
<b>Total Industry Sales</b>	<b>\$1,566.4</b>

*Source: USDA (2017), American Mushroom Institute (2018)*

Nationally, the \$1.6 billion mushroom industry generates an additional \$1.5 billion in indirect and induced spending, for a total impact of over \$3.1 billion. The industry supports 21,000 jobs with \$864 million in wages.<sup>3</sup>

**TABLE 3.2 – ANNUAL ECONOMIC IMPACT OF THE MUSHROOM INDUSTRY, UNITED STATES**

<b>Economic Impact</b>	<b>United States</b>
Direct Output (\$M)	\$1,566
Indirect & Induced Output (\$M)	\$1,542
<b>Total Impact (\$M)</b>	<b>\$3,108</b>
<b>Total Employment Supported (FTEs)</b>	<b>21,000</b>
<b>Employee Compensation (\$M)</b>	<b>\$864</b>

*Source: IMPLAN (2015)*

<sup>3</sup> The ratio between direct and indirect/induced benefits are greater nationwide because the larger geography captures more indirect and induced benefits than a statewide geography. There is a greater range of businesses nationwide for the business-to-business spending of indirect impacts, and the purchasing of goods and services for the induced benefits of induced spending capture a greater share at the national level than within a single state.

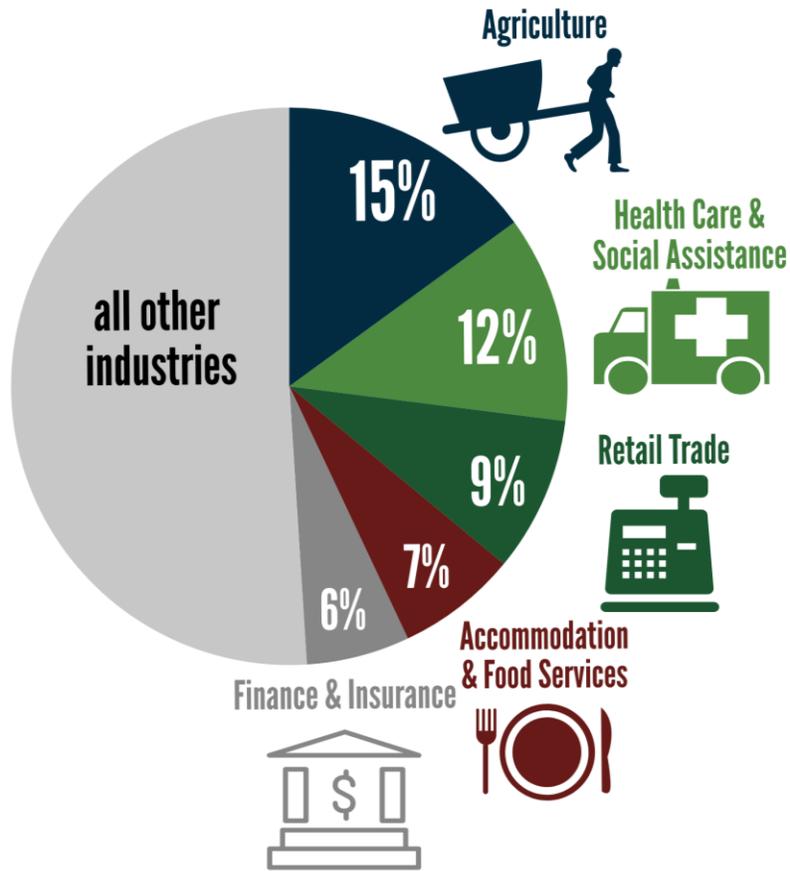
**FIGURE 3.1 – ANNUAL ECONOMIC IMPACT OF ONE POUND OF MUSHROOMS, UNITED STATES**

Source: IMPLAN (2015), Piktochart (2018)

### 3.2 INDUSTRIES SUPPORTED

The mushroom industry supports jobs throughout the economy. Nationally, 60 percent of the total jobs impact is direct. The other 40 percent of indirect and induced job creation is felt across numerous sectors. The top sectors include agriculture, health care, retail, accommodation and food services, and finance and insurance.

FIGURE 3.1 – ANNUAL INDIRECT AND INDUCED JOBS SUPPORTED BY THE MUSHROOM INDUSTRY, UNITED STATES



Source: IMPLAN (2015), Piktochart (2018)

## 4.0 CONCLUSION

This report explored the economic value of the mushroom industry in Pennsylvania and the United States. The mushroom industry experienced steady growth over the past decade, but started to decline in 2016. In tandem, the industry has been consolidating. Between 2007 and 2017, the number of agaricus and specialty mushroom growers dropped by 32 percent. Growth in the industry can be attributed to the expansion and increased efficiency in existing operations. The overall growth of the industry in recent years has driven its total economic impact. Nationwide, the mushroom industry had a \$3.1 billion economic impact in 2017 and accounted for more than 21,000 jobs. In total, each pound of mushrooms produced has an economic impact of \$3.30 in the United States.

## APPENDIX A – ECONOMIC AND FISCAL IMPACT MODEL THEORY

### A.1 Overview

Economic impact estimates are generated by utilizing **input-output models** to translate an initial amount of direct economic activity into the total amount of economic activity that it supports, which includes multiple waves of spillover impacts generated by spending on goods and services and by spending of labor income by employees. This section summarizes the methodologies and tools used to construct, use, and interpret the input-output models needed to estimate the mushroom industry's economic impact

### A.2 Input-Output Model Theory

In an inter-connected economy, every dollar spent generates two spillover impacts:

- First, some amount of the proportion of that expenditure that goes to the purchase of goods and services gets circulated back into an economy when those goods and services are purchased from local vendors. This represents what is called the “indirect effect,” and reflects the fact that local purchases of goods and services support local vendors, who in turn require additional purchasing with their own set of vendors.
- Second, some amount of the proportion of that expenditure that goes to labor income gets circulated back into an economy when those employees spend some of their earnings on various goods and services. This represents what is called the “induced effect,” and reflects the fact that some of those goods and services will be purchased from local vendors, further stimulating a local economy.

The role of input-output models is to determine the linkages across industries in order to model out the magnitude and composition of spillover impact to all industries of a dollar spent in any one industry. Thus, the total economic impact of the mushroom industry is the sum of the direct economic footprint plus the indirect and induced effects generated by that direct footprint.

### A.3 Input-Output Model Mechanics

To model the impacts resulting from the direct expenditures generated by the mushroom industry, Econsult Solutions, Inc. developed a customized economic impact model using the **IMPLAN** input/output modeling system. IMPLAN represents an industry standard approach to assess the economic and job creation impacts of economic development projects, the creation of new businesses, and public policy changes.

IMPLAN is one of several popular choices for regional input-output modeling. Each system has its own nuances in establishing proper location coefficients. IMPLAN uses a location quotient to

determine its regional purchase coefficient (RPC). This represents the proportion of demand for a good that is filled locally; this assessment helps determine the multiplier for the localized region. Additionally, IMPLAN also accounts for inter-institutional transfers (e.g. firms to households, households to the government) through its Social Account Matrix (SAM) multipliers. IMPLAN takes the multipliers and divides them into 440 industry categories in accordance to the North American Industrial Classification System (NAICS) codes.

These economic impacts in turn produce one-time or ongoing increases in various tax bases, which yield temporary or permanent increases in various tax revenues. To estimate these increases, Econsult Solutions, Inc. created a **fiscal impact model** to translate total economic impacts into their commensurate tax revenue gains.

#### **A.4 Employment and Wages Supported**

IMPLAN estimates the direct jobs employed by the project or activity being modeled. These estimated direct jobs will be displayed in the report unless the number of jobs are known beforehand by the project's owner, and if provided, will be noted in the body of the report. The project/activity expenditures also support induced and indirect jobs. These are jobs not directly employed by the project, but instead are employees who work for the project's vendors and employees who work at businesses frequented by those employees directly employed by the project. We report the total jobs supported by the project, therefore all direct, indirect, and induced jobs. These jobs are a mix of full-time and part-time jobs.

IMPLAN generates job estimates based on the term job-years, or how many jobs will be supported each year. For instance, if a construction project takes two years, and IMPLAN estimates there are 100 employees, or more correctly "job-years" supported, over two years, that represents 50 jobs each year. The 50 jobs represent the annualized number of jobs supported by the construction project. The job can be the same each year such as the coffee barista serving the directly employed construction workers or different if in the first year of the project a welder is needed and in the second year of the project an electrician is required.

The total income is for all direct, indirect and induced jobs. It includes proprietor income, wages, and all benefits. Since many projects/events require the employment sourced from multiple industries, the average wages paid will be different per industry. Therefore, it is not correct to divide the total labor income and divide it by the total job-years to derive an average employee compensation estimate.

#### **A.5 Fiscal Impacts**

The economic impacts described above in turn produce one-time or ongoing increases in various tax bases, which yield temporary or permanent increases in various tax revenues. The IMPLAN model does provide a rough estimate of the fiscal impact of this increased economic activity on state and local governments. To develop more precise estimates in certain categories, ESI has developed a custom fiscal model for the United States that translates total economic impacts (as

estimated by the IMPLAN model described above) into their commensurate tax revenue gains for the Federal Government by calculating the effective tax rate on various types of economic activity.