ACKNOWLEDGMENTS

Emsi gratefully acknowledges the excellent support of the staff at the Texas A&M University Athletics Department in making this study possible. Special thanks go to Ross Bjork, Director, Texas A&M athletics department, who approved the study, and to Carole Dollins, Senior Vice President of Ticketing, 12th Man Foundation; John Friebele, Vice President of Sales & Marketing, Experience Bryan-College Station; Steve Miller, Assistant Athletic Director, Texas A&M athletics department; and David Roubion, Associate Athletics Director, Texas A&M athletics department, who collected much of the data and information requested. Any errors in the report are the responsibility of Emsi and not of any of the above-mentioned individuals.
EXECUTIVE SUMMARY

This report assesses the impact of the Texas A&M University athletics department (Texas A&M Athletics) on the county economy and the benefits generated by the department for taxpayers. The results of this study show that Texas A&M Athletics creates a positive net impact on the county economy and generates benefits for state and local taxpayers.

ECONOMIC IMPACT ANALYSIS

During the analysis year, Texas A&M Athletics spent $54.3 million on payroll and benefits for 1,510 full-time and part-time employees, and spent another $114.7 million on goods and services to carry out its day-to-day operations. This initial round of spending creates more spending across other businesses throughout the county economy, resulting in the commonly referred to multiplier effects. This analysis estimates the net economic impact of Texas A&M Athletics that directly takes into account the fact that state and local dollars spent on Texas A&M Athletics could have been spent elsewhere in the county if not directed towards the department and would have created impacts regardless. We account for this by estimating the impacts that would have been created from the alternative spending and subtracting the alternative impacts from the spending impacts of Texas A&M Athletics.

This analysis shows that in fiscal year (FY) 2018-19, operations, construction, and visitor spending of Texas A&M Athletics generated $128.8 million in added income for the Brazos County economy. The additional income of $128.8 million created by Texas A&M Athletics is equal to approximately 1.4% of the total gross regional product (GRP) of Brazos County. For perspective, this impact from the department is larger than the entire Transportation & Warehousing industry in the county. The impact of $128.8 million is equivalent to supporting 3,197 jobs. For further perspective, this means that one out of every 46 jobs in Brazos County is supported by the activities of Texas A&M Athletics and its visitors. In terms of sales, the total impact from Texas A&M Athletics on Brazos County was $371.8 million. These economic impacts break down as follows:

OPERATIONS SPENDING IMPACT

Payroll and benefits to support the department’s day-to-day operations amounted to $54.3 million. The department’s non-pay expenditures amounted to $114.7 million. The net impact of operations spending by the department in Brazos County during the analysis year

1 Note that Emsi considers added income as a more accurate measure of impact than sales because added income does not include the money that leaked out of the county economy to out-of-county suppliers and does not include intermediary transactions, whereas sales includes these leakages and intermediary transactions.
was approximately $83.5 million in added income, which is equivalent to supporting 1,952 jobs. In terms of sales, the impact from operations spending was $210.7 million.

CONSTRUCTION SPENDING IMPACT

Texas A&M Athletics invests in construction each year to maintain its facilities, create additional capacities, and meet its growing educational demands. While the amount varies from year to year, these quick infusions of income and jobs have a substantial impact on the county economy. In FY 2018-19, the department's construction spending generated $9.7 million in added income, which is equivalent to supporting 162 jobs. In terms of sales, the impact from construction spending was $37.5 million.

VISITOR SPENDING IMPACT

Hundreds of thousands of out-of-county visitors attracted to Brazos County for activities hosted by Texas A&M Athletics brought new dollars to the economy through their spending at hotels, restaurants, gas stations, and other county businesses. The spending from these visitors added approximately $35.7 million in income for the Brazos County economy, which is equivalent to supporting 1,084 jobs. In terms of sales, the impact from visitor spending was $123.6 million.

Of the $35.7 million in added income, $33 million stemmed from visitors of athletic events and the remaining $2.7 million is from visitors attending third-party events hosted in Texas A&M Athletics’ facilities. Notably, $22.7 million emanated from football events.

TAXPAYER BENEFITS ANALYSIS

By Texas A&M Athletics spending money on paying employees and non-pay expenditures, along with spending by non-local visitors attending events hosted by the department, earnings and business profits are increased across the state. This results in state and local taxpayers seeing higher tax revenues. In FY 2018-19, taxpayers received an estimated $3.3 million in added tax revenue stemming from the department's spending and the spending of its visitors in the state of Texas. Narrowing the focus down to the local taxpayers of Brazos County, local taxpayers received $3.0 million in added tax revenues from the spending of Texas A&M Athletics and its visitors in FY 2018-19.

IMPORTANT NOTE

When reviewing the impacts estimated in this study, it’s important to note that it reports impacts in the form of added income rather than sales. Sales includes all of the intermediary costs associated with producing goods and services, as well as money that leaks out of the county as it is spent at out-of-county businesses. Income, on the other hand, is a net measure that excludes these intermediary costs and leakages, and is synonymous with gross regional product (GRP) and value added. For this reason, it is a more meaningful measure of new economic activity than sales.

The reader should also note that when looking at impact studies completed by other firms, impacts are often presented in terms of sales. In addition, the reader should note that all impacts presented here are considered net; in other words, counterfactual scenarios are considered. Emsi removes the impacts that would have occurred anyway, even without Texas A&M Athletics. Many other impact studies may present gross impact figures. Gross impact figures can be found in the main body of this report.
INTRODUCTION

The Texas A&M University athletics department (Texas A&M Athletics) is led by Ross Bjork, Director. The department’s service region, for the purpose of this report, is Brazos County.

While Texas A&M Athletics affects the county in a variety of ways, many of them difficult to quantify, this study is concerned with considering its economic benefits. The department, its day-to-day operations, its construction activities, and the expenditures of its visitors support the county economy through the output and employment generated by county vendors. The benefits created by the department extend as far as the state treasury in terms of increased tax receipts.

This report assesses the impact of Texas A&M Athletics as a whole on the county economy and the benefits generated by the department for state and local taxpayers. The approach is twofold. We begin with an economic impact analysis of the department on the Brazos County economy. To derive results, we rely on a specialized Multi-Regional Social Accounting Matrix (MR-SAM) model to calculate the added income created in the Brazos County economy as a result of increased consumer spending. Results of the economic impact analysis are broken out according to the following impacts: 1) impact of the department’s day-to-day operations, 2) impact of the department’s construction spending, and 3) impact of visitor spending. The second component of the study measures the benefits generated by Texas A&M Athletics for state and local taxpayers in the form of increased tax revenues.

The study uses a wide array of data that are based on several sources, including the FY 2018-19 visitor and financial reports from Texas A&M Athletics; industry and employment data from the Bureau of Labor Statistics and Census Bureau; and outputs of Emsi’s impact model and MR-SAM model.

Emsi, working with Texas A&M University’s Office of Public Partnership and Outreach, has also created reports that show the economic impact of Texas A&M University on the state and region, including separate reports for the Galveston campus and the Texas A&M University Health Science Center. These may be accessed at ppo.tamu.edu.

TEXAS A&M ATHLETICS IMPACTS BRAZOS COUNTY BY ATTRACTING VISITORS TO THE COUNTY, WHO THEN INJECT NEW MONIES INTO THE COUNTY ECONOMY THROUGH THEIR SPENDING.
CHAPTER 1:
PROFILE OF THE TEXAS A&M
UNIVERSITY ATHLETICS DEPARTMENT AND THE ECONOMY

Texas A&M University (Texas A&M) is a large public research university based in College Station, Texas, with locations and facilities throughout Texas, and with research and academics that encompass a worldwide community. Established in 1876 as the first institution of higher education in Texas, today it is a multi-campus university with more than 70,000 students and over 500,000 living alumni.

Texas A&M creates an ongoing economic impact through the increased skills and career potential of its students—the “Aggies”—and its general economic activity in Texas. But it also creates a significant economic impact through the activity of its athletics department. The university’s athletics department is home to twenty varsity programs (nine men’s and 11 women’s), which compete in the NCAA’s Division I Southeastern Conference.

Aggie athletics are a tradition almost as old as Texas A&M itself; the university’s first official football game was played in 1894. The first baseball game was in 1897. Today, these original programs have been supplemented by 18 more: men’s programs in basketball, cross-country, golf, swimming, and track and field, and women’s programs in basketball, cross-country, equestrian sports, golf, soccer, softball, swimming, tennis, track and field, and volleyball. The department also offers a wide range of non-varsity sports and athletics clubs and activities to keep all of its students active.

Central to the economic value of Texas A&M Athletics are the construction and renovation of the department’s facilities and the large number of visitors attracted to Brazos County by athletic and third-party events. Some of Texas A&M’s most notable facilities include:

- Kyle Field (built in 1927 and most recently renovated in 2015), the largest football stadium in Texas with a seating capacity of over 102,000;
- Reed Arena (opened in 1998), home to men’s and women’s basketball and volleyball, as well as numerous community events, concerts, trade shows, and conferences; and
- Olsen Field at Blue Bell Park (built in 1978 and significantly renovated in 2011), home of baseball.
Texas A&M Athletics Employee and Finance Data

The study uses two general types of information: 1) data collected from the department and 2) county economic data obtained from various public sources and Emsi’s proprietary data modeling tools. This chapter presents the basic underlying information from Texas A&M Athletics used in this analysis and provides an overview of the Brazos County economy.

Employee Data

Data provided by Texas A&M Athletics include information on staff by place of work and by place of residence. These data appear in Table 1.1. As shown, Texas A&M Athletics employed 328 full-time and 1,267 part-time staff in FY 2018-19. Of these, 100% worked in the county and 50% lived in the county. These data are used to isolate the portion of the employees’ payroll and household expenses that remains in the county economy.

<table>
<thead>
<tr>
<th>Full-time staff</th>
<th>Part-time staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>328</td>
<td>1,267</td>
</tr>
<tr>
<td><strong>Total staff</strong></td>
<td><strong>1,595</strong></td>
</tr>
<tr>
<td>% of employees who work in the county</td>
<td>100%</td>
</tr>
<tr>
<td>% of employees who live in the county</td>
<td>50%</td>
</tr>
</tbody>
</table>

Table 1.1: Employee data, FY 2018-19

Revenues

Figure 1.1 shows the department’s annual revenues by funding source—a total of $212.7 million in FY 2018-19. As indicated, contributions comprised 40% of the total revenue. Ticket sales made up another 23% and media rights another 15%. Nearly 10% of revenue stemmed from royalties, licensing, advertisement, and sponsorships. The remaining 12% of revenue came from conference distributions of Bowl Generated Revenue, sports camps, and other revenue sources.

See Appendix 5 for a detailed description of the data sources used in the Emsi modeling tools.

$212.7 million total revenues

Contributions, 40%
Media rights, 15%
All other revenue, 6%
Ticket sales, 23%
Royalties, licensing, advertisement, & sponsorships, 9%
Conference distributions of Bowl Generated Revenue, 3%
Sports camps, 3%
All other revenue, 6%

Figure 1.1: Texas A&M Athletics revenues by source, FY 2018-19

$193 million total expenditures

Employee salaries, wages, & benefits, 28%
Construction, 12%
Operation & maintenance of plant, 13%
All other expenditures, 46%

Figure 1.2: Texas A&M Athletics expenses by function, FY 2018-19

Source: Data provided by Texas A&M Athletics.
Percentages do not add due to rounding.
Figure 1.2 displays the department’s expense data. The combined payroll at Texas A&M Athletics amounted to $54.3 million. This was equal to 28% of the department’s total expenses for FY 2018-19. Other expenditures, including operation and maintenance of plant, construction, depreciation, and purchases of supplies and services, made up $138.7 million.

Table 1.2 summarizes the breakdown of the county economy by major industrial sector ordered by total income, with details on labor and non-labor income. Labor income refers to wages, salaries, and proprietors’ income. Non-labor income refers to profits, rents, and other forms of investment income. Together, labor and non-labor income comprise the county’s total income, which can also be considered as the county’s gross regional product (GRP).
As shown in Table 1.2, the total income, or GRP, of Brazos County is approximately $9.4 billion, equal to the sum of labor income ($6.7 billion) and non-labor income ($2.8 billion). In Chapter 2, we use the total added income as the measure of the relative impacts of the department on the county economy.

Figure 1.3 provides the breakdown of jobs by industry in Brazos County. Among non-government industry sectors, the Accommodation & Food Services sector is the largest employer, supporting 15,229 jobs or 10.3% of total employment in the county. The second largest employer (excluding government sectors) is the Retail Trade sector, supporting 13,081 jobs or 8.8% of the county’s total employment. Altogether, the county supports 148,222 jobs.\footnote{Job numbers reflect Emsi’s complete employment data, which includes the following four job classes: 1) employees who are counted in the Bureau of Labor Statistics’ Quarterly Census of Employment and Wages (QCEW), 2) employees who are not covered by the federal or state unemployment insurance (UI) system and are thus excluded from QCEW, 3) self-employed workers, and 4) extended proprietors.}

**FIGURE 1.3:** Jobs by major industry sector in Brazos County, 2019*

* Data reflect the most recent year for which data are available. Emsi data are updated quarterly.

Source: Emsi employment data.
Texas A&M Athletics impacts the Brazos County economy in a variety of ways. The department is an employer and buyer of goods and services. It attracts monies that otherwise would not have entered the county economy through its day-to-day operations, its construction activities, and the expenditures of its visitors.

In this chapter, we estimate the following economic impacts of Texas A&M Athletics: 1) the operations spending impact, 2) the construction spending impact, and 3) the visitor spending impact.

When exploring each of these economic impacts, we consider the following hypothetical question:

**How would economic activity change in Brazos County if Texas A&M Athletics did not exist in FY 2018-19?**

Each of the economic impacts should be interpreted according to this hypothetical question. Another way to think about the question is to realize that we measure net impacts, not gross impacts. Gross impacts represent an upper-bound estimate in terms of capturing all activity stemming from the department; however, net impacts reflect a truer measure of economic impact since they demonstrate what would not have existed in the county economy if not for the department.

Economic impact analyses use different types of impacts to estimate the results. The impact focused on in this study assesses the change in income. This measure is similar to the commonly used gross regional product (GRP). Income may be further broken out into the labor income impact, also known as earnings, which assesses the change in employee compensation; and the non-labor income impact, which assesses the change in business profits. Together, labor income and non-labor income sum to total income.

Another way to state the impact is in terms of jobs, a measure of the number of full- and part-time jobs that would be required to support the change in income. Finally, a frequently used measure is the sales impact, which comprises the change in business sales revenue in the economy as a result of increased economic activity. It is important to bear in mind, however, that much of this sales revenue leaves the county economy through intermediary transactions and costs.4 All of these measures—added labor and non-labor income,  

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4 See Appendix 4 for an example of the intermediary costs included in the sales impact but not in the income impact.
total income, jobs, and sales— are used to estimate the economic impact results presented in this chapter. The analysis breaks out the impact measures into different components, each based on the economic effect that caused the impact. The following is a list of each type of effect presented in this analysis:

• The **initial effect** is the exogenous shock to the economy caused by the initial spending of money, whether to pay for salaries and wages, purchase goods or services, or cover operating expenses.

• The initial round of spending creates more spending in the economy, resulting in what is commonly known as the **multiplier effect**. The multiplier effect comprises the additional activity that occurs across all industries in the economy and may be further decomposed into the following three types of effects:
  - The **direct effect** refers to the additional economic activity that occurs as the industries affected by the initial effect spend money to purchase goods and services from their supply chain industries.
  - The **indirect effect** occurs as the supply chain of the initial industries creates even more activity in the economy through their own inter-industry spending.
  - The **induced effect** refers to the economic activity created by the household sector as the businesses affected by the initial, direct, and indirect effects raise salaries or hire more people.

The terminology used to describe the economic effects listed above differs slightly from that of other commonly used input-output models, such as IMPLAN. For example, the initial effect in this study is called the “direct effect” by IMPLAN, as shown in the table below. Further, the term “indirect effect” as used by IMPLAN refers to the combined direct and indirect effects defined in this study. To avoid confusion, readers are encouraged to interpret the results presented in this chapter in the context of the terms and definitions listed above. Note that, regardless of the effects used to decompose the results, the total impact measures are analogous.

<table>
<thead>
<tr>
<th>Emsi</th>
<th>Initial</th>
<th>Direct</th>
<th>Indirect</th>
<th>Induced</th>
</tr>
</thead>
<tbody>
<tr>
<td>IMPLAN</td>
<td>Direct</td>
<td>Indirect</td>
<td>Induced</td>
<td></td>
</tr>
</tbody>
</table>

Multiplier effects in this analysis are derived using Emsi's Multi-Regional Social Accounting Matrix (MR-SAM) input-output model that captures the interconnection of industries, government, and households in the county. The Emsi MR-SAM contains approximately 1,000 industry sectors at the highest level of detail available in the North American Industry Classification System (NAICS) and supplies the industry-specific multipliers required to determine the impacts associated with increased activity within a given economy. The multi-regional capacity of the MR-SAM allows impacts to be measured in the region and state simultaneously, taking into account the department's activity in each area, as well as each area's economic characteristics. In this analysis, impacts on the region include impacts from the department’s regional activity, as well as the indirect and induced multiplier effects that reach the region from the department’s activity in the rest of the state. For more information on the Emsi MR-SAM model and its data sources, see Appendix 5.

**OPERATIONS SPENDING IMPACT**

Staff payroll is part of the county’s total earnings, and the spending of employees for groceries, apparel, and other household expenditures helps support county businesses. The department itself purchases supplies and services, and many of its vendors are located in Brazos County. These expenditures create a ripple effect that generates still more jobs and higher wages throughout the economy.

Table 2.1 presents department expenditures (not including construction) for the following three categories: 1) salaries, wages, and benefits, 2) operation and maintenance of plant, and 3) all other expenditures (including purchases for supplies and services). The first step in estimating the multiplier effects of the department's operational expenditures is to map these categories of expenditures to the approximately 1,000 industries of the Emsi MR-SAM model. Assuming that the spending patterns of department personnel approximately match those of the average consumer, we map salaries, wages, and benefits to spending on industry outputs using national household expenditure...
coefficients provided by Emsi’s national SAM. All Texas A&M athletics department employees work in Brazos County (see Table 1.1), and therefore we consider 100% of the salaries, wages, and benefits. For the other two expenditure categories (i.e., operation and maintenance of plant and all other expenditures), we assume the department’s spending patterns approximately match national averages and apply the national spending coefficients for NAICS 902612 (Colleges, Universities, and Professional Schools (State Government)).

Operation and maintenance of plant expenditures are mapped to the industries that relate to capital construction, maintenance, and support, while the department’s remaining expenditures are mapped to the remaining industries.

We now have three vectors of expenditures for Texas A&M Athletics: one for salaries, wages, and benefits; another for operation and maintenance of plant; and a third for the department’s purchases of supplies and services. The next step is to estimate the portion of these expenditures that occur inside the county. The expenditures occurring outside the county are known as leakages. We estimate in-county expenditures using regional purchase coefficients (RPCs), a measure of the overall demand for the commodities produced by each sector that is satisfied by county suppliers, for each of the approximately 1,000 industries in the MR-SAM model. For example, if 40% of the demand for NAICS 541211 (Offices of Certified Public Accountants) is satisfied by county suppliers, the RPC for that industry is 40%. The remaining 60% of the demand for NAICS 541211 is provided by suppliers located outside the county. The three vectors of expenditures are multiplied, industry by industry, by the corresponding RPC to arrive at the in-county expenditures associated with the department. See Table 2.1 for a break-out of the expenditures that occur in-county. Finally, in-county spending is entered, industry by industry, into the MR-SAM model’s multiplier matrix, which in turn provides an estimate of the associated multiplier effects on county labor income, non-labor income, total income, sales, and jobs.

Table 2.2 presents the economic impact of department operations spending. The people employed by Texas A&M Athletics and their salaries, wages, and benefits comprise the initial effect, shown in the top row of the table in terms of labor income, non-labor income, total added income, sales, and jobs. The additional impacts created by the initial effect appear in the next four rows under the section labeled multiplier effect. Summing the initial and multiplier effects, the gross impacts are $84.4 million in labor income and $17.3 million in non-labor income. This sums to a total impact of $101.6 million in total added income associated with the spending of the department and its employees in the county. This is equivalent to supporting 2,207 jobs. It can also be said that the impact in terms of sales sums to $249.9 million.

Even though Emsi suggests the reader only consider Texas A&M Athletics impact in terms of added income, impact studies performed by other firms may focus on sales, or output. Therefore, we present the impact in terms of sales along with added income. Emsi considers added income as a more accurate measure of impact than sales because added income does not include the money that leaked out of the county economy.

### Table 2.1: Texas A&M at Galveston expenses by function (excluding depreciation & interest), FY 2018-19

<table>
<thead>
<tr>
<th>Expense category</th>
<th>In-county expenditures (thousands)</th>
<th>Out-of-county expenditures (thousands)</th>
<th>Total expenditures (thousands)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employee salaries, wages, and benefits</td>
<td>54,314</td>
<td>0</td>
<td>54,314</td>
</tr>
<tr>
<td>Operation and maintenance of plant</td>
<td>16,358</td>
<td>9,362</td>
<td>25,721</td>
</tr>
<tr>
<td>All other expenditures</td>
<td>26,662</td>
<td>62,316</td>
<td>88,978</td>
</tr>
<tr>
<td>Total</td>
<td>97,334</td>
<td>71,678</td>
<td>169,012</td>
</tr>
</tbody>
</table>

This table does not include expenditures for construction, as they are presented separately in the following section.

Source: Data provided by Texas A&M Athletics and the Emsi impact model.

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5 See Appendix 2 for a definition of NAICS.
6 See Appendix 5 for a description of Emsi’s MR-SAM model.
to out-of-county suppliers and does not include intermediary transactions, whereas sales includes these leakages and intermediary transactions.

The $101.6 million in gross impact is often reported by researchers as the total impact. We go a step further to arrive at a net impact by applying a counterfactual scenario, i.e., what would have happened if a given event—in this case, the expenditure of in-county funds on Texas A&M Athletics—had not occurred. Texas A&M Athletics received an estimated 23% of its funding from sources within Brazos County. These monies came from in-county visitor ticket sales, auxiliary revenue, and donations from private sources located within the county. We must account for the opportunity cost of this in-county funding. Had other industries received these monies rather than Texas A&M Athletics, income impacts would have still been created in the economy. In economic analysis, impacts that occur under counterfactual conditions are used to offset the impacts that actually occur in order to derive the true impact of the event under analysis.

We estimate this counterfactual by simulating a scenario where in-county monies spent on the department are instead spent on consumer goods and savings. This simulates the in-county monies being returned to the taxpayers and being spent by the household sector. Our approach is to establish the total amount spent by county residents on Texas A&M Athletics, map this to the detailed industries of the MR-SAM model using national household expenditure coefficients, use the industry RPCs to estimate in-county spending, and run the in-county spending through the MR-SAM model’s multiplier matrix to derive multiplier effects. The results of this exercise are shown as negative values in the row labeled less alternative uses of funds in Table 2.2.

The total net impact of the department’s operations is equal to the gross impact less the impact of the alternative use of funds—the opportunity cost of the county money. As shown in the last row of Table 2.2, the total net impact is approximately $75.2 million in labor income and $8.3 million in non-labor income. This sums together to $83.5 million in total added income and is equivalent to supporting 1,952 jobs. In terms of sales, the total net impact came to $210.7 million. These impacts represent new economic activity created in the county economy solely attributable to the operations of Texas A&M Athletics.

### Table 2.2: Operations spending impact, FY 2018-19

<table>
<thead>
<tr>
<th></th>
<th>Labor income (thousands)</th>
<th>Non-labor income (thousands)</th>
<th>Total income (thousands)</th>
<th>Sales (thousands)</th>
<th>Jobs supported</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Initial effect</strong></td>
<td>$54,314</td>
<td>$0</td>
<td>$54,314</td>
<td>$169,012</td>
<td>1,595</td>
</tr>
<tr>
<td><strong>MULTIPLIER EFFECT</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct effect</td>
<td>$16,672</td>
<td>$7,865</td>
<td>$24,537</td>
<td>$43,020</td>
<td>314</td>
</tr>
<tr>
<td>Indirect effect</td>
<td>$3,670</td>
<td>$1,204</td>
<td>$4,874</td>
<td>$8,967</td>
<td>68</td>
</tr>
<tr>
<td>Induced effect</td>
<td>$9,695</td>
<td>$8,216</td>
<td>$17,912</td>
<td>$28,949</td>
<td>229</td>
</tr>
<tr>
<td><strong>Total multiplier effect</strong></td>
<td>$30,037</td>
<td>$17,285</td>
<td>$47,322</td>
<td>$80,935</td>
<td>612</td>
</tr>
<tr>
<td><strong>Gross impact (initial + multiplier)</strong></td>
<td>$84,351</td>
<td>$17,285</td>
<td>$101,637</td>
<td>$249,948</td>
<td>2,207</td>
</tr>
<tr>
<td>Less alternative uses of funds</td>
<td>-$9,158</td>
<td>-$9,027</td>
<td>-$18,185</td>
<td>-$39,221</td>
<td>-255</td>
</tr>
<tr>
<td><strong>Net impact</strong></td>
<td>$75,193</td>
<td>$8,258</td>
<td>$83,451</td>
<td>$210,726</td>
<td>1,952</td>
</tr>
</tbody>
</table>

*Source: Emsi impact model.*
CONSTRUCTION SPENDING IMPACT

In this section, we estimate the economic impact of the construction spending of Texas A&M Athletics. Because construction funding is separate from operations funding in the budgeting process, it is not captured in the operations spending impact estimated earlier. However, like operations spending, the construction spending creates subsequent rounds of spending and multiplier effects that generate still more jobs and income throughout the county. During FY 2018-19, Texas A&M Athletics spent a total of $24 million on various construction projects, such as expanding the swimming and diving facility.

Assuming Texas A&M Athletics construction spending approximately matches national construction spending patterns of NAICS 902612 (Colleges, Universities, and Professional Schools (State Government)), we map Texas A&M Athletics construction spending to the construction industries of the MR-SAM model. Next, we use the RPCs to estimate the portion of this spending that occurs in-county. Finally, the in-county spending is run through the multiplier matrix to estimate the direct, indirect, and induced effects. Because construction is so labor intensive, the non-labor income impact is relatively small.

To account for the opportunity cost of any in-county construction money, we estimate the impacts of a similar alternative uses of funds as found in the operations spending impact. This is done by simulating a scenario where in-county monies spent on construction are instead spent on consumer goods. These impacts are then subtracted from the gross construction spending impacts. Again, since construction is so labor intensive, most of the added income stems from labor income as opposed to non-labor income.

Table 2.3 presents the impacts of the department’s construction spending during FY 2018-19. Note the initial effect is purely a sales effect, so there is no initial change in labor or non-labor income. The FY 2018-19 Texas A&M athletics department construction spending creates a net total short-run impact of $9.7 million in added income—the equivalent of supporting 162 jobs in Brazos County. The sales impact of construction spending came to $37.5 million.

<table>
<thead>
<tr>
<th></th>
<th>Labor income (thousands)</th>
<th>Non-labor income (thousands)</th>
<th>Total income (thousands)</th>
<th>Sales (thousands)</th>
<th>Jobs supported</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Initial effect</strong></td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$23,952</td>
<td>0</td>
</tr>
<tr>
<td><strong>MULTIPLIER EFFECT</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct effect</td>
<td>$6,730</td>
<td>$1,392</td>
<td>$8,122</td>
<td>$15,418</td>
<td>132</td>
</tr>
<tr>
<td>Indirect effect</td>
<td>$1,336</td>
<td>$276</td>
<td>$1,612</td>
<td>$3,060</td>
<td>26</td>
</tr>
<tr>
<td>Induced effect</td>
<td>$1,676</td>
<td>$347</td>
<td>$2,022</td>
<td>$3,839</td>
<td>33</td>
</tr>
<tr>
<td><strong>Total multiplier effect</strong></td>
<td>$9,741</td>
<td>$2,015</td>
<td>$11,756</td>
<td>$22,317</td>
<td>191</td>
</tr>
<tr>
<td><strong>Gross impact (initial + multiplier)</strong></td>
<td>$9,741</td>
<td>$2,015</td>
<td>$11,756</td>
<td>$46,269</td>
<td>191</td>
</tr>
<tr>
<td>Less alternative uses of funds</td>
<td>-1,031</td>
<td>-1,016</td>
<td>-2,048</td>
<td>-8,814</td>
<td>-29</td>
</tr>
<tr>
<td><strong>Net impact</strong></td>
<td>$8,710</td>
<td>$999</td>
<td>$9,708</td>
<td>$37,455</td>
<td>162</td>
</tr>
</tbody>
</table>

Source: Emsi impact model.
VISITOR SPENDING IMPACT

Hundreds of thousands of visitors attended events hosted by Texas A&M Athletics in FY 2018-19, including athletic events and third-party events; however, not all of these visitors can be counted towards the impact. If the visitors who are from Brazos County had not attended the events hosted by the department, they would have spent their money elsewhere, thus positively impacting the county regardless of the department. Even after removing the local visitors, Texas A&M Athletics estimated that 476,986 out-of-county visitors attended events it hosted in FY 2018-19. Of the 476,986 out-of-county visitors, 348,721 attended athletic events such as football and basketball games, and the remaining 128,265 attended third-party events hosted at Reed Arena and other athletic facilities. Table 2.4 outlines the total number of visitors, as well as the number of out-of-county visitors by event type.

Table 2.5 presents the average expenditures per person-trip for accommodation, food, transportation, and other personal expenses (including shopping and entertainment). A little more than half of the out-of-county visitors only made day trips to the county; therefore, their accommodation cost was $0. This contributes to a low average per-trip visitor cost for accommodation. Based on these figures, the gross spending of out-of-county visitors totaled $80.3 thousand in FY 2018-19. However, some of this spending includes monies paid to the department through non-textbook items (e.g., event tickets, food, etc.). These have already been accounted for in the operations impact and should thus be removed to avoid double-counting. We estimate that on-campus sales generated by out-of-county visitors totaled $58.2 million. The net sales from out-of-county visitors in FY 2018-19 thus come to $58.3 million.

Calculating the increase in income as a result of visitor spending again requires use of the MR-SAM model. The analysis begins by discounting the off-campus sales generated by out-of-county visitors to account for leakage in the trade sector, and then bridging the net figures to the detailed sectors of the MR-SAM model. The model runs the net sales figures through the multiplier matrix to arrive at the multiplier effects. As shown in Table 2.6, the net impact of visitor spending in FY 2018-19 is $24.3 million in labor income and $11.4 million in non-labor income. This totals to $35 million.

Table 2.4: Total visitors and out-of-county visitors in Brazos County by event type, FY 2018-19*

<table>
<thead>
<tr>
<th>Event type</th>
<th>Total visitors</th>
<th>Out-of-county visitors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Football</td>
<td>393,141</td>
<td>239,600</td>
</tr>
<tr>
<td>Men’s Basketball</td>
<td>52,380</td>
<td>22,050</td>
</tr>
<tr>
<td>Women’s Basketball</td>
<td>26,010</td>
<td>19,956</td>
</tr>
<tr>
<td>Baseball</td>
<td>72,185</td>
<td>35,859</td>
</tr>
<tr>
<td>Softball</td>
<td>18,513</td>
<td>8,090</td>
</tr>
<tr>
<td>Other Athletics</td>
<td>35,555</td>
<td>23,166</td>
</tr>
<tr>
<td>Total athletic event visitors</td>
<td>597,784</td>
<td>348,721</td>
</tr>
<tr>
<td>Third-party events at Reed Arena</td>
<td>180,750</td>
<td>120,330</td>
</tr>
<tr>
<td>All other third-party events</td>
<td>26,452</td>
<td>7,935</td>
</tr>
<tr>
<td>Total special event visitors</td>
<td>207,202</td>
<td>128,265</td>
</tr>
<tr>
<td>Grand total visitors</td>
<td>804,986</td>
<td>476,986</td>
</tr>
</tbody>
</table>

Source: Data provided by Texas A&M Athletics.

HUNDREDS OF THOUSANDS OF OUT-OF-COUNTY VISITORS ATTENDED EVENTS HOSTED BY TEXAS A&M ATHLETICS IN FY 2018-19.

16 THE ECONOMIC VALUE OF THE TEXAS A&M ATHLETICS DEPARTMENT IN FY 2018-19
in added income and is equivalent to supporting 1,084 jobs. In terms of sales, the impact came to $123.6 million.

As seen in Table 2.4, the majority of the out-of-county visitors were attracted to the athletic events hosted by Texas A&M Athletics. During their stay in FY 2018-19, athletic event visitors spent $53.7 million on accommodations, food and dining, transportation, and other goods. This spending created $33 million in added income for the Brazos County economy. The remaining $2.7 million is from visitors attending third-party events hosted in Texas A&M Athletics’ facilities. Notably, $22.7 million emanated from football events.

<table>
<thead>
<tr>
<th>TABLE 2.5: Average per-trip visitor costs and sales generated by out-of-county visitors in Brazos County, FY 2018-19*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Accommodation</strong></td>
</tr>
<tr>
<td><strong>Food</strong></td>
</tr>
<tr>
<td><strong>Entertainment and shopping</strong></td>
</tr>
<tr>
<td><strong>Transportation</strong></td>
</tr>
<tr>
<td><strong>Total expenses per visitor</strong></td>
</tr>
<tr>
<td><strong>Number of out-of-county visitors</strong></td>
</tr>
<tr>
<td><strong>Gross sales</strong></td>
</tr>
<tr>
<td><strong>On-campus sales</strong></td>
</tr>
<tr>
<td><strong>Net off-campus sales</strong></td>
</tr>
</tbody>
</table>

*Costs have been adjusted to account for the length of stay of out-of-county visitors. Accommodation and transportation have been adjusted downward to recognize that, on average, two visitors share the costs of housing and transportation. Numbers may not add due to rounding.

Source: Sales calculations estimated by Emsi based on data provided by Texas A&M Athletics.

### TOTAL TEXAS A&M ATHLETICS DEPARTMENT IMPACT

On an annual basis, Texas A&M Athletics generates a flow of spending that has a significant impact on the county economy. The impacts of this spending are captured by the operations, construction, and visitor spending impacts. Table 2.7 displays the grand total impacts of Texas A&M Athletics on the Brazos County economy in FY 2018-19. For context, the percentages of Texas A&M Athletics compared to the total labor income, total non-labor income, combined total income, sales, and jobs in Brazos County, as presented in Table 1.2 and Figure 1.3, are included. The total added value of Texas A&M Athletics is **$128.8 million**, equivalent to 1.4% of the GRP of Brazos County. By comparison, this contribution that the department provides on its own is larger than the entire Transportation & Warehousing industry in the county. The department’s total impact supported **3,197 jobs** in FY 2018-19. For perspective, this means that one out of every 46 jobs in Brazos County is supported by the activities of Texas A&M Athletics and its visitors. The impact in terms of sales summed to **$371.8 million** in sales impact on Brazos County.

These impacts from the department and its visitors stem from different industry sectors and spread throughout the county economy. Table 2.8 displays the total impact of Texas A&M Athletics by each industry sector based on their two-digit NAICS code. The table shows the total impact of operations, construction, and visitors as shown in Table 2.7, broken down by each industry.
### TABLE 2.7: Total Texas A&M athletics department impact, FY 2018-19

<table>
<thead>
<tr>
<th></th>
<th>Labor income (thousands)</th>
<th>Non-labor income (thousands)</th>
<th>Total income (thousands)</th>
<th>Sales (thousands)</th>
<th>Jobs supported</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operations spending</td>
<td>$75,193</td>
<td>$8,258</td>
<td>$83,451</td>
<td>$210,726</td>
<td>1,952</td>
</tr>
<tr>
<td>Construction spending</td>
<td>$8,710</td>
<td>$999</td>
<td>$9,708</td>
<td>$37,455</td>
<td>162</td>
</tr>
<tr>
<td>Visitor spending</td>
<td>$24,316</td>
<td>$11,365</td>
<td>$35,680</td>
<td>$123,586</td>
<td>1,084</td>
</tr>
<tr>
<td><strong>Total impact</strong></td>
<td><strong>$108,219</strong></td>
<td><strong>$20,622</strong></td>
<td><strong>$128,840</strong></td>
<td><strong>$371,768</strong></td>
<td><strong>3,197</strong></td>
</tr>
</tbody>
</table>

% of the Brazos County economy: 1.6% 0.7% 1.4% 1.9% 2.2%

*Source: Emsi impact model.*

### TABLE 2.8: Total Texas A&M athletics department impact by industry, FY 2018-19

<table>
<thead>
<tr>
<th>Industry sector</th>
<th>Total income (thousands)</th>
<th>Jobs supported</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government, Education</td>
<td>$47,586</td>
<td>1,477</td>
</tr>
<tr>
<td>Construction</td>
<td>$19,182</td>
<td>333</td>
</tr>
<tr>
<td>Accommodation &amp; Food Services</td>
<td>$18,073</td>
<td>597</td>
</tr>
<tr>
<td>Retail Trade</td>
<td>$13,226</td>
<td>371</td>
</tr>
<tr>
<td>Professional &amp; Technical Services</td>
<td>$7,719</td>
<td>112</td>
</tr>
<tr>
<td>Other Services (except Public Administration)</td>
<td>$7,509</td>
<td>21</td>
</tr>
<tr>
<td>Information</td>
<td>$4,500</td>
<td>36</td>
</tr>
<tr>
<td>Arts, Entertainment, &amp; Recreation</td>
<td>$2,927</td>
<td>120</td>
</tr>
<tr>
<td>Health Care &amp; Social Assistance</td>
<td>$2,478</td>
<td>39</td>
</tr>
<tr>
<td>Wholesale Trade</td>
<td>$1,352</td>
<td>11</td>
</tr>
<tr>
<td>Mining, Quarrying, &amp; Oil and Gas Extraction</td>
<td>$1,207</td>
<td>12</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>$751</td>
<td>14</td>
</tr>
<tr>
<td>Transportation &amp; Warehousing</td>
<td>$619</td>
<td>17</td>
</tr>
<tr>
<td>Finance &amp; Insurance</td>
<td>$592</td>
<td>7</td>
</tr>
<tr>
<td>Educational Services</td>
<td>$352</td>
<td>14</td>
</tr>
<tr>
<td>Administrative &amp; Waste Services</td>
<td>$284</td>
<td>7</td>
</tr>
<tr>
<td>Real Estate &amp; Rental &amp; Leasing</td>
<td>$161</td>
<td>3</td>
</tr>
<tr>
<td>Government, Non-Education</td>
<td>$147</td>
<td>2</td>
</tr>
<tr>
<td>Agriculture, Forestry, Fishing, &amp; Hunting</td>
<td>$110</td>
<td>4</td>
</tr>
<tr>
<td>Utilities</td>
<td>$51</td>
<td>0</td>
</tr>
<tr>
<td>Management of Companies &amp; Enterprises</td>
<td>$16</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total impact</strong></td>
<td><strong>$128,840</strong></td>
<td><strong>3,197</strong></td>
</tr>
</tbody>
</table>

*Source: Emsi impact model.*
sector’s individual impact on the county economy using processes outlined earlier in this chapter. By showing the impact from individual industry sectors, it is possible to see in finer detail the industries that drive the greatest impact on the county economy from the department’s spending and from where its visitors spend their money. For example, Texas A&M Athletics and visitor’s spending in the Accommodation & Food Services industry sector generated an impact of $18.1 million in FY 2018-19.
CHAPTER 3: TAXPAYER BENEFITS ANALYSIS

Texas A&M Athletics paid its employees $54.3 million in payroll in FY 2018-19, increasing the labor income in the state. When Texas A&M Athletics spends money on its construction projects and non-pay expenses, the department grows the state economy. By spending money on state businesses, the department helps make the businesses more profitable, increasing the non-labor income in Texas. In addition, as out-of-state visitors spend money on businesses in Texas, they also increase the business profits, or non-labor income in the state. Labor income and non-labor income, in turn, increase tax revenues since state and local government can apply tax rates to spending, properties, and business profits.

Summing the tax revenues from the department’s spending and its visitors, the added tax revenues that occurred in the state in FY 2018-19 is equal to $3.3 million.

Estimating the effect of Texas A&M Athletics on increased tax revenues begins with expanding the department’s impacts from the county to the state level. The labor income, non-labor income, and spending impacts increase the state’s Gross State Product (GSP) by $52.4 million. To the increase in GSP, we apply a rate of taxes on production and imports as a percentage of GSP to capture the tax revenues received by the state and local government from this additional GSP.

Summing the state and local tax revenues from the Texas A&M athletic department’s spending and its visitors, the added tax revenues that occurred in the state in FY 2018-19 is $3.3 million.

In this analysis, we also measure the tax revenues received by the local taxpayers of Brazos County. Using county and city tax rates, as well as the impact occurring in the county rather than the state, the tax revenues received by the local taxpayers of Brazos County came to $3.0 million in FY 2018-19.
CHAPTER 4:
CONCLUSION

While Texas A&M Athletics’ value to Brazos County is larger than simply its economic impact, understanding the dollars and cents value is an important asset to understanding the department’s value as a whole. In order to fully assess the department’s value to the county economy, this report has evaluated the department from the perspectives of economic impact analysis and taxpayer benefits analysis.

From an economic impact perspective, we calculated that Texas A&M Athletics generates a total economic impact of $128.8 million in total added income for the county economy. This represents the sum of several different impacts, including the department’s:

- Operations spending impact ($83.5 million);
- Construction spending impact ($9.7 million);
- Visitor spending impact ($35.7 million);

The total impact of $128.8 million is equivalent to approximately 1.4% of the total GRP of Brazos County and is equivalent to supporting 3,197 jobs. For perspective, this means that one out of every 46 jobs in Brazos County is supported by the activities of Texas A&M Athletics and its visitors. The impact in terms of sales summed to $371.8 million in sales impact on Brazos County.

The department’s spending, as well as the spending from its visitors, add tax revenues to the state that would not have been there otherwise. The activities of the department and its visitors in FY 2018-19 added $3.3 million in tax revenues for Texas. Narrowing the focus down to the local taxpayers of Brazos County, local taxpayers of Brazos County received $3.0 million in added tax revenues from the spending of Texas A&M Athletics and its visitors in FY 2018-19.

Modeling the impact of the department is subject to many factors, the variability of which we considered in our sensitivity analysis (Appendix 1). With this variability accounted for, we present the findings of this study as a robust picture of the economic value of Texas A&M Athletics.


RESOURCES AND REFERENCES

THE ECONOMIC VALUE OF THE TEXAS A&M ATHLETICS DEPARTMENT IN FY 2018-19
APPENDIX 1: SENSITIVITY ANALYSIS

Sensitivity analysis measures the extent to which a model’s outputs are affected by hypothetical changes in the background data and assumptions. This is especially important when those variables are inherently uncertain. This analysis allows us to identify a plausible range of potential results that would occur if the value of any of the variables is in fact different from what was expected.

While we can calculate the impact of visitors, it can be difficult to determine how many originated from outside the county. Table A1.1 presents a sensitivity analysis for the annual number of out-of-county visitors. The assumption increases and decreases relative to the base case of 476,986 visitors by the following increments: 10%, 25%, and 50% as both an increase and a decrease to the baseline assumption. The visitor spending impact is then recalculated with each number of out-of-county visitors, holding all else constant. Visitor spending impacts attributable to the Texas A&M athletic department range from a high of $51.5 million with 715,479 visitors to a low of $17.2 million with 238,493 visitors.

### Table A1.1: Sensitivity analysis of the annual number of out-of-county visitors

<table>
<thead>
<tr>
<th>% variation</th>
<th>-50%</th>
<th>-25%</th>
<th>-10%</th>
<th>Base Case</th>
<th>10%</th>
<th>25%</th>
<th>50%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual out-of-state visitors</td>
<td>238,493</td>
<td>357,740</td>
<td>429,287</td>
<td>476,986</td>
<td>524,685</td>
<td>596,233</td>
<td>715,479</td>
</tr>
<tr>
<td>Visitor spending impact (million)</td>
<td>$17,191</td>
<td>$25,774</td>
<td>$30,923</td>
<td>$35,683</td>
<td>$37,789</td>
<td>$42,938</td>
<td>$51,520</td>
</tr>
</tbody>
</table>
Alternative use of funds  A measure of how monies that are currently used to fund the department might otherwise have been used if the department did not exist.

Counterfactual scenario  What would have happened if a given event had not occurred. In the case of this economic impact study, the counterfactual scenario is a scenario where the department did not exist.

Earnings (labor income)  Income that is received as a result of labor; i.e., wages.

Economics  Study of the allocation of scarce resources among alternative and competing ends. Economics is not normative (what ought to be done), but positive (describes what is, or how people are likely to behave in response to economic changes).

Gross regional product  Measure of the final value of all goods and services produced in a county after netting out the cost of goods used in production. Alternatively, gross regional product (GRP) equals the combined incomes of all factors of production; i.e., labor, land and capital. These include wages, salaries, proprietors’ incomes, profits, rents, and other. Gross regional product is also sometimes called value added or added income.

Initial effect  Income generated by the initial injection of monies into the economy through the payroll of the department.

Input-output analysis  Relationship between a given set of demands for final goods and services and the implied amounts of manufactured inputs, raw materials, and labor that this requires. When educational institutions pay wages and salaries and spend money for supplies in the county, they also generate earnings in all sectors of the economy, thereby increasing the demand for goods and services and jobs.

Multiplier effect  Additional income created in the economy as the department and its visitors spend money in the county. It consists of the income created by the supply chain of the industries initially affected by the spending of the department and its visitors (i.e., the direct effect), income created by the supply chain of the initial supply chain (i.e., the indirect effect), and the income created by the increased spending of the household sector (i.e., the induced effect).

Non-labor income  Income received from investments, such as rent, interest, and dividends.
APPENDIX 3: FREQUENTLY ASKED QUESTIONS (FAQS)

This appendix provides answers to some frequently asked questions about the results.

What is economic impact analysis?
Economic impact analysis quantifies the impact from a given economic event—in this case, the presence of a department—on the economy of a specified region.

Do the results differ by region, and if so, why?
Yes. Regional economic data are drawn from Emsi’s proprietary MR-SAM model, the Census Bureau, and other sources to reflect the specific earnings levels, jobs numbers, unemployment rates, population demographics, and other key characteristics of the region served by the department. Therefore, model results for the department are specific to the given region.

Are the funds transferred to the department increasing in value, or simply being re-directed?
Emsi’s approach is not a simple “rearranging of the furniture” where the impact of operations spending is essentially a restatement of the level of funding received by the department. Rather, it is an impact assessment of the additional income created in the region as a result of the department spending on payroll and other non-pay expenditures, net of any impacts that would have occurred anyway if the department did not exist.

Total economic impact: How do I communicate this in laymen’s terms?
Big numbers are great, but putting them into perspective can be a challenge. To add perspective, find an industry with roughly the same “% of GRP” as your department (Table 1.2). This percentage represents its portion of the total gross regional product in the county (similar to the nationally recognized gross domestic product but at a county level). This allows the department to say that their single brick and mortar campus does just as much for Brazos County as the entire Utilities industry, for example. This powerful statement can help put the large total impact number into perspective.
Emsi’s economic impact study differs from many other studies because we prefer to report the impacts in terms of income rather than sales (or output). Income is synonymous with value added or gross regional product (GRP). Sales include all the intermediary costs associated with producing goods and services. Income is a net measure that excludes these intermediary costs:

\[
\text{Income} = \text{Sales} - \text{Intermediary Costs}
\]

For this reason, income is a more meaningful measure of new economic activity than reporting sales. This is evidenced by the use of gross domestic product (GDP)—a measure of income—by economists when considering the economic growth or size of a country. The difference is GRP reflects a county and GDP a country.

To demonstrate the difference between income and sales, let us consider an example of a baker’s production of a loaf of bread. The baker buys the ingredients such as eggs, flour, and yeast for $2.00. He uses capital such as a mixer to combine the ingredients and an oven to bake the bread and convert it into a final product. Overhead costs for these steps are $1.00. Total intermediary costs are $3.00. The baker then sells the loaf of bread for $5.00.

The sales amount of the loaf of bread is $5.00. The income from the loaf of bread is equal to the sales amount less the intermediary costs:

\[
\text{Income} = $5.00 - $3.00 = $2.00
\]

In our analysis, we provide context behind the income figures by also reporting the associated number of jobs. The impacts are also reported in sales and earnings terms for reference.
Emsi’s MR-SAM represents the flow of all economic transactions in a given region. It replaces Emsi’s previous input-output (IO) model, which operated with some 1,000 industries, four layers of government, a single household consumption sector, and an investment sector. The old IO model was used to simulate the ripple effects (i.e., multipliers) in the county economy as a result of industries entering or exiting the region. The MR-SAM model performs the same tasks as the old IO model, but it also does much more. Along with the same 1,000 industries, government, household and investment sectors embedded in the old IO tool, the MR-SAM exhibits much more functionality, a greater amount of data, and a higher level of detail on the demographic and occupational components of jobs (16 demographic cohorts and about 750 occupations are characterized).

This appendix presents a high-level overview of the MR-SAM. Additional documentation on the technical aspects of the model is available upon request.

**DATA SOURCES FOR THE MODEL**

The Emsi MR-SAM model relies on a number of internal and external data sources, mostly compiled by the federal government. What follows is a listing and short explanation of our sources. The use of these data will be covered in more detail later in this appendix.

**Emsi Data** are produced from many data sources to produce detailed industry, occupation, and demographic jobs and earnings data at the local level. This information (especially sales-to-jobs ratios derived from jobs and earnings-to-sales ratios) is used to help regionalize the national matrices as well as to disaggregate them into more detailed industries than are normally available.

**BEA Make and Use Tables (MUT)** are the basis for input-output models in the U.S. The *make* table is a matrix that describes the amount of each commodity made by each industry in a given year. Industries are placed in the rows and commodities in the columns. The *use* table is a matrix that describes the amount of each commodity used by each industry in a given year. In the use table, commodities are placed in the rows and industries in the columns. The BEA produces two different sets of MUTs, the benchmark and the summary. The benchmark set contains about 500 sectors and is released every five years, with a five-year lag time (e.g., 2002 benchmark MUTs were released in 2007). The summary set contains about 80 sectors and is released every year, with a two-year lag (e.g., 2010 summary MUTs were released in late 2011/early 2012). The MUTs are used in the Emsi MR-SAM model to produce an industry-by-industry matrix describing all industry purchases from all industries.

**BEA Gross Domestic Product by State (GSP)** describes gross domestic product from the value added (also known as added income) perspective. Value added is equal to employee compensation, gross operating surplus, and taxes on production and imports, less subsidies. Each of these components is reported for each state and an aggregate group of industries. This dataset is updated once per year, with a one-year lag. The Emsi MR-SAM model makes use of this data as a control and pegs certain pieces of the model to values from this dataset.

**BEA National Income and Product Accounts (NIPA)** cover a wide variety of economic measures for the nation, including gross domestic product (GDP), sources of output, and distribution of income. This dataset is updated periodically throughout the year and can be between a month and several years old depending on the specific account. NIPA data are used in many of the Emsi MR-SAM processes as both controls and seeds.
**BEA Local Area Income (LPI)** encapsulates multiple tables with geographies down to the county level. The following two tables are specifically used: CA05 (Personal income and earnings by industry) and CA91 (Gross flow of earnings). CA91 is used when creating the commuting submodel and CA05 is used in several processes to help with place-of-work and place-of-residence differences, as well as to calculate personal income, transfers, dividends, interest, and rent.

**Bureau of Labor Statistics Consumer Expenditure Survey (CEX)** reports on the buying habits of consumers along with some information as to their income, consumer unit, and demographics. Emsi utilizes this data heavily in the creation of the national demographic by income type consumption on industries.

**Census of Government’s (CoG) state and local government finance dataset** is used specifically to aid breaking out state and local data that is reported in the MUTs. This allows Emsi to have unique production functions for each of its state and local government sectors.

**Census’ OnTheMap (OTM)** is a collection of three datasets for the census block level for multiple years. **Origin-Destination (OD)** offers job totals associated with both home census blocks and a work census block. **Residence Area Characteristics (RAC)** offers jobs totaled by home census block. **Workplace Area Characteristics (WAC)** offers jobs totaled by work census block. All three of these are used in the commuting submodel to gain better estimates of earnings by industry that may be counted as commuting. This dataset has holes for specific years and regions. These holes are filled with Census’ Journey-to-Work described later.

**Census’ Current Population Survey (CPS)** is used as the basis for the demographic breakout data of the MR-SAM model. This set is used to estimate the ratios of demographic cohorts and their income for the three different income categories (i.e., wages, property income, and transfers).

**Census’ Journey-to-Work (JtW)** is part of the 2000 Census and describes the amount of commuting jobs between counties. This set is used to fill in the areas where OTM does not have data.

**Census’ American Community Survey (ACS) Public Use Microdata Sample (PUMS)** is the replacement for Census’ long form and is used by Emsi to fill the holes in the CPS data.

**Oak Ridge National Lab (ORNL) County-to-County Distance Matrix (Skim Tree) contains a matrix of distances and network impedances between each county via various modes of transportation such as highway, railroad, water, and combined highway-rail. Also included in this set are minimum impedances utilizing the best combination of paths. The ORNL distance matrix is used in Emsi’s gravitational flows model that estimates the amount of trade between counties in the country.**

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**OVERVIEW OF THE MR-SAM MODEL**

Emsi’s MR-SAM modeling system is a comparative static model in the same general class as RIMS II (Bureau of Economic Analysis) and IMPLAN (Minnesota Implan Group). The MR-SAM model is thus not an econometric model, the primary example of which is PolicyInsight by REMI. It relies on a matrix representation of industry-to-industry purchasing patterns originally based on national data which are regionalized with the use of local data and mathematical manipulation (i.e., non-survey methods). Models of this type estimate the ripple effects of changes in jobs, earnings, or sales in one or more industries upon other industries in a region.

The Emsi MR-SAM model shows final equilibrium impacts—that is, the user enters a change that perturbs the economy and the model shows the changes required to establish a new equilibrium. As such, it is not a dynamic model that shows year-by-year changes over time (as REMI’s does).

**NATIONAL SAM**

Following standard practice, the SAM model appears as a square matrix, with each row sum exactly equaling...
the corresponding column sum. Reflecting its kinship with the standard Leontief input-output framework, individual SAM elements show accounting flows between row and column sectors during a chosen base year. Read across rows, SAM entries show the flow of funds into column accounts (also known as receipts or the appropriation of funds by those column accounts). Read down columns, SAM entries show the flow of funds into row accounts (also known as expenditures or the dispersal of funds to those row accounts).

The SAM may be broken into three different aggregation layers: broad accounts, sub-accounts, and detailed accounts. The broad layer is the most aggregate and will be covered first. Broad accounts cover between one and four sub-accounts, which in turn cover many detailed accounts. This appendix will not discuss detailed accounts directly because of their number. For example, in the industry broad account, there are two sub-accounts and over 1,000 detailed accounts.

**MULTI-REGIONAL ASPECT OF THE MR-SAM**

Multi-regional (MR) describes a non-survey model that has the ability to analyze the transactions and ripple effects (i.e., multipliers) of not just a single region, but multiple regions interacting with each other. Regions in this case are made up of a collection of counties.

Emsi’s multi-regional model is built off of gravitational flows, assuming that the larger a county’s economy, the more influence it will have on the surrounding counties’ purchases and sales. The equation behind this model is essentially the same that Isaac Newton used to calculate the gravitational pull between planets and stars. In Newton's equation, the masses of both objects are multiplied, then divided by the distance separating them and multiplied by a constant. In Emsi’s model, the masses are replaced with the supply of a sector for one county and the demand for that same sector from another county. The distance is replaced with an impedance value that takes into account the distance, type of roads, rail lines, and other modes of transportation. Once this is calculated for every county-to-county pair, a set of mathematical operations is performed to make sure all counties absorb the correct amount of supply from every county and the correct amount of demand from every county. These operations produce more than 200 million data points.

**COMPONENTS OF THE EMSI MR-SAM MODEL**

The Emsi MR-SAM is built from a number of different components that are gathered together to display information whenever a user selects a region. What follows is a description of each of these components and how each is created. Emsi’s internally created data are used to a great extent throughout the processes described below, but its creation is not described in this appendix.

**COUNTY EARNINGS DISTRIBUTION MATRIX**

The county earnings distribution matrices describe the earnings spent by every industry on every occupation for a year—i.e., earnings by occupation. The matrices are built utilizing Emsi’s industry earnings, occupational average earnings, and staffing patterns. Each matrix starts with a region’s staffing pattern matrix which is multiplied by the industry jobs vector. This produces the number of occupational jobs in each industry for the region. Next, the occupational average hourly earnings per job are multiplied by 2,080 hours, which converts the average hourly earnings into a yearly estimate. Then the matrix of occupational jobs is multiplied by the occupational annual earnings per job, converting it into earnings values. Last, all earnings are adjusted to match the known industry totals. This is a fairly simple process, but one that is very important. These matrices describe the place-of-work earnings used by the MR-SAM.

**COMMUTING MODEL**

The commuting sub-model is an integral part of Emsi’s MR-SAM model. It allows the regional and multi-regional models to know what amount of the earnings can be attributed to place-of-residence vs. place-of-work. The commuting data describe the flow
of earnings from any county to any other county (including within the counties themselves). For this situation, the commuted earnings are not just a single value describing total earnings flows over a complete year, but are broken out by occupation and demographic. Breaking out the earnings allows for analysis of place-of-residence and place-of-work earnings. These data are created using Bureau of Labor Statistics’ OnTheMap dataset, Census’ Journey-to-Work, BEA’s LPI CA91 and CA05 tables, and some of Emsi’s data. The process incorporates the cleanup and disaggregation of the OnTheMap data, the estimation of a closed system of county inflows and outflows of earnings, and the creation of finalized commuting data.

NATIONAL SAM

The national SAM as described above is made up of several different components. Many of the elements discussed are filled in with values from the national Z matrix—or industry-to-industry transaction matrix. This matrix is built from BEA data that describe which industries make and use what commodities at the national level. These data are manipulated with some industry standard equations to produce the national Z matrix. The data in the Z matrix act as the basis for the majority of the data in the national SAM. The rest of the values are filled in with data from the county earnings distribution matrices, the commuting data, and the BEAs National Income and Product Accounts.

One of the major issues that affect any SAM project is the combination of data from multiple sources that may not be consistent with one another. Matrix balancing is the broad name for the techniques used to correct this problem. Emsi uses a modification of the “diagonal similarity scaling” algorithm to balance the national SAM.

GRAVITATIONAL FLOWS MODEL

The most important piece of the Emsi MR-SAM model is the gravitational flows model that produces county-by-county regional purchasing coefficients (RPCs). RPCs estimate how much an industry purchases from other industries inside and outside of the defined region. This information is critical for calculating all IO models.

Gravity modeling starts with the creation of an impedance matrix that values the difficulty of moving a product from county to county. For each sector, an impedance matrix is created based on a set of distance impedance methods for that sector. A distance impedance method is one of the measurements reported in the Oak Ridge National Laboratory’s County-to-County Distance Matrix. In this matrix, every county-to-county relationship is accounted for in six measures: great-circle distance, highway impedance, rail miles, rail impedance, water impedance, and highway-rail-highway impedance. Next, using the impedance information, the trade flows for each industry in every county are solved for. The result is an estimate of multi-regional flows from every county to every county. These flows are divided by each respective county’s demand to produce multi-regional RPCs.