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LAICU

Emsi

THE ECONOMIC IMPACT OF ALUMNI

Louisiana Association of Independent Colleges & Universities

MAIN REPORT

Contents

LAICU is a non-profit 501(c)(6) organization.

Executive Summary

THIS REPORT assesses the impact of Louisiana Association of Independent Colleges & Universities (LAICU) alumni on the state economy. LAICU colleges and universities keep Louisiana residents in state and attract talented students from other states and countries. LAICU institutions offer a personal experience with small class sizes taught by highly qualified faculty whose focus and primary responsibility is teaching, and they help students become critical thinkers, grounded by social, ethical, and reasoning skills acquired at LAICU institutions. Graduates from LAICU institutions are accepted into the graduate or professional school of their choice at a rate that far exceeds the national average. With a degree from a LAICU college or university, graduates are prepared for a job that exists now and are equipped with essential and transferable skills that can be applied to future jobs that may arise. Over the years, by studying at LAICU institutions, students have become workforce ready, and today, thousands of these former students are employed in Louisiana.

The accumulated impact of former students currently employed in the Louisiana workforce amounted to **$630.2 million** in added income for the Louisiana economy, which is equivalent to supporting **10,397 jobs**.

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 state as it is spent at out-of-state businesses. Income, on the other hand, is a net measure that excludes these intermediary costs and leakages and is synonymous with gross state product (GSP) and value added. For this reason, it is a more meaningful measure of new economic activity than sales.

Acknowledgements

EMSI GRATEFULLY ACKNOWLEDGES the excellent support of the staff at the Louisiana Association of Independent Colleges & Universities (LAICU) in making this study possible. Emsi also recognizes the leadership and contributions of the 10 member institutions of LAICU. Any errors in the report are the responsibility of Emsi and not of any of the above-mentioned individuals.

CHAPTER 1

The Louisiana Economy

SINCE THE MEMBERS of Louisiana Association of Independent Colleges and Universities (LAICU) were first established, they have been serving Louisiana by enhancing the workforce, providing local residents with access to diverse higher education opportunities, preparing students with essential and transferrable skills and through awarding degrees in high demand areas.

Table 1.1 summarizes the breakdown of the state economy by major industrial sector, 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 state's total income, which can also be considered as the state's gross state product (GSP).

As shown in Table 1.1, the total income, or GSP, of Louisiana is approximately $245.4 billion, equal to the sum of labor income ($143.1 billion) and non-labor income ($102.3 billion). In Chapter 2, we use the total added income as the measure of the relative impacts of the institutions on the state economy.

TABLE 1.1: LABOR AND NON-LABOR INCOME BY MAJOR INDUSTRY SECTOR IN LOUISIANA, 2020*

Industry sector	Labor income (millions)	Non-labor income (millions	Total income (millions)**	% of total income	Sales (millions
Manufacturing	$13,712	$34,207	$47,919	20%	$138,235
Other Services (except Public Administration)	$4,798	$18,092	$22,890	9%	$35,306
Health Care & Social Assistance	$17,249	$2,038	$19,287	8%	$31,657
Government, Non-Education	$15,007	$4,226	$19,233	8%	$107,082
Construction	$12,672	$2,333	$15,005	6%	$28,210
Retail Trade	$8,889	$4,904	$13,793	6%	$23,047
Wholesale Trade	$5,830	$7,491	$13,321	5%	$20,658
Finance & Insurance	$7,957	$4,762	$12,719	5%	$23,687
Professional & Technical Services	$10,179	$2,402	$12,581	5%	$18,538
Mining, Quarrying, & Oil & Gas Extraction	$4,733	$7,108	$11,840	5%	$21,902
Transportation & Warehousing	$6,819	$3,431	$10,250	4%	$22,517
Government, Education	$8,234	$0	$8,234	3%	$9,519
Accommodation & Food Services	$4,722	$2,385	$7,107	3%	$13,112
Real Estate & Rental & Leasing	$5,682	$1,338	$7,020	3%	$19,508
Administrative & Waste Services	$5,685	$1,150	$6,834	3%	$11,714
Information	$1,766	$2,859	$4,625	2%	$8,396
Utilities	$1,143	$2,930	$4,073	2%	$6,001
Management of Companies & Enterprises	$2,542	$174	$2,716	1%	$4,454
Educational Services	$2,244	$302	$2,546	1%	$3,409
Arts, Entertainment, & Recreation	$1,664	$863	$2,527	1%	$4,096
Agriculture, Forestry, Fishing & Hunting	$1,536	-$661	$875	<1%	$4,881
Total	$143,062	$102,333	$245,394	100%	$555,928

* Data reflect the most recent year for which data are available. Emsi data are updated quarterly.
**Numbers may not add due to rounding.
Source: Emsi industry data.

Figure 1.1 provides the breakdown of jobs by industry in Louisiana. The Health Care & Social Assistance sector is the largest employer, supporting 321.5 thousand jobs or 11.8% of total employment in the state. The second largest employer is the Retail Trade sector, supporting 265.8 thousand jobs or 9.8% of the state's total employment. Altogether, the state supports 2.7 million jobs.[1]

Table 1.2 and Figure 1.2 present the mean earnings by education level in the state of Louisiana at the midpoint of the average-aged worker's career. These numbers are derived from Emsi's complete employment data on average earnings per worker in

1 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.

the state.[2] The numbers are then weighted by the institutions' demographic profiles, as collected from the Integrated Postsecondary Education Data System (IPEDS). As shown, students have the potential to earn more as they achieve higher levels of education compared to maintaining a high school diploma. Students who earn a bachelor's degree from the institutions can expect approximate wages of $54,600 per year within Louisiana, approximately $11,000 more than someone with an associate degree.

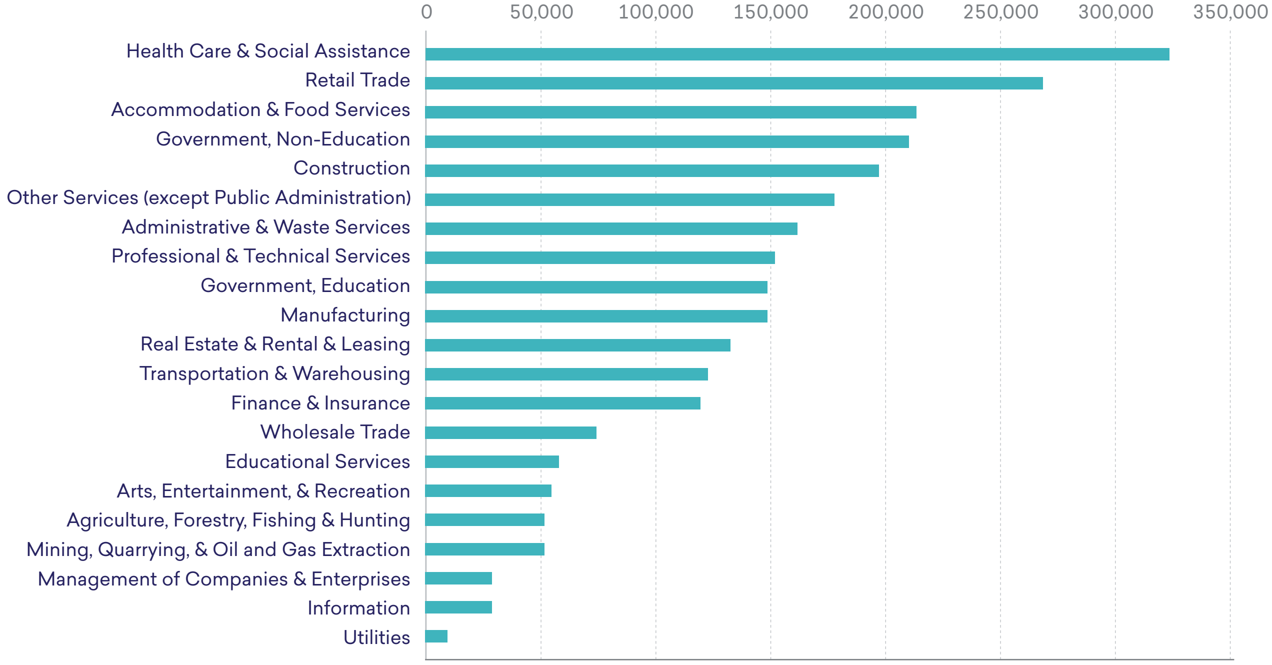
2 Wage rates in the Emsi MR-SAM model combine state and federal sources to provide earnings that reflect complete employment in the state, including proprietors, self-employed workers, and others not typically included in regional or state data, as well as benefits and all forms of employer contributions. As such, Emsi industry earnings-per-worker numbers are generally higher than those reported by other sources.

TABLE 1.2: AVERAGE EARNINGS BY EDUCATION LEVEL AT A LAICU STUDENT'S CAREER MIDPOINT

Education level	State earnings	Difference from next lowest degree
Less than high school	$26,400	n/a
High school or equivalent	$33,100	$6,700
Certificate	$38,300	$5,200
Associate degree	$43,600	$5,300
Bachelor's degree	$54,600	$11,000
Master's degree	$63,600	$9,000
Doctoral degree	$94,300	$30,700

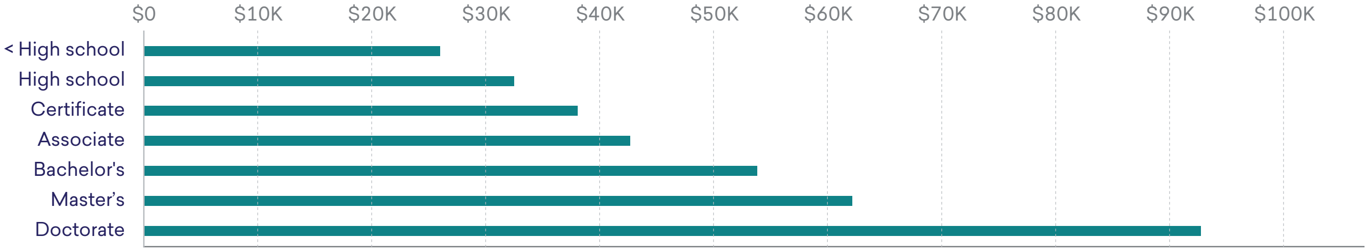
Source: Emsi employment data.

FIGURE 1.1: JOBS BY MAJOR INDUSTRY SECTOR IN LOUISIANA, 2020*



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

FIGURE 1.2: AVERAGE EARNINGS BY EDUCATION LEVEL AT A LAICU STUDENT'S CAREER MIDPOINT



Source: Emsi employment data.

CHAPTER 2

Economic Impact on the Louisiana Economy

LAICU alumni positively impact the Louisiana economy. They provide students with the knowledge, skills, and abilities they need to become productive citizens and add to the overall output of the state.

IN THIS CHAPTER, we estimate the economic impact of LAICU's alumni, we measure the income added in the state as former students expand the state economy's stock of human capital.

Net impacts *reflect a truer measure of economic impact since they demonstrate what would not have existed in the state economy if not for the institutions.*

Economic impact terminology

When exploring the alumni impact, we consider the following hypothetical question:

How would economic activity change in Louisiana if LAICU alumni did not exist in FY 2018-19?

The alumni impact should be interpreted according to this hypothetical question. Another way to think about the question is to realize that we measure a net impact, not a gross impact. A gross impact represents an upper-bound estimate in terms of capturing all activity stemming from the institutions; however, a net impact reflects a truer measure of economic impact since they demonstrate what would not have existed in the state economy if not for the institutions' alumni.

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 state product (GSP). 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 state economy through intermediary transactions and costs.[3] All of these measures—added labor and non-labor income, 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>
<tr><th>Emsi</th><th>Initial</th><th>Direct</th><th>Indirect</th><th>Induced</th></tr>
<tr><td>IMPLAN</td><td>Direct</td><td colspan="2">Indirect</td><td>Induced</td></tr>
</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 state. 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. For more information on the Emsi MR-SAM model and its data sources, see Appendix 6.

3 See Appendix 5 for an example of the intermediary costs included in the sales impact but not in the income impact.

Alumni impact

IN THIS SECTION, we estimate the economic impacts stemming from the added labor income of alumni in combination with their employers' added non-labor income. This impact is based on the number of students who have attended the institutions *throughout their history* as reported to IPEDS by the institutions. We then use this total number to consider the impact of those students in the single FY 2018-19. Former students who earned a degree as well as those who may not have finished their degree or did not take courses for credit are considered alumni.

The LAICU alumni impact stems from the ***added human capital****—the knowledge, creativity, imagination, and entrepreneurship—found in its alumni.*

While attending the institutions, students gain experience, education, and the knowledge, skills, and abilities that increase their productivity and allow them to command a higher wage once they enter the workforce. But the reward of increased productivity does not stop there. Talented professionals make capital more productive too (e.g., buildings, production facilities, equipment). The employers of the institutions' alumni enjoy the fruits of this increased productivity in the form of additional non-labor income (i.e., higher profits).

The alumni impact is the result of years of past instruction and the associated accumulation of human capital. The initial effect of alumni is comprised of two main components. The first and largest of these is the added labor income of the institutions' former students. The second component of the initial effect is comprised of the added non-labor income of the businesses that employ former students of LAICU.

We begin by estimating the portion of alumni who are employed in the workforce. To estimate the historical employment patterns of alumni in the state, we use the following sets of data or assumptions: 1) settling-in factors to determine how long it takes the average student to settle into a career;[4] 2) death, retirement, and unemployment rates from the National Center for Health Statistics, the Social Security Administration, and the Bureau of Labor Statistics; and 3) state migration data from the Internal Revenue Service. The result is the estimated portion of alumni from each previous year who were still actively employed in the state as of FY 2018-19.

The next step is to quantify the skills and human capital that alumni acquired from the institutions. We use the students' production of Credit Hour Equivalents (CHEs) provided by IPEDS as a proxy for accumulated human capital. The average number of CHEs completed per student in FY 2018-19 was 19.6. To estimate the number of CHEs present in the workforce during the analysis year, we use the institutions' historical student headcount over the past 30 years, from FY 1989-90 to FY 2018-19.[5] We multiply the 19.6 average CHEs per student by the headcounts that we estimate are still actively employed from each of the previous years.[6] Students who enroll at the institutions more than one year are counted at least twice in the historical enrollment data. However, CHEs remain distinct regardless of when and by whom they were earned, so there is no duplication in the CHE counts. We estimate there are approximately 3.9 million CHEs from alumni active in the workforce.

Next, we estimate the value of the CHEs, or the skills and human capital acquired by the institutions' alumni. This is done using the *incremental* added labor income stemming from the students' higher wages. The incremental added labor income is the difference between the wage earned by the institutions' alumni and the alternative wage they would have earned had they not attended the institutions. Using the state incremental earnings, credits required, and distribution of credits at each level of study, we estimate the average value per CHE to equal $163. This value represents the state average incremental increase in wages that the institutions' alumni received during the analysis year for every CHE they completed.

Because workforce experience leads to increased productivity and higher wages, the value per CHE varies depending on the students' workforce experience, with the highest value applied to the CHEs of students who had been employed the longest by FY 2018-19, and the lowest value per CHE applied to students who were just entering the workforce. More information on the theory and calculations behind the value per CHE appears in Appendix 7. In determining the amount of added labor income attributable to alumni, we multiply the CHEs of former students in each year of the historical time horizon by the corresponding average value per CHE for that year, and then sum the products together. This calculation

Table 2.1: NUMBER OF CHES IN WORKFORCE AND INITIAL LABOR INCOME CREATED IN LOUISIANA, FY 2018-19

Number of CHEs in workforce	3,917,877
Average value per CHE	$163
Initial labor income, gross	**$637,103,212**
Adjustments for counterfactual scenarios	
Percent reduction for alternative education opportunities	15%
Percent reduction for adjustment for labor import effects	50%
Initial labor income, net	**$270,768,865**

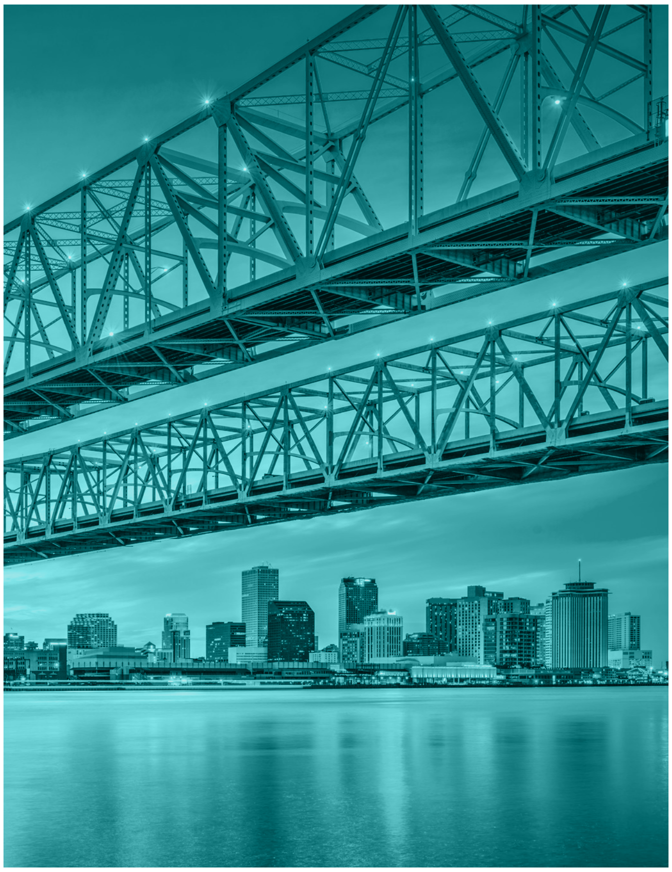
Source: Emsi impact model.

4 Settling-in factors are used to delay the onset of the benefits to students in order to allow time for them to find employment and settle into their careers. In the absence of hard data, we assume a range between one and three years for students who graduate with a certificate or a degree, and between one and five years for returning students.

5 We apply a 30-year time horizon because the data on students who attended LAICU prior to FY 1989-90 is less reliable, and because most of the students served more than 30 years ago had left the state workforce by FY 2018-19. Where data was unavailable from IPES, Emsi used estimates calculated using the IPEDS historical headcounts.

6 This assumes the average level of study from past years is equal to the level of study of students today. Emsi used data provided by some institutions for previous studies to estimate students' credit load in prior years.

yields approximately $637.1 million in gross labor income from increased wages received by former students in FY 2018-19 (as shown in Table 2.1).



The next two rows in Table 2.1 show two adjustments used to account for counterfactual outcomes. As discussed above, counterfactual outcomes in economic analysis represent what would have happened if a given event had not occurred. The event in question is the education and training provided by LAICU and subsequent influx of skilled labor into the state economy. The first counterfactual scenario that we address is the adjustment for alternative education opportunities. In the counterfactual scenario where LAICU does not exist, we assume a portion of the institutions' alumni would have received a comparable education elsewhere in the state or would have left the state and received a comparable education and then returned to the state. The incremental added labor income that accrues to those students cannot be counted towards the added labor income from the institutions' alumni. The adjustment for alternative education opportunities amounts to a 15% reduction of the $637.1 million in added labor income. This means that 15% of the added labor income from the institutions' alumni would have been generated in the state anyway, even if the institutions did not exist. For more information on the alternative education adjustment, see Appendix 8.

The other adjustment in Table 2.1 accounts for the importation of labor. Suppose LAICU did not exist and in consequence there were fewer skilled workers in the state. Businesses could still satisfy some of their need for skilled labor by recruiting from outside Louisiana. We refer to this as the labor import effect. Lacking information on its possible magnitude, we assume 50% of the jobs that students fill at state businesses could have been filled by workers recruited from outside the state if the institutions did not exist.[7] Consequently, the gross labor income must be adjusted to account for the importation of this labor, since it would have happened regardless of the presence of the institutions. We conduct a sensitivity analysis for this assumption in Appendix 2. With the 50% adjustment, the net added labor income added to the economy comes to $270.8 million, as shown in Table 2.1.

The $270.8 million in added labor income appears under the initial effect in the labor income column of Table 2.2. To this we add an estimate for initial non-labor income. As discussed earlier in this section, businesses that employ former students of LAICU see higher profits as a result of the increased productivity of their capital assets. To estimate this additional income, we allocate the initial increase in labor income ($270.8 million) to the six-digit NAICS industry sectors where students are most likely to be employed. This allocation entails a process that maps completers in the state to the detailed occupations for which those completers have been trained, and then maps the detailed occupations to the

7 A similar assumption is used by Walden (2014) in his analysis of the Cooperating Raleigh Colleges.

six-digit industry sectors in the MR-SAM model.[8] Using a crosswalk created by National Center for Education Statistics (NCES) and the Bureau of Labor Statistics, we map the breakdown of the institutions' completers to the approximately 700 detailed occupations in the Standard Occupational Classification (SOC) system. Finally, we apply a matrix of wages by industry and by occupation from the MR-SAM model to map the occupational distribution of the $270.8 million in initial labor income effects to the detailed industry sectors in the MR-SAM model.[9]

Once these allocations are complete, we apply the ratio of non-labor to labor income provided by the MR-SAM model for each sector to our estimate of initial labor income. This computation yields an estimated $83.4 million in added non-labor income attributable to the institutions' alumni. Summing initial labor and non-labor income together provides the total initial effect of alumni productivity in the Louisiana economy, equal to approximately $354.2 million. To estimate multiplier effects, we convert the industry-specific income figures generated through the initial effect to sales using sales-to-income ratios from the MR-SAM model. We then run the values through the MR-SAM's multiplier matrix.

Table 2.2 shows the multiplier effects of alumni. Multiplier effects occur as alumni generate an increased demand for consumer goods and services through the expenditure of their higher wages. Further, as the industries where alumni are employed increase their output, there is a corresponding increase in the demand for input from the industries in the employers' supply chain. Together, the incomes generated by the expansions in business input purchases and household spending constitute the multiplier effect of the increased productivity of the institutions' alumni. The final results are $214 million in added labor income and $62 million in added non-labor income, for an overall total of $276 million in multiplier effects. The grand total of the alumni impact is $630.2 million in total added income, the sum of all initial and multiplier labor and non-labor income effects. This is equivalent to supporting 10,397 jobs.

Table 2.2: ALUMNI IMPACT, FY 2018-19

	Labor income (thousands)	Non-labor income (thousands)	Total income (thousands)	Sales (thousands)	Jobs supported
Initial effect	**$270,769**	**$83,402**	**$354,171**	**$797,858**	**5,717**
Multiplier effect					
Direct effect	$48,673	$16,913	$65,586	$133,376	1,116
Indirect effect	$17,330	$6,182	$23,512	$48,057	403
Induced effect	$147,974	$38,934	$186,908	$359,721	3,161
Total multiplier effect	**$213,977**	**$62,029**	**$276,006**	**$541,155**	**4,680**
Total impact (initial + multiplier)	**$484,746**	**$145,431**	**$630,177**	**$1,339,013**	**10,397**

Source: Emsi impact model.

8 Completer data comes from the Integrated Postsecondary Education Data System (IPEDS), which organizes program completions according to the Classification of Instructional Programs (CIP) developed by the National Center for Education Statistics (NCES).

9 For example, if the MR-SAM model indicates that 20% of wages paid to workers in SOC 51-4121 (Welders) occur in NAICS 332313 (Plate Work Manufacturing), then we allocate 20% of the initial labor income effect under SOC 51-4121 to NAICS 332313.

CHAPTER 3

Conclusion

LAICU'S VALUE TO THE STATE OF LOUISIANA is larger than simply its institutions' academic programs and degree completers. LAICU institutions are an important asset to the state's economy, adding real dollars and cents to Louisiana. To assess LAICU's value to the state's economy, this report evaluates the institutions' alumni impact, which is considerable. Emsi calculates that LAICU's alumni generate a total economic impact of **$630.2 million** in total added income for the Louisiana economy.

LAICU's alumni generate a total economic impact of ***$630.2 million*** *in total added income for the Louisiana economy.*

Appendix

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A1 LAICU Member Institutions

Table A1.1: LAICU MEMBER INSTITUTIONS

Institution	Location	Headcount*
Centenary College	Shreveport	563
Dillard University	New Orleans	1,215
Franciscan Missionaries of Our Lady University	Baton Rouge	1,366
Louisiana College	Pineville	1,153
Loyola University	New Orleans	4,497
New Orleans Baptist Theological Seminary	New Orleans	2,293
Saint Joseph Seminary College	St. Benedict	107
Tulane University	New Orleans	13,927
University of Holy Cross	New Orleans	1,137
Xavier University	New Orleans	3,383

*Headcounts represent FY 2018-19.
Source: IPEDS.

A2 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.

In the model we assume a labor import effect variable of 50%, which means that 50% of the state's labor demands would have been satisfied without the presence of LAICU. In other words, businesses that hired the institutions' students could have substituted some of these workers with equally-qualified people from outside the state had there been no LAICU students to hire. Therefore, we attribute only the remaining 50% of the initial labor income generated by increased alumni productivity to the institutions.

Table A1.1 presents the results of the sensitivity analysis for the labor import effect variable. As explained earlier, the assumption increases and decreases relative to the base case of 50% by the increments indicated in the table. Alumni productivity impacts attributable to LAICU, for example, range from a high of $945.3 million at a -50% variation to a low of $315.1 million at a +50% variation from the base case assumption. This means that if the labor import effect variable increases, the impact that we claim as attributable to alumni decreases. Even under the most conservative assumptions, the alumni impact on the Louisiana economy still remains sizeable.

Table A2.1: SENSITIVITY ANALYSIS OF LABOR IMPORT EFFECT VARIABLE

% variation in assumption	-50%	-25%	-10%	Base case	10%	25%	50%
Labor import effect variable	25%	38%	45%	50%	55%	63%	75%
Alumni impact (millions)	$945	$788	$693	$630	$567	$473	$315

Source: Regions provided by LAICU.

A3 Glossary of Terms

Alternative education A "with" and "without" measure of the percent of students who would still be able to avail themselves of education if the institutions under analysis did not exist. An estimate of 10%, for example, means that 10% of students do not depend directly on the existence of the institutions in order to obtain their education.

Asset value Capitalized value of a stream of future returns. Asset value measures what someone would have to pay today for an instrument that provides the same stream of future revenues.

Attrition rate Rate at which students leave the workforce due to out-migration, unemployment, retirement, or death.

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 institutions did not exist.

Credit hour equivalent Credit hour equivalent, or CHE, is defined as 15 contact hours of education if on a semester system, and 10 contact hours if on a quarter system. In general, it requires 450 contact hours to complete one full-time equivalent, or FTE.

Demand Relationship between the market price of education and the volume of education demanded (expressed in terms of enrollment). The law of the downward-sloping demand curve is related to the fact that enrollment increases only if the price (tuition and fees) is lowered, or conversely, enrollment decreases if price increases.

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 state product Measure of the final value of all goods and services produced in a state after netting out the cost of goods used in production. Alternatively, gross state product (GSP) 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 state 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 institutions and the higher earnings of their students.

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 state, they also generate earnings in all sectors of the economy, thereby increasing the demand for goods and services and jobs. Moreover, as students enter or rejoin the workforce with higher skills, they earn higher salaries and wages. In turn, this generates more consumption and spending in other sectors of the economy.

Multiplier effect Additional income created in the economy as the institutions and their students spend money in the state. It consists of the income created by the supply chain of the industries initially affected by the spending of the institutions and their students (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).

NAICS The North American Industry Classification System (NAICS) classifies North American business establishment in order to better collect, analyze, and publish statistical data related to the business economy.

Non-labor income Income received from investments, such as rent, interest, and dividends.

A4 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 the institutions– 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 institutions. Therefore, model results for the institutions are specific to the given region.

A5 Example of Sales versus Income

Emsi's economic impact study differs from many other studies because we prefer to report the impact in terms of income rather than sales (or output). Income is synonymous with value added or gross state product (GSP). Sales include all the intermediary costs associated with producing goods and services. Income is a net measure that excludes these intermediary costs:

Income = Sales—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 GSP reflects a state 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:

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 impact is also reported in sales and earnings terms for reference.

A6 Emsi MR-SAM

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 state 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.

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 BEA's 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.

A7 Value per Credit Hour Equivalent and the Mincer Function

Two key components in the analysis are 1) the value of the students' educational achievements, and 2) the change in that value over the students' working careers. Both of these components are described in detail in this appendix.

Value per CHE

Typically, the educational achievements of students are marked by the credentials they earn. However, not all students who attended the institutions in the 2018-19 analysis year obtained a degree or certificate. Some returned the following year to complete their education goals, while others took a few courses and entered the workforce without graduating. As such, the only way to measure the value of the students' achievement is through their credit hour equivalents, or CHEs. This approach allows us to see the benefits to all students who attended the institutions, not just those who earned a credential.

To calculate the value per CHE, we first determine how many CHEs are required to complete each education level. For example, assuming that there are 30 CHEs in an academic year, a student generally completes 120 CHEs in order to move from a high school diploma to a bachelor's degree, another 60 CHEs to move from a bachelor's degree to a master's degree, and so on. This progression of CHEs generates an education ladder beginning at the less than high school level and ending with the completion of a doctoral degree, with each level of education representing a separate stage in the progression.

The second step is to assign a unique value to the CHEs in the education ladder based on the wage differentials presented in Table 1.2. For example, the difference in state earnings between a high school diploma and an associate degree is $10,500. We spread this $10,500 wage differential across the 60 CHEs that occur between a high school diploma and an associate degree, applying a ceremonial "boost" to the last CHE in the stage to mark the achievement of the degree.1 We repeat this process for each education level in the ladder.

Next we map the CHE production of the FY 2018-19 student population to the education ladder. Table 1.2 provides information on the CHE production of students attending LAICU, broken out by educational achievement. In total, students completed 699,148 CHEs during the analysis year. We map each of these CHEs to the education ladder depending on the students' education level and the average number of CHEs they completed during the year. For example, bachelor's degree graduates are allocated to the stage between the associate degree and the bachelor's degree, and the average number of CHEs they completed informs the shape of the distribution curve used to spread out their total CHE production within that stage of the progression.

The sum product of the CHEs earned at each step within the education ladder and their corresponding value yields the students' aggregate annual increase in income (ΔE), as shown in the following equation:

$$\Delta E = \sum_{i=1}^{n} e_i h_i \quad \text{where } i \in 1, 2, \ldots n$$

and n is the number of steps in the education ladder, ei is the marginal earnings gain at step i, and hi is the number of CHEs completed at step i.

1 Economic theory holds that workers that acquire education credentials send a signal to employers about their ability level. This phenomenon is commonly known as the sheepskin effect or signaling effect. The ceremonial boosts applied to the achievement of degrees in the Emsi impact model are derived from Jaeger and Page (1996).

Table A7.1 displays the result for the students' aggregate annual increase in income (ΔE), a total of $117.2 million. By dividing this value by the students' total production of 699,148 CHEs during the analysis year, we derive an overall value of $168 per CHE.

Table A7.1:
AGGREGATE ANNUAL INCREASE IN INCOME OF STUDENTS AND VALUE PER CHE

Aggregate annual increase in income	$117,174,743
Total credit hour equivalents (CHEs) in FY 2018-19	699,148
Value per CHE	**$168**

Source: Emsi impact model.

Mincer Function

The $168 value per CHE in Table A7.1 only tells part of the story, however. Human capital theory holds that earnings levels do not remain constant; rather, they start relatively low and gradually increase as the worker gains more experience. Research also shows that the earnings increment between educated and non-educated workers grows through time. These basic patterns in earnings over time were originally identified by Jacob Mincer, who viewed the lifecycle earnings distribution as a function with the key elements being earnings, years of education, and work experience, with age serving as a proxy for experience.2 While some have criticized Mincer's earnings function, it is still upheld in recent data and has served as the foundation for a variety of research pertaining to labor economics. Those critical of the Mincer function point to several unobserved factors such as ability, socioeconomic status, and family background that also help explain higher earnings. Failure to account for these factors results in what is known as an "ability bias." Research by Card (1999 and 2001) suggests that the benefits estimated using Mincer's function are biased upwards by 10% or less. As such, we reduce the estimated benefits by 10%. We use state-specific and education level-specific Mincer coefficients.

Figure A7.1: LIFECYCLE CHANGE IN EARNINGS

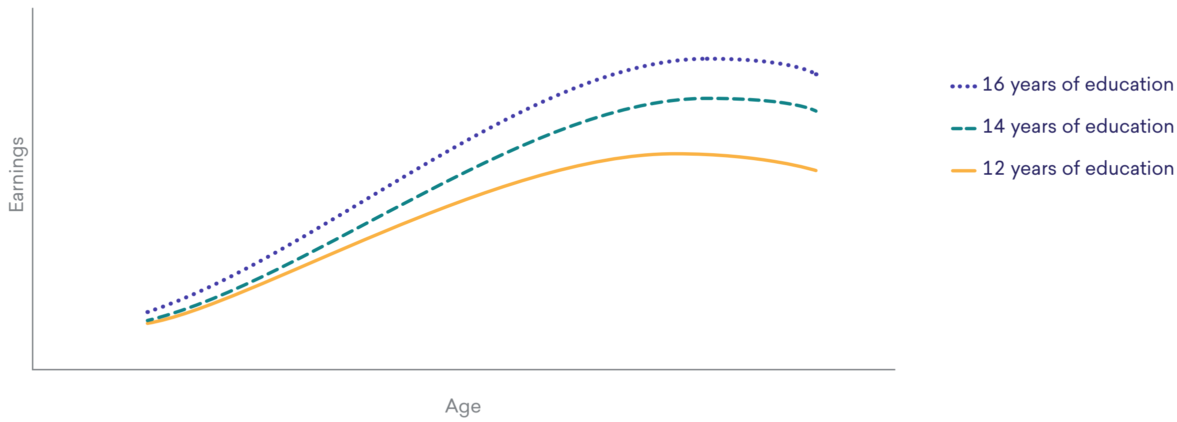

Figure A7.1 illustrates several important points about the Mincer function. First, as demonstrated by the shape of the curves, an individual's earnings initially increase at an increasing rate, then increase at a decreasing rate, reach a maximum

2 See Mincer (1958 and 1974).

somewhere well after the midpoint of the working career, and then decline in later years. Second, individuals with higher levels of education reach their maximum earnings at an older age compared to individuals with lower levels of education (recall that age serves as a proxy for years of experience). And third, the benefits of education, as measured by the difference in earnings between education levels, increase with age.

In calculating the alumni impact in Chapter 2, we use the slope of the curve in Mincer's earnings function to condition the $168 value per CHE to the students' age and work experience. To the students just starting their career during the analysis year, we apply a lower value per CHE; to the students in the latter half or approaching the end of their careers we apply a higher value per CHE. The original $168 value per CHE applies only to the CHE production of students precisely at the midpoint of their careers during the analysis year.: Alternative Education Variable

In a scenario where the institutions did not exist, some of their students would still be able to avail themselves of an alternative comparable education. These students create benefits in the state even in the absence of the institutions. The alternative education variable accounts for these students and is used to discount the benefits we attribute to the institutions.

Recall this analysis considers only relevant economic information regarding the institutions. Considering the existence of various other academic institutions surrounding the institutions, we have to assume that a portion of the students could find alternative education and either remain in or return to the state. For example, some students may participate in online programs while remaining in the state. Others may attend an out-of-state institution and return to the state upon completing their studies. For these students—who would have found an alternative education and produced benefits in the state regardless of the presence of the institutions—we discount the benefits attributed to the institutions. An important distinction must be made here: the benefits from students who would find alternative education outside the state and not return to the state are *not* discounted. Because these benefits would not occur in the state without the presence of the institutions, they must be included.

In the absence of the institutions, we assume 15% of the institutions' students would find alternative education opportunities and remain in or return to the state. We account for this by discounting the alumni impact by 15%. In other words, we assume 15% of the benefits created by the institutions' students would have occurred anyway in the counterfactual scenario where the institutions did not exist.

Emsi

LAICU