



**Susquehanna Valley
Community Education Project**

Facilitating the establishment of a Susquehanna Valley Community College

The Economic Impact of the Proposed Susquehanna Valley Community College

MAIN REPORT

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Executive summary

The proposed new public Susquehanna Valley Community College (proposed college) will have an economic impact on a main service region comprised of Northumberland, Union, Montour, and Snyder Counties (NUMS) and an extended service region that includes Lycoming County (NUMSL). Short-run capital spending for the proposed college will amount to \$13.1 million from FY 2022 to FY 2032 and consists of leasing facilities and purchasing equipment, as well as renovations to existing buildings and new construction. The proposed college will create jobs for faculty and staff, offer affordable higher education opportunities for regional students, and generate positive economic impacts throughout the regional economy due to its day-to-day operational spending. The proposed college will also retain and attract students to the NUMS, whose day-to-day spending will generate economic activity within the region.

This analysis quantifies the economic impact of the proposed Susquehanna Valley Community College on the NUMS economy from FY 2022 to FY 2032, using projections provided by the Susquehanna Valley Community Education Project (SVCEP). These economic impacts break down as follows:

*The proposed college will **create affordable higher education opportunities for regional students** and generate positive economic impacts throughout the regional economy.*



Economic impact

Short-run capital spending impacts



As the \$13.1 million in capital investment is spent on renovations, construction, and equipment from FY 2022 to FY 2032, the proposed college will create new economic activity that will ripple throughout the region. Because this \$13.1 million ends in FY 2032, we do not look at the long-run annual impacts for capital spending that may occur after the final year of analysis.

This new economic activity will amount to a present value of **\$2.6 million** in total added income for the regional economy.

Long-run operations spending impacts



As the proposed college becomes operational, it will spend money on day-to-day operational expenditures, including expenses to support new employees and spending on other supplies and services.



These operations spending impacts will begin in FY 2022. By FY 2032, the proposed college is projected to employ an estimated 76 employees and will annually spend around \$4.8 million on salaries and benefits.

From FY 2022 to FY 2032, the increased operations spending resulting from the proposed college will create a present value of **\$39.7 million** in total added income for the regional economy.

Long-run student spending impacts



With a community college in the NUMS, many students will be able to stay in the region rather than leave to attend college elsewhere.

Some students will also relocate to the NUMS from outside the region in order to attend the proposed college. These retained and relocated students will spend money on housing, entertainment, groceries, and transportation within the region. This spending will not otherwise occur if not for the proposed college.

From FY 2022 to FY 2032, the students' spending will create a present value of **\$15 million** in total added income for the regional economy.

Long-run alumni impacts



The proposed college will not only create new alumni that would not have otherwise been served, but it will respond to the needs of a growing economy and demand for skilled workers. These alumni will start positively impacting the regional economy in FY 2022. This analysis is capped at FY 2032; however, the number of alumni trained as a result of the proposed college will continue to grow long after. The added earnings and increased productivity of these alumni will create long-run impacts across the regional economy.

By FY 2032, the proposed college will have produced around 3,000 alumni. From FY 2022 to FY 2032, these alumni who are active in the regional workforce will create a present value of **\$21.3 million** in total added income in the regional economy.

Total impact

The opening of a new community college in the NUMS will generate a significant amount of new economic activity within the regional economy. This new economic activity will amount to a present value of **\$78.5 million** in total added income from FY 2022 to FY 2032, which is the sum total of the short-run capital spending impacts and long-run operations spending impacts, student spending impacts, and alumni impacts.

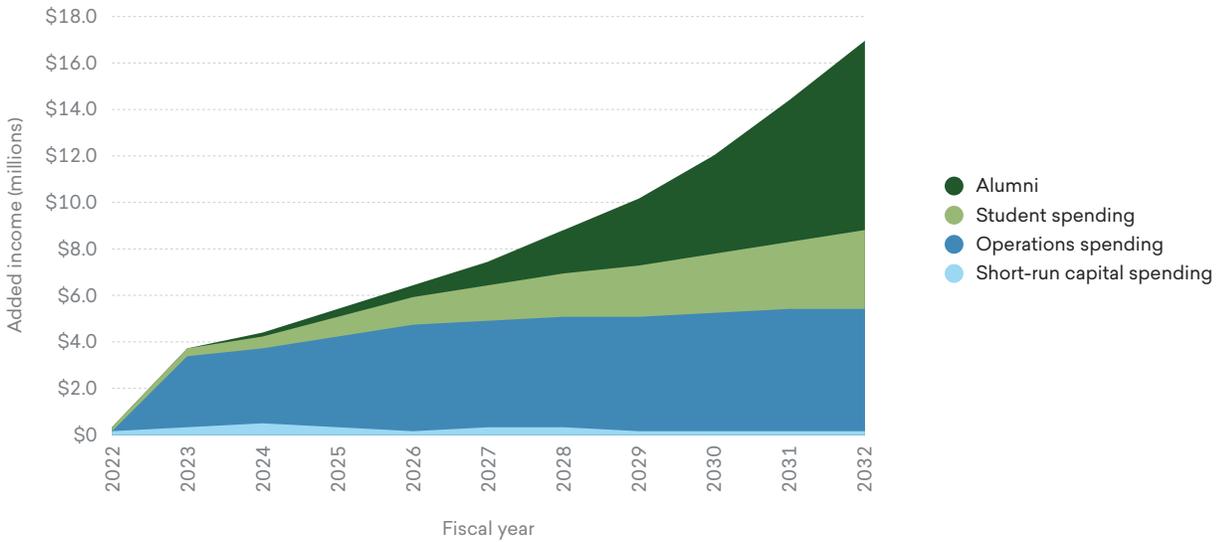
PRESENT VALUE IMPACTS,
FY 2022 TO FY 2032

NUMS	NUMSL
 Short-run capital spending \$2.6 MILLION	 Short-run capital spending \$3.1 MILLION
 Long-run operations spending \$39.7 MILLION	 Long-run operations spending \$42.2 MILLION
 Long-run student spending \$15 MILLION	 Long-run student spending \$20.5 MILLION
 Long-run alumni \$21.3 MILLION	 Long-run alumni \$26.1 MILLION
TOTAL IMPACT \$78.5 MILLION	TOTAL IMPACT \$91.9 MILLION

Important note

When reviewing the impacts estimated in this study, it's important to note that it primarily reports impacts in the form of added income rather than sales. Sales includes all of the intermediary costs associated with producing goods and services. Income, on the other hand, is a net measure that excludes these intermediary costs 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.

TOTAL IMPACT FROM FY 2022 TO FY 2032, UNDISCOUNTED



Annual impacts

The economic impacts discussed thus far are those summed across the analysis years of FY 2022 to FY 2032 and discounted to present value terms. However, each of the three long-run types of impacts will create an annual impact after the final year of analysis. These break down as follows:

- Operations spending annual impact:** The proposed college’s operational spending will increase yearly and stabilize around FY 2033. By FY 2032, the last year of this analysis, increased operations spending will add around **\$5.3 million** in total income on an annual basis, equivalent to supporting **82 jobs** per year.
- Student spending annual impact:** Similarly, once the number of students the proposed college is able to serve stabilizes, **\$3.3 million** in income will be added per year, supporting **90 jobs** annually, as a result of spending from retained and relocated students in the region.
- Alumni annual impact:** The proposed college will produce alumni every year, who will then accumulate in the regional workforce. By FY 2032, alumni are estimated to add **\$8.1 million** in total income to the economy per year, supporting **98 jobs** annually. This annual impact is expected to increase every year for several years as the proposed college continues to serve students and they enter the workforce.

The total annual impact from the proposed college will be at least **\$16.7 million** in added income. This is equivalent to supporting **270 jobs** every year.



Return on investment

An estimated \$1.2 million of the proposed college’s capital investment is expected to come from the local government. In return, local taxpayers will receive an estimated present value of **\$4.2 million in added tax revenue** stemming from the higher student earnings and increased output of businesses from the impacts discussed above. These benefits and costs yield a **benefit-cost ratio of 3.5**, indicating a profitable investment. The taxpayer’s average annual **internal rate of return is 26.4%**, which compares favorably to other long-term investments in the public and private sectors. This \$1.2 million in local taxpayer investment is also expected to generate a **return on investment of 2.5**, meaning that for every dollar the local government invests in opening the proposed college, the proposed college will fully recover the dollar and generate an additional \$2.50 in benefits for the NUMS economy.

Although not quantified in this analysis, education is statistically associated with a variety of lifestyle changes that generate social savings. Studies show that as students become more educated, they commit less crimes, are healthier, and are less reliant on government programs like welfare. All of these benefit taxpayers and society as a whole in the region and state.

LOCAL TAXPAYERS RETURN ON INVESTMENT

NUMS	NUMSL
Return on investment	
2.5	2.5
Benefit-cost ratio	
3.5	3.5
Annual internal rate of return	
26.4%	25.7%

Implicit multiplier

The implicit multiplier is the present value of added income divided by the capital spending on the proposed college. From FY 2022 to FY 2032, every dollar of the \$13.1 million of the proposed college’s capital spending will create a present value of **\$5.98** in added income throughout the region.

Payback period

By FY 2024, **2.9 years** after construction begins, it is expected that the impacts generated by the proposed college will have grown significantly enough to recover the costs of not only the capital investment, but the annual costs of keeping the proposed college operational.

ACKNOWLEDGEMENTS

Emsi gratefully acknowledges the excellent support of the staff at the Susquehanna Valley Community Education Project (SVCEP) in making this study possible. Special thanks go to Dr. Lenaire Ahlum, Executive Director, SVCEP; David Nowroski, Treasurer, SVCEP; Meghan Beck, President, SVCEP; Craig Harley, Director, Financial Development Services; Lauren Bryson, Executive Director, Focus Central Pennsylvania; and Tea Jay Aikey, President and CEO, Central Pennsylvania Chamber of Commerce, 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.



Introduction

THE Susquehanna Valley Community Education Project (SVCEP) is facilitating the establishment of an independent community college in central Pennsylvania where there is currently not a community college dedicated to serving students. The proposed college will not only offer affordable higher education opportunities for students in the middle of the state, but will also create jobs for faculty and staff and generate positive economic impacts throughout the regional economy.

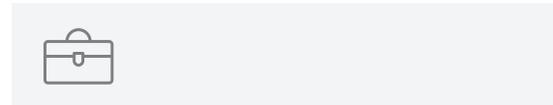
In this report, using projections provided by the SVCEP, we estimate four types of impacts to quantify the new economic activity created by the proposed college in the short-run and long-run:

- **Short-run capital spending impacts:** the capital spending for the construction, renovation, and purchase of equipment for the proposed college will total to \$13.1 million from FY 2022 to FY 2032, the last year of analysis. Because this analysis only looks at capital funding until FY 2032, we do not look at the long-run annual impacts for capital spending that may occur after the final year of analysis. As the \$13.1 million is spent, it will create new economic activity that will ripple throughout the NUMS economy.
- **Long-run operations spending impacts:** as the proposed college becomes operational, it will need to hire faculty and staff and spend money on day-to-day operations. These operations spending impacts will begin in FY 2022. As the college stays open year after year, the operations spending impacts will grow until FY 2032, the last year of this analysis. The proposed college will provide long-run operations spending impacts across the NUMS.
- **Long-run student spending impacts:** with a community college now in the NUMS, some students will relocate to the region in order to attend the college and others, originally from the region, will remain in the region because of opportunities provided by the proposed college. These students will spend money on housing, food, and entertainment in the region.



This injection of money is attributable to the proposed college, beginning in FY 2022 when the proposed college expects to start serving students. The spending from these students will continue to impact the economy year after year.

- Long-run alumni impacts:** the proposed college will not only create new alumni who would not otherwise be served but will respond to the demands of a growing economy and student population. These alumni represent a significant increase in the stock of human capital available to the NUMS economy. Alumni will begin to accrue in the regional workforce in FY 2022. By FY 2032, the final year of this analysis, around 3,000 alumni will have been produced as a result of the proposed college, the majority of whom are expected to remain in the region. The added earnings and increased productivity of these alumni will create long-run impacts across the regional economy.

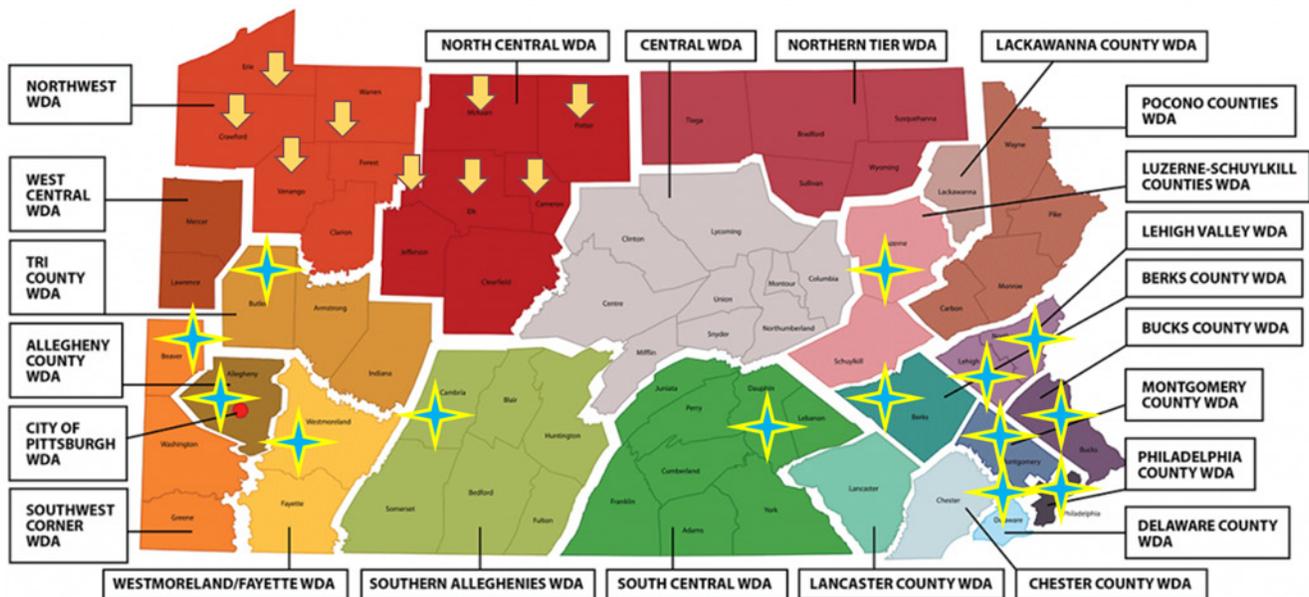


This analysis spans across the four types of impacts from FY 2022 to FY 2032. However, the long-run impacts will continue long after the final year of this analysis.

MILESTONES TO OUR OWN COMMUNITY COLLEGE (ESTIMATED TIMEFRAMES)

University partnership agreement	Multi-county sponsorship resolution	State application submitted for approval	Appoint a governing board of trustees Hire founding president, administration, faculty and staff Begin program instruction
2021	2021-22	2022	2023-24

Source: SVCEP.



Northern Pennsylvania Regional College (9 counties)
 Community College
 Slide Design Prepared by Dr. Lenaire Ahlum for SVCEP. 2019.



About economic impact analysis

Economic impact analyses use different types of impacts to estimate the results. The impact focused on in this study is the **income impact**, which assesses the change in gross regional product, or GRP. Income may be further broken out into the **labor income impact**, which assesses the change in employee compensation; and the **non-labor income impact**, which assesses the change in income business profits. Another way to state the income impact is **jobs**, a measure of the number of full- and part-time jobs that would be required to support the change in income. In the next section, jobs are reported on an annual basis rather than total because jobs are duplicated across the years. 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 region economy through intermediary transactions and costs.¹ All of these measures—jobs, income, and sales—are used to estimate the economic impact results.

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 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 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.

¹ See Appendix 2 for an example of the intermediary costs included in the sales impact but not in the income impact.



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 section 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.

Emsi	Initial	Direct	Indirect	Induced
IMPLAN	Direct	Indirect		Induced

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 region. 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 3.





The economic impact of the proposed Susquehanna Valley Community College

THIS analysis quantifies the economic impacts associated with the proposed Susquehanna Valley Community College, an endeavor beginning in FY 2022. According to estimates provided by the SVCEP, the proposed college will require at least \$2.8 million in funding to open its doors. In total, it expects the proposed college to spend \$13.1 million in capital investments from FY 2022 to FY 2032. Approximately 43% of the total capital funding is expected to come from the state and local government. The remaining \$7.5 million in funds will originate from the federal government and from other funding sources (Table 1).

TABLE 1: FUNDING SOURCES FOR THE PROPOSED COLLEGE

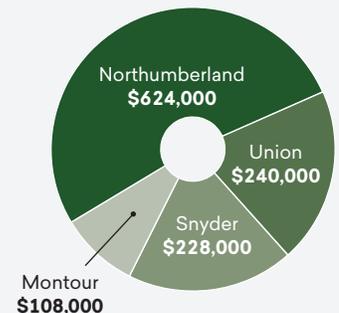
Funding source	Amount	% of total
Local government	\$1,200,000	9%
State government	\$4,450,000	34%
Federal government	\$1,850,000	14%
Other sources of funding	\$5,615,000	43%
Total	\$13,115,000	100%

Source: Data provided by the SVCEP.

Funds allocated to spending on the proposed college will serve a variety of purposes, from leasing facilities and equipment to renovating existing buildings and constructing various education centers. The SVCEP has outlined the proportion of funds that would be spent on construction, equipment, and other needs. Figure 1 outlines the total spending in these categories by year for the proposed college.

The proposed college will create impacts on the NUMS economy in several ways. Capital investments will consist of the construction, renovation, and purchase of equipment for the proposed college, providing short-run capital spending impacts. Once the facilities are operational, the proposed college will be able to serve students whom would not otherwise have been able to

MULTI-COUNTY SPONSORSHIP: FUNDING OUR OWN NEW COMMUNITY COLLEGE



\$1.2 million
(\$1.14 per household per month)

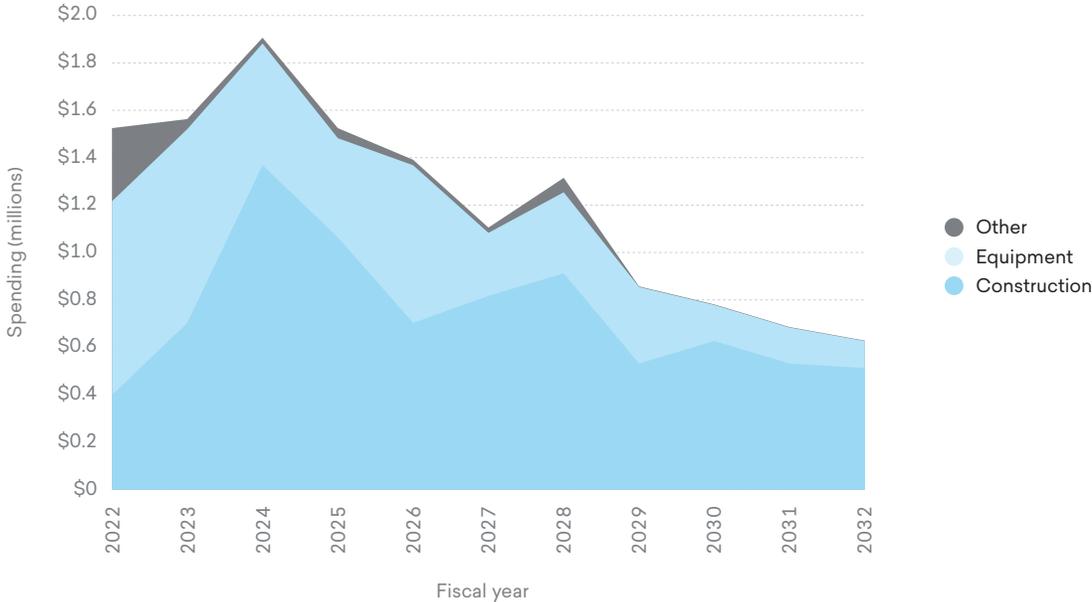
Source: SVCEP.



gain a higher education. The proposed college will create jobs for faculty and staff and will increase the day-to-day operational supply chain purchases from local businesses. Additionally, the proposed college will attract students to the region and retain students in the region who would have left, thus positively impacting the regional economy through the students' spending. This will provide a steady stream of long-run spending impacts year after year. Lastly, as the students who would otherwise not have been served graduate, they will create long-run benefits within the region.

In this section, we estimate these impacts under four headings: 1) the short-run capital spending impact from the spending on construction and other purchases; 2) the long-run operations spending impact from the college's payroll and purchases; 3) the long-run student spending impact from the expenditures of students the college will be able to serve; and 4) the long-run alumni impact from the graduates the proposed college will be able to produce. The proposed college's service region for which the impacts are measured is referred to as the NUMS and consists of Northumberland, Union, Montour, and Snyder Counties.

FIGURE 1: SPENDING BY YEAR AND FUNCTION, UNDISCOUNTED



Source: Data provided by the SVCEP





Short-run capital spending impacts

The capital spending will primarily be used to renovate and expand existing facilities, construct new facilities, and to purchase equipment to serve students. As outlined in Figure 1, the spending will occur from FY 2022 to FY 2032. We refer to this period as the construction phase. Over the course of the construction phase, a total of \$13.1 million will be spent. This spending will create a significant increase in the demand for the goods and services that are required to open the proposed college. The capital spending will create subsequent rounds of spending and corresponding multiplier effects that will generate still more jobs and income throughout the NUMS economy. We do not look at the long-run annual impacts for capital spending that may occur after FY 2032, the final year of analysis.

The first step in estimating the multiplier effects of the construction spending is to map the three spending categories in Figure 1—construction, equipment, and other—to the approximately 1,000 industries of the Emsi MR-SAM model. We assume the proposed college's spending patterns will approximately match national averages for those three categories and apply national spending patterns for NAICS 903612 (Colleges, Universities, and Professional Schools (Local Government)). Some slight adjustments were made to the spending patterns based on data provided by the SVCEP.

The next step is to estimate the portion of these expenditures that occur inside the region. The expenditures occurring outside the region are known as leakages. We estimate in-region expenditures using regional purchase coefficients (RPCs), a measure of the overall demand for the commodities produced by each sector that is satisfied by regional suppliers, for each of the approximately 1,000 industries in the MR-SAM model. For example, if 40% of the demand for NAICS 52410 (Insurance carriers) is satisfied by the proposed college's suppliers, the RPC for that industry is 40%.

The remaining 60% of the demand for NAICS 52410 is provided by suppliers located outside the region. The spending is multiplied, industry by industry, by the corresponding RPC to arrive at the in-region spending. Of the \$13.1 million spent over the course of the construction phase, we estimate \$4.5 million will be spent within the NUMS and \$8.6 million will be spent on out-of-region

*Capital spending toward the proposed college will create a net total short-run economic impact of **\$2.6 million** in added income for the NUMS.*



goods and services (Table 2). Finally, in-region 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 labor income, non-labor income, total added income, and sales.

TABLE 2: SPENDING BY YEAR AND PLACE OF OCCURRENCE, UNDISCOUNTED

Year	In-region (thousands)	Out-of-region (thousands)	Total (thousands)
FY 2022	\$323	\$1,184	\$1,507
FY 2023	\$429	\$1,110	\$1,539
FY 2024	\$723	\$1,159	\$1,882
FY 2025	\$568	\$936	\$1,504
FY 2026	\$412	\$961	\$1,374
FY 2027	\$427	\$663	\$1,090
FY 2028	\$488	\$802	\$1,290
FY 2029	\$292	\$558	\$850
FY 2030	\$326	\$454	\$780
FY 2031	\$276	\$404	\$680
FY 2032	\$260	\$360	\$620
Total	\$4,524	\$8,591	\$13,115

Source: Data provided by the SVCEP and the Emsi impact model.

Table 3 and Figure 2 present the short-run economic impacts of the proposed college by year. The first row under each year in the table represents the initial effect of that year's construction spending. Results appear in the section labelled multiplier effect in the table. Adding the initial effect and the multiplier effects yields the gross impact.

Recall from Table 1 that approximately 9% of the funding is from the local government.² Had these funds been spent on other projects, other economic impacts would be created. This scenario is commonly known as a counterfactual; i.e., what has not happened but what would have happened if a given event—in this case, the proposed college receiving these local funds—had not occurred. 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 local public monies are instead spent on consumer goods and savings. This simulates the public monies being returned to the taxpayers and being spent by the household sector. Our approach is similar to that described above. We map these public funds to the detailed industries of the MR-SAM model using national household

2 The remaining revenues come from the state and federal government and other funding sources. These funds are considered an injection of new monies into the economy and therefore do not apply to the counterfactual.



expenditure coefficients, use the industry RPCs to estimate in-region spending, and run the in-region 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 labelled "Less alternative uses of funds" in Table 3. The total net impacts of the construction spending are equal to the total gross impacts less the impacts of the alternative uses of funds.

TABLE 3: SHORT-RUN CAPITAL SPENDING IMPACTS BY YEAR, UNDISCOUNTED

	Labor income (thousands)	Non-labor income (thousands)	Total added income (thousands)	Sales (thousands)
FY 2022				
Initial effect	\$0	\$0	\$0	\$1,507
Multiplier effect				
Direct effect	\$121	\$60	\$181	\$323
Indirect effect	\$15	\$6	\$21	\$39
Induced effect	\$21	\$14	\$35	\$59
Gross impact	\$158	\$79	\$237	\$1,928
Less alternative uses of funds	-\$17	-\$20	-\$37	-\$228
Net impact	\$141	\$59	\$200	\$1,700
...				
FY 2032				
Initial effect	\$0	\$0	\$0	\$620
Multiplier effect				
Direct effect	\$109	\$28	\$137	\$260
Indirect effect	\$14	\$4	\$18	\$34
Induced effect	\$18	\$5	\$23	\$43
Gross impact	\$141	\$37	\$178	\$958
Less alternative uses of funds	-\$7	-\$8	-\$15	-\$94
Net impact	\$134	\$28	\$163	\$864

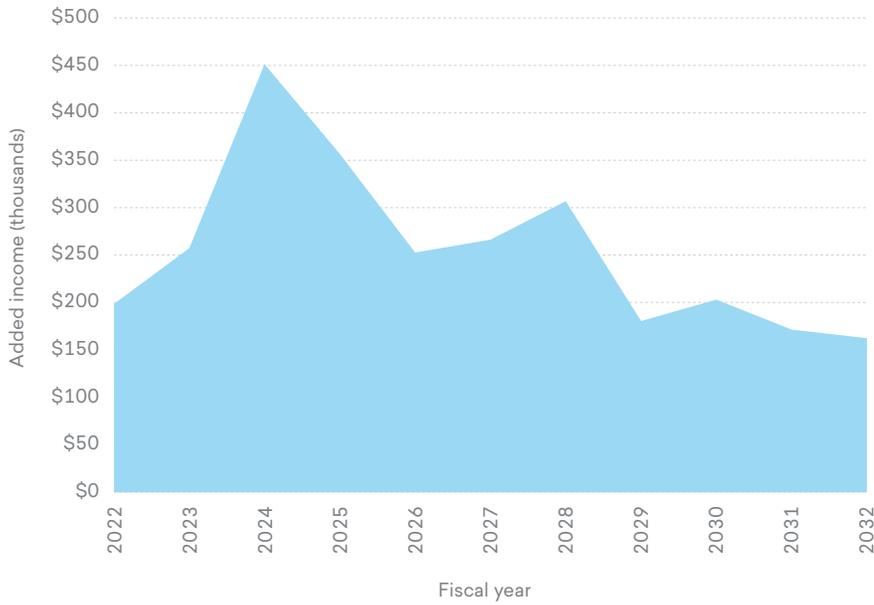
Source: Emsi impact model.

Table 3 and Figure 2 present undiscounted year-by-year impacts. In order to understand the total impact from FY 2022 to FY 2032, we must discount all future impacts to their present value in 2020 dollars. This is done using a discount rate of 1.5%, the discount rate recommended by the Office of Management and Budget for long-term investments.³ Once the future impacts are discounted, we sum the present value of each year's impacts to reach a total net impact of the proposed college's construction spending from FY 2022 to FY 2032. Results are presented in Table 4. Spending toward the proposed college will create a total short-run economic impact of \$2.6 million in added income for the NUMS.

3 Office of Management and Budget. "Discount Rates for Cost-Effectiveness Analysis of Federal Programs." Real Interest Rates on Treasury Notes and Bonds of Specified Maturities (in Percent). Last modified November 2018. <https://www.whitehouse.gov/wp-content/uploads/2018/12/Discount-History.pdf>.



FIGURE 2: SHORT-RUN CAPITAL SPENDING IMPACTS BY YEAR, UNDISCOUNTED



Source: Emsi impact model.

TABLE 4: PRESENT VALUE OF SHORT-RUN CAPITAL SPENDING IMPACTS, TOTAL FROM FY 2022 TO FY 2032

	Labor income (thousands)	Non-labor income (thousands)	Total added income (thousands)	Sales (thousands)
FY 2022 – FY 2032, TOTAL				
Initial effect	\$0	\$0	\$0	\$11,998
Multiplier effect				
Direct effect	\$1,689	\$501	\$2,190	\$4,115
Indirect effect	\$220	\$62	\$282	\$533
Induced effect	\$284	\$91	\$375	\$695
Gross impact	\$2,193	\$653	\$2,846	\$17,341
Less alternative uses of funds	-\$134	-\$161	-\$295	-\$1,817
Net impact	\$2,059	\$492	\$2,551	\$15,524

Source: Emsi impact model.



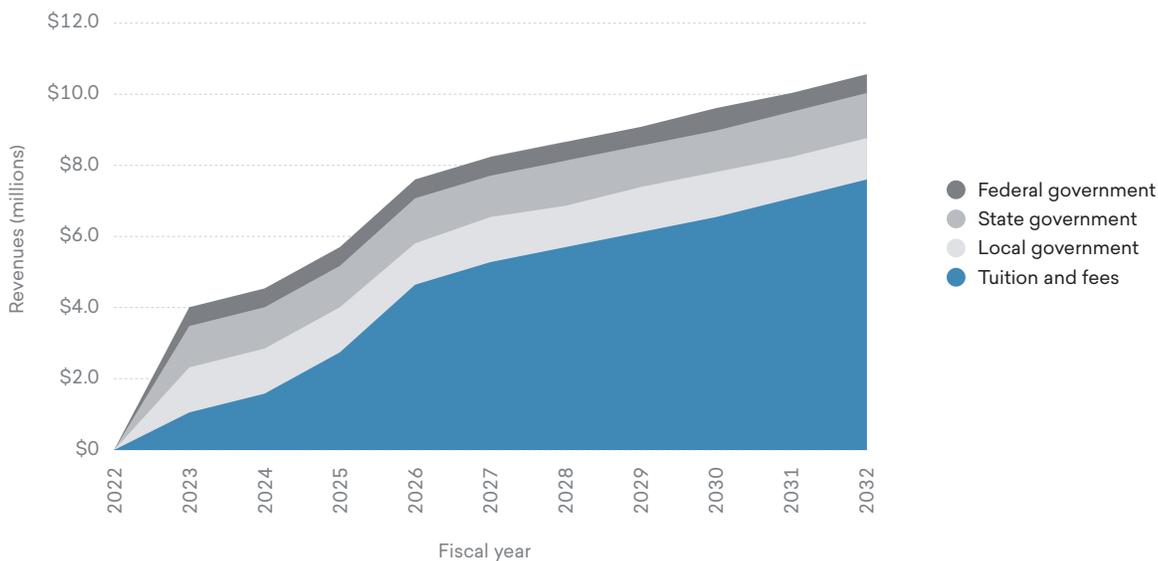


Long-run operations spending impacts

As the proposed college becomes operational, it will need to hire faculty and staff and spend money on day-to-day operational expenditures. In this section, we estimate the economic impact of these new rounds of operations spending that will occur once the proposed college opens its doors. These economic impacts will continue annually as long as the added capacities created by the proposed college are utilized. We estimate the operational impacts between FY 2022—when the proposed college first becomes operational—and FY 2032—the final year of this analysis.

To begin this analysis, we consider the revenue and spending needed to operate the proposed college per year. The SVCEP provided revenue and operations spending estimates for the proposed college from FY 2022 to FY 2027, after which point revenues and operations spending are expected to increase annually by 5% and 3%, respectively. It is estimated that the proposed college will spend \$9.9 thousand for payroll and \$6.8 thousand for non-pay expenditures in the first year of analysis. By the last year of analysis, the proposed college is expected to spend around \$6.5 million for its operations (excluding depreciation and interest). To fund these operations, it is estimated that the proposed college will receive approximately \$10.4 million in revenues by the last year of analysis. Figure 3 and Figure 4 outline the operations revenue and expenditures, respectively, by year and type.

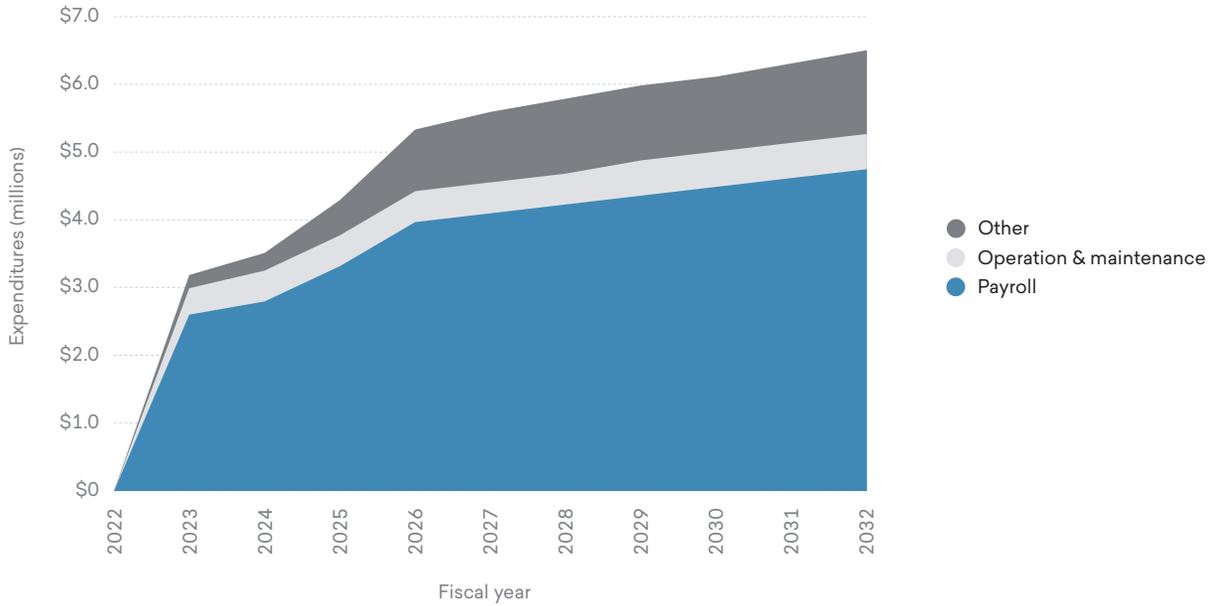
FIGURE 3: REVENUE BY YEAR AND SOURCE, UNDISCOUNTED



Source: Data provided by the SVCEP



FIGURE 4: EXPENDITURES BY YEAR AND TYPE
(EXCLUDING DEPRECIATION & INTEREST), UNDISCOUNTED



Source: Data provided by the SVCEP

The first step in estimating the operations spending impacts is to map these categories to the approximately 1,000 industries of the Emsi MR-SAM model. Again, assuming that the spending patterns of the proposed college’s personnel will approximately match those of the average consumer, we map payroll to spending on industry outputs using national household expenditure coefficients supplied by Emsi’s national SAM. For the other two expenditure categories, we assume the spending patterns approximately match national averages and apply the national spending coefficients for NAICS 903612 (Colleges, Universities, and Professional Schools (Local Government)).

We now have two vectors of expenditures: one for payroll and another for the proposed college’s purchases of supplies and services. Using the RPCs, we estimate the portion of these expenditures that occur inside the region. The vectors of expenditures are multiplied, industry by industry, by the corresponding RPC to arrive at the in-region expenditures associated with the proposed college. Finally, in-region 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 labor income, non-labor income, total added income, sales, and jobs.

Table 5 presents the economic impact of the proposed college’s operations for FY 2022 and FY 2032, whereas Figure 5 presents the impact every year. For each year in the table, the top row shows the initial effects of the proposed college’s operations in terms of labor income, non-labor income, total added income, and sales. However, the funding for these increased operations had to



come from somewhere. Consequently, we must account for any alternate uses of these funds. This is similar to the counterfactual we considered in the short-run capital spending impacts section. The results of this exercise are shown as negative values in the row labeled “Less alternative uses of funds” in Table 5.

TABLE 5: OPERATIONS SPENDING IMPACTS, FIRST AND LAST YEAR OF ANALYSIS, UNDISCOUNTED

	Labor income (thousands)	Non-labor income (thousands)	Total added income (thousands)	Sales (thousands)
FY 2022				
Initial effect	\$10	\$0	\$10	\$17
Multiplier effect				
Direct effect	\$1	<\$1	\$2	\$3
Indirect effect	<\$1	<\$1	<\$1	<\$1
Induced effect	\$1	\$2	\$3	\$5
Gross impact	\$13	\$2	\$15	\$25
Less alternative uses of funds	-\$2	-\$2	-\$4	-\$11
Net impact	\$11	\$0	\$11	\$14
...				
FY 2032				
Initial effect	\$4,778	\$0	\$4,778	\$6,528
Multiplier effect				
Direct effect	\$141	\$92	\$234	\$405
Indirect effect	\$18	\$8	\$26	\$48
Induced effect	\$607	\$728	\$1,335	\$2,066
Gross impact	\$5,545	\$828	\$6,373	\$9,047
Less alternative uses of funds	-\$484	-\$584	-\$1,068	-\$3,287
Net impact	\$5,060	\$244	\$5,304	\$5,760

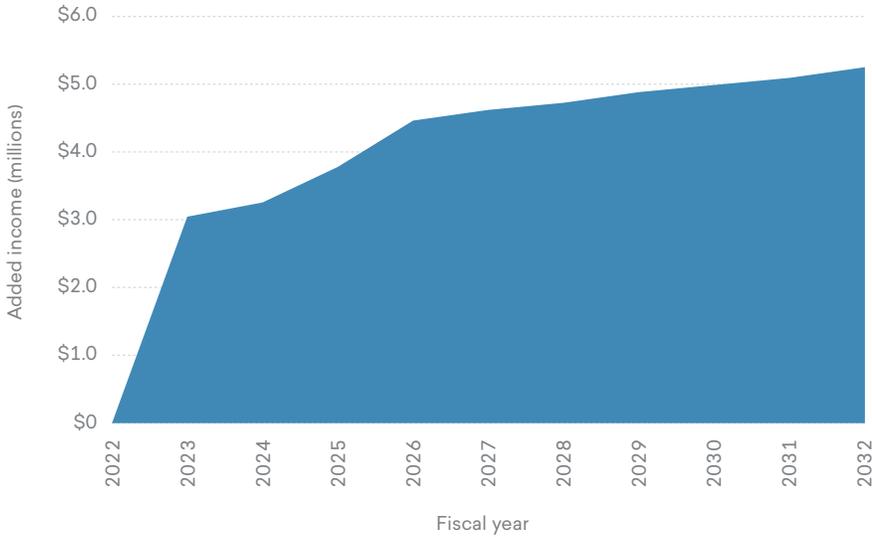
Source: Emsi impact model.

Table 5 and Figure 5 present undiscounted year-by-year operations spending impacts. The total impacts, summed across FY 2022 to FY 2032 and discounted to 2020 dollars, are presented in Table 6.⁴ From FY 2022 to FY 2032, the present value of increased operations spending resulting from the proposed college will create \$39.7 million in total added income.

4 A discount rate of 1.5% was used, which represents the discount rate recommended by the Office of Management and Budget for 10-year investments. Office of Management and Budget. Circular A-94 Appendix C, http://www.whitehouse.gov/omb/circulars_a094/a94_appx-c



FIGURE 5: OPERATIONS SPENDING IMPACTS BY YEAR, UNDISCOUNTED



Source: Data provided by the SVCEP

TABLE 6: PRESENT VALUE OF OPERATIONS SPENDING IMPACTS, TOTAL FROM FY 2022 TO FY 2032

	Labor income (thousands)	Non-labor income (thousands)	Total added income (thousands)	Sales (thousands)
FY 2022 – FY 2032, TOTAL				
Initial effect	\$35,051	\$0	\$35,051	\$46,913
Multiplier effect				
Direct effect	\$1,051	\$624	\$1,676	\$2,936
Indirect effect	\$135	\$54	\$189	\$349
Induced effect	\$4,451	\$5,323	\$9,774	\$15,134
Gross impact	\$40,688	\$6,001	\$46,689	\$65,333
Less alternative uses of funds	-\$3,188	-\$3,846	-\$7,034	-\$21,643
Net impact	\$37,500	\$2,155	\$39,655	\$43,690

Source: Emsi impact model.

Annual operations spending impacts

While the total impacts that occur from FY 2022 to FY 2032 are relevant because of the temporal nature of the proposed college’s operations spending, it is critical to understand that there will be a recurring annual operations spending impact as long as the proposed college is open. These are the true long-run operations spending impacts. Without making any assumptions for growth beyond the years of analysis, the NUMS economy will enjoy an annual impact of **\$5.3 million** in total added income. This is equivalent to supporting **82 jobs** every year.





Long-run student spending impacts

Students will contribute to economic impacts of the proposed college in the NUMS. However, not all of these students can be counted towards the impact. Of the in-region students, only those students who will be retained, or who will leave the region for other educational opportunities if the college does not open, are measured. Students who will have stayed in the region anyway are not counted towards the impact since their monies would have been added to the NUMS economy regardless of the proposed college. Additionally, approximately 3% of the students will originate from outside the region. The majority of these students will relocate to the region in order to attend the college. These students will bring monies with them to spend on living arrangements, food, transportation, and so forth. The student spending impacts are expected to start in 2022, when the first students are served, and are measured until 2032, the final year of this analysis.

It is estimated that the vast majority of students who will attend the proposed college will originate from the NUMS. Furthermore, it is likely that a number of them will leave the region if the proposed college does not open. On average, 61% of students who attend a community college will live within 50 miles of the college.⁵ Given the lack of accessibility to affordable higher education opportunities in central Pennsylvania, it is likely that the students living in this radius would leave to pursue other education opportunities if the proposed college does not open. Therefore, we estimate that 61% of the proposed college's expected students would be retained in the region if the college opens.⁶ By retaining these students in the NUMS, the money they spend on groceries, accommodation, transportation, and so on while attending the proposed college will stay within the region, generating new economic activity.

The proposed college is also expected to provide on-campus housing beginning in FY 2023, so some students will live on-campus while attending the proposed college. Although the students who live on-campus spend money on living and food expenses while attending the college, we exclude most of their spending for room and board because it is already recognized in the proposed college's revenue.

The proposed college will retain and attract students to the NUMS, whose spending will create new economic activity in the regional economy.

5 Economic Modeling Specialists, Intl. "How Your School Affects Where You Live." Accessed December 11, 2020. <https://www.us.ccb/how-your-school-affects-where-you-live/>.

6 See Appendix 4 for a sensitivity analysis of the retained student variable.



The average costs for students appear in Table 7, equal to \$6,000 per student. Note that this table excludes expenses for books and supplies, since many of these monies are already reflected in the operations spending impact discussed in the previous section. Table 8 outlines the total number of students the proposed college is expected to serve each year, as well as the estimated number of relocated and retained students. Again, we only want to measure the impact of those students who will relocate to the region or be retained in the region. Enrollment will increase every year and is expected to stabilize by FY 2033, beyond this study's cutoff year. By multiplying the expenses per student by the number of relocated and retained students, we arrive at a total of \$10.1 million in annual sales by the last year of analysis.⁷

TABLE 7: AVERAGE ANNUAL STUDENT SPENDING

Room and board	\$4,800
Personal expenses	\$682
Transportation	\$518
Total expenses per student*	\$6,000

* Numbers may not add due to rounding.

Source: Data provided by the SVCEP.

TABLE 8: ADDED STUDENTS AND TOTAL SALES BY YEAR, UNDISCOUNTED

Year	Total expected students	Expected relocated students	Expected retained students	Total sales from relocated and retained students (thousands)
FY 2022	70	2	41	\$261
FY 2023	250	8	149	\$935
FY 2024	425	13	253	\$1,590
FY 2025	750	24	447	\$2,806
FY 2026	850	27	507	\$3,181
FY 2027	1,157	37	690	\$4,330
FY 2028	1,464	46	873	\$5,479
FY 2029	1,771	56	1,056	\$6,628
FY 2030	2,079	66	1,239	\$7,778
FY 2031	2,386	76	1,422	\$8,927
FY 2032	2,693	85	1,605	\$10,076

Source: Data provided by the SVCEP and the Emsi impact model.

Estimating the impacts generated by the student spending follows a procedure similar to that of the other impacts previously described. We distribute the sales to the industry sectors of the MR-SAM model, apply RPCs to reflect in-region

⁷ Numbers may not match by multiplying due to rounding.



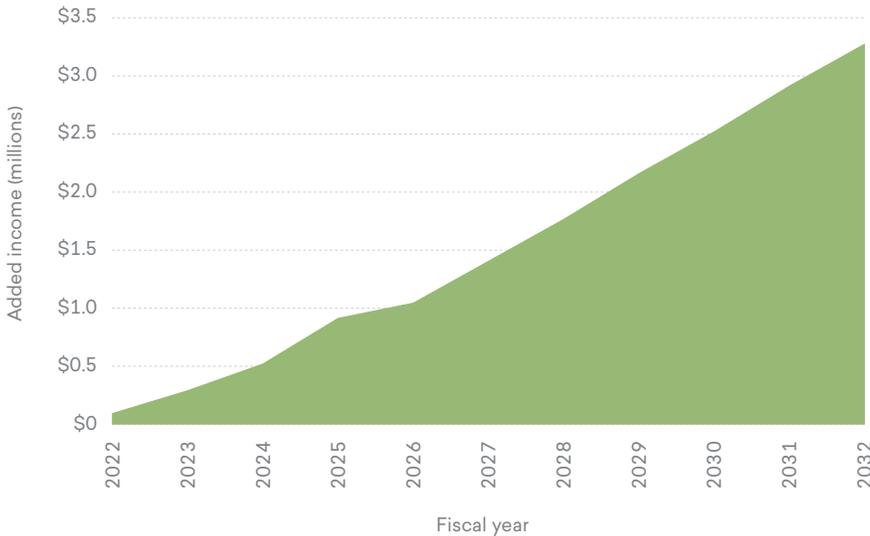
spending, and run the sales figures through the MR-SAM model to derive multiplier effects. Similar to the short-run capital spending impact, the initial effect is purely sales-oriented and there is no change in labor or non-labor income. The impact of student spending thus falls entirely under the multiplier effect. Table 9 outlines the annual impacts for FY 2022, when the first students are expected to enroll at the proposed college, and FY 2032, the cutoff date in this study's time horizon. Figure 6 outlines the impact for every year of the analysis.

TABLE 9: STUDENT SPENDING IMPACTS, FIRST AND LAST YEAR OF ANALYSIS, UNDISCOUNTED

	Labor income (thousands)	Non-labor income (thousands)	Total added income (thousands)	Sales (thousands)
FY 2022				
Initial effect	\$0	\$0	\$0	\$261
Multiplier effect				
Direct effect	\$42	\$24	\$66	\$123
Indirect effect	\$5	\$3	\$8	\$16
Induced effect	\$7	\$4	\$12	\$22
Total impact	\$55	\$31	\$86	\$421
...				
FY 2032				
Initial effect	\$0	\$0	\$0	\$10,076
Multiplier effect				
Direct effect	\$1,630	\$911	\$2,542	\$4,744
Indirect effect	\$205	\$119	\$324	\$626
Induced effect	\$285	\$167	\$453	\$831
Total impact	\$2,121	\$1,198	\$3,319	\$16,277

Source: Emsi impact model.

FIGURE 6: STUDENT SPENDING IMPACTS BY YEAR, UNDISCOUNTED



Source: Emsi impact model.



The total long-run student spending impacts, summed across those years and discounted to 2020 dollars, are presented in Table 10.⁸ From FY 2022 to FY 2032, students will add \$15 million in total added income for the NUMS economy.

TABLE 10: PRESENT VALUE OF STUDENT SPENDING IMPACTS, TOTAL FROM FY 2022 TO FY 2032

	Labor income (thousands)	Non-labor income (thousands)	Total added income (thousands)	Sales (thousands)
FY 2022 – FY 2032, TOTAL				
Initial effect	\$0	\$0	\$0	\$45,430
Multiplier effect				
Direct effect	\$7,351	\$4,110	\$11,461	\$21,390
Indirect effect	\$925	\$538	\$1,462	\$2,822
Induced effect	\$1,286	\$755	\$2,041	\$3,747
Total impact	\$9,562	\$5,403	\$14,965	\$73,389

Source: Emsi impact model.

Annual student spending impacts

While the total impacts that occur from FY 2022 to FY 2032 are relevant because of the temporal nature of the student spending, there will be recurring annual student spending impacts as long as the proposed college serves students. These are the true long-run proposed college student spending impacts. The NUMS economy will benefit from an annual impact of **\$3.3 million** in total added income, which is equivalent to supporting **90 jobs** annually.

8 A discount rate of 1.5% was used, which represents the discount rate recommended by the Office of Management and Budget for 10-year investments. Office of Management and Budget. Circular A-94 Appendix C, http://www.whitehouse.gov/omb/circulars_a094/a94_appx-c





Long-run alumni impacts

While the proposed college will create economic impacts through capital, operations, and student spending, the real mission and purpose of the proposed college will be to foster human capital—i.e., knowledge, creativity, imagination, and entrepreneurship. The proposed college will be able to serve students otherwise not served in the regional economy and respond to growing needs of local employers. By FY 2032, an estimated 3,000 alumni will have graduated from the proposed college.⁹ These are alumni who otherwise would not have been able to gain new skills and therefore add to the productivity of local employers if not for the proposed college.

Students attending the proposed college will receive a wide range of knowledge, skills, and abilities that will 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, such as buildings, production facilities, and equipment, more productive too. The employers of the proposed college's alumni enjoy the fruits of this increased productivity in the form of non-labor income (i.e., higher profits).

In this section, we estimate the economic impacts stemming from the higher labor income of these alumni in combination with the increased productivity that will be enjoyed by their future employers. The time horizon for this portion of the analysis falls between FY 2022 and FY 2032—the earliest point in time when the alumni will be working in the NUMS workforce and the final year of this analysis.

There is an important difference between the alumni impact and the impacts estimated in the previous sections. Whereas the short- and long-run spending impacts stem from an injection of new sales into the regional economy, the alumni impact stems from the increased human capital that will accumulate in the NUMS workforce as a result of the proposed college. The initial effect of alumni is comprised of two main components. The first and largest of these is the added labor income of the proposed college's graduates. The second component is the added non-labor income of the businesses that will employ these alumni.

To estimate the added labor income created each year, we use the number of alumni produced and their *incremental* added labor income stemming from their educations. The number of alumni is calculated using the enrollments as outlined

By FY 2032, an estimated
3,000 alumni *will have graduated*
from the proposed college.

⁹ Emsi worked with SVCEP to determine the expected number of alumni.



in the student spending impact (Table 8) and multiplying them by each degree level's graduation rate. The incremental labor income is the difference between the earnings at each level of education of new graduates and the earnings at the level of education the students had when entering the proposed college. For example, since the proposed college will be serving students seeking a certificate or associate degree and the majority of these students will enter with high school diplomas, the incremental added labor income associated with an alumnus with a certificate is the difference between the average earnings for someone with a certificate and someone with a high school diploma.

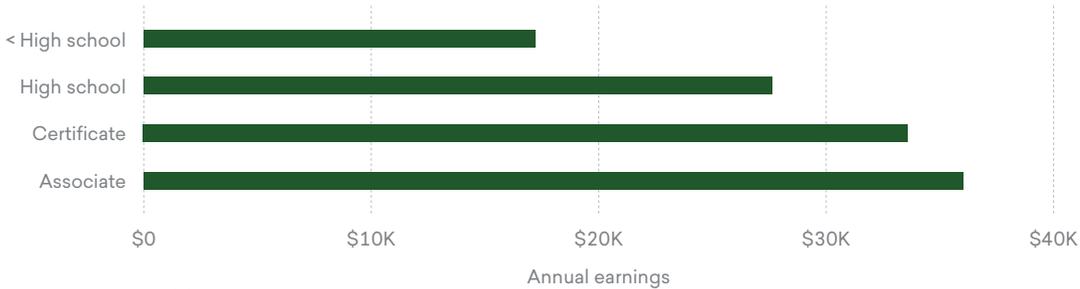
The average earnings in the NUMS associated with each level of educational attainment are found in Table 11 and Figure 7. The added labor income created each year is equal to the sum of the incremental earnings of each year's new alumni working in the regional workforce. Although not shown in Table 11, the incremental added labor income for non-credit certification and community education alumni is also calculated and incorporated into the total added labor income each year.

TABLE 11: AVERAGE ANNUAL EARNINGS BY EDUCATION LEVEL IN THE NUMS

	Annual earnings	Increase in earnings	Once stabilized, annual graduates
Less than high school	\$17,100	n/a	n/a
High school or equivalent	\$27,700	\$10,600	n/a
Certificate	\$33,400	\$5,700	85
Associate degree	\$36,100	\$8,400	420

Source: Emsi impact model.

FIGURE 7: AVERAGE ANNUAL EARNINGS BY EDUCATION LEVEL IN THE NUMS



Source: Emsi impact model.

There is one counterfactual we must consider in the alumni impact, which is the importation of labor. Suppose the proposed college does not open and the capacities of the proposed college do not exist. These alumni would not graduate and there would be fewer skilled workers in the NUMS. However, businesses could still satisfy some of their need for skilled labor by recruiting from outside the NUMS. 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 regional businesses could be filled by workers recruited from outside the region.

As seen in Table 12, the average wage increase per alumnus is \$5,845. This differential was dampened to adjust for “ability bias” to account for other factors besides education that influence individual behavior. After accounting for the labor import effect counterfactual scenario, the net wage increase per alumnus is \$2,922.

TABLE 12: AVERAGE WAGE INCREASE PER ALUMNUS

Average wage increase per alumnus	\$5,845
Labor import effect	50%
Net wage increase per alumnus	\$2,922

Source: Emsi impact model.

It is important to understand that the alumni impacts are cumulative as more alumni are produced. For example, the first alumni from the proposed college—community education students—will complete their program in FY 2022. The added labor income in FY 2022 will only consist of their incremental earnings. Alumni are also produced from the second cohort of students from the proposed college, which now includes associate degree students. The total incremental added labor income in FY 2025, when the first cohort of associate degree students enter the regional workforce, will equal the sum of the alumni added labor income who graduated in FY 2022, FY 2023, and FY 2024. This continues until FY 2032, the cutoff date in this study’s time horizon. We also adjust previous years’ alumni for various measures of attrition such as unemployment and migration. Table 13 shows the accumulation of alumni—after adjusting the previous years’ alumni for attrition—and adjusted added labor income by year.

TABLE 13: ALUMNI AND LABOR INCOME BY YEAR

Fiscal year	Graduates	Cumulative alumni working in region	Added labor income, undiscounted (thousands)
FY 2022	18	6	\$5
FY 2023	26	23	\$20
FY 2024	46	54	\$48
FY 2025	106	115	\$128
FY 2026	136	214	\$285
FY 2027	254	378	\$576
FY 2028	290	608	\$1,008
FY 2029	387	906	\$1,589
FY 2030	497	1,289	\$2,354
FY 2031	565	1,756	\$3,319
FY 2032	673	2,307	\$4,488
Total	3,000	2,307	\$13,820

Source: Data provided by the SVCEP and the Emsi impact model.



Now that we have the labor income portion of our initial effect, we estimate the non-labor income portion of the initial effect. As discussed earlier in this section, businesses that will employ alumni from the proposed college enjoy higher profits as a result of the increased productivity of their capital assets. To estimate this income, we allocate the initial increase in labor income to the six-digit NAICS industry sectors where students are most likely to be employed. We do so by using inverse staffing patterns, which break down the industries in which students are most likely to be employed. Finally, we apply a matrix of wages by industry and by occupation from the MR-SAM model to map the occupational distribution of the initial labor income effects to the detailed industry sectors in the MR-SAM model.¹⁰

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 the non-labor income attributable to the proposed college's alumni. Summing initial labor and non-labor income together provides the total initial effect of these alumni in the NUMS economy, as represented by the "Total added income" column. We now have a complete initial effect from which we can derive the multiplier effects. To do so, we convert the industry-specific income figures generated through the

TABLE 14: ALUMNI IMPACTS, FIRST AND LAST YEAR OF ANALYSIS, UNDISCOUNTED

	Labor income (thousands)	Non-labor income (thousands)	Total added income (thousands)	Sales (thousands)
FY 2022				
Initial effect	\$5	\$2	\$8	\$29
Multiplier effect				
Direct effect	<\$1	<\$1	<\$1	\$1
Indirect effect	<\$1	<\$1	<\$1	<\$1
Induced effect	<\$1	<\$1	\$1	\$4
Total impact	\$7	\$3	\$10	\$34
...				
FY 2032				
Initial effect	\$4,488	\$1,941	\$6,429	\$23,833
Multiplier effect				
Direct effect	\$294	\$131	\$424	\$1,042
Indirect effect	\$51	\$25	\$76	\$180
Induced effect	\$788	\$348	\$1,136	\$3,251
Total impact	\$5,620	\$2,445	\$8,065	\$28,307

Source: Emsi impact model.

10 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.



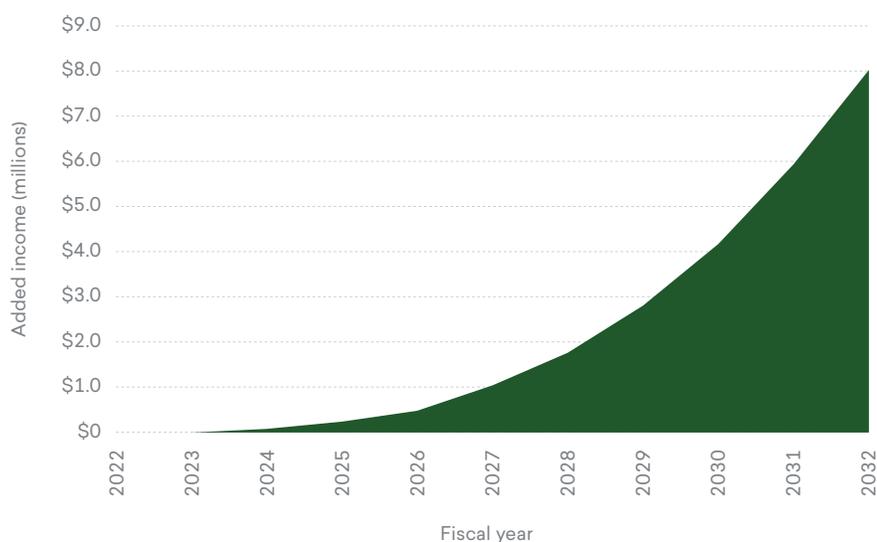
initial effect to sales using sales-to-income ratios from the MR-SAM model. We then run the values through the MR-SAM's multiplier matrix, as described at the beginning of this section. Table 14 outlines this process in detail for FY 2022, when the first graduates from the proposed college enter the regional workforce, and FY 2032, the final year of the analysis. Figure 8 presents the impacts for every year of the analysis.

Table 14 and Figure 8 present the undiscounted alumni impacts that accumulate year-by-year between FY 2022 and FY 2032. The total long-run alumni impacts, summed across those years and discounted to 2020 dollars, are presented in Table 15.¹¹ From FY 2022 to FY 2032, the proposed college's alumni will add \$21.3 million in total added income.

Annual alumni impacts

Similar to the long-run spending impacts, recurring alumni impacts will continue as long as the proposed college is open. However, unlike the long-run spending impacts, the alumni impacts will continue to accumulate as more and more alumni are produced and as long as these alumni remain in the NUMS. The proposed college will graduate around 673 alumni per year. Many of these students will work in the region. By FY 2032, the accumulation of alumni will create an annual impact of **\$8.1 million** in total added income. This is equivalent to supporting **98 jobs** per year for the NUMS. This annual impact is expected to increase every year for several years as the proposed college continues to graduate more students and they enter the regional workforce.

FIGURE 8: ALUMNI IMPACTS BY YEAR, UNDISCOUNTED



Source: Emsi impact model.

TABLE 15: PRESENT VALUE OF ALUMNI IMPACTS, TOTAL FROM FY 2022 TO FY 2032

	Labor income (thousands)	Non-labor income (thousands)	Total added income (thousands)	Sales (thousands)
FY 2022 – FY 2032, TOTAL				
Initial effect	\$11,852	\$5,126	\$16,978	\$62,940
Multiplier effect				
Direct effect	\$775	\$345	\$1,120	\$2,753
Indirect effect	\$134	\$66	\$200	\$476
Induced effect	\$2,081	\$919	\$3,000	\$8,585
Net impact	\$14,842	\$6,456	\$21,298	\$74,753

Source: Emsi impact model.

¹¹ A discount rate of 1.5% was used, which represents the discount rate recommended by the Office of Management and Budget for 10-year investments. Office of Management and Budget. Circular A-94 Appendix C, http://www.whitehouse.gov/omb/circulars_a094/a94_appx-c



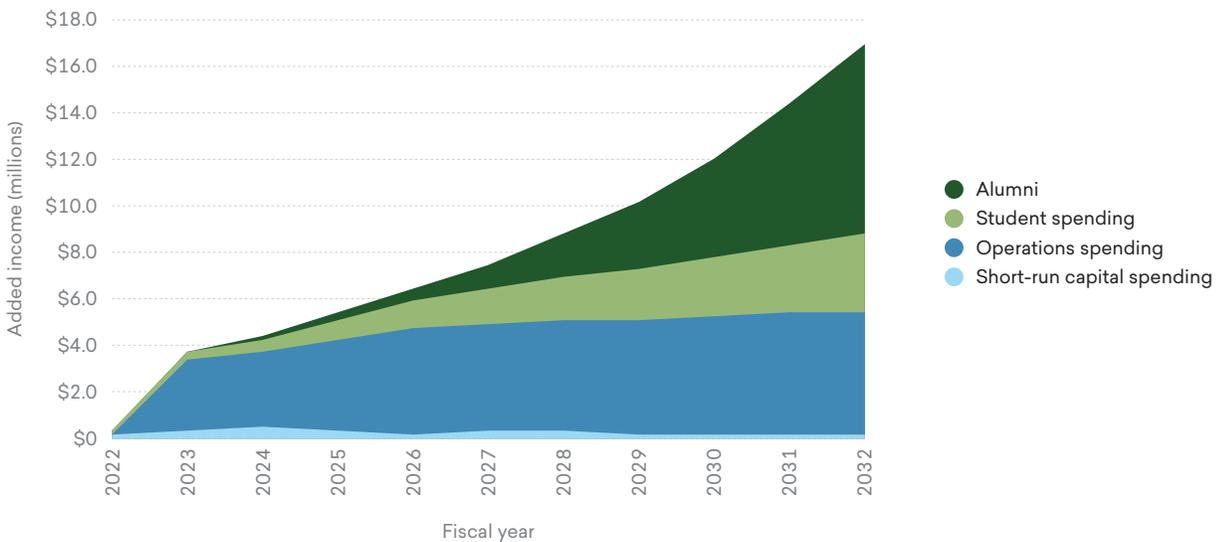


Total economic impacts from the proposed college

In this analysis, we estimate four types of economic impacts created by the proposed college: short-run capital spending impacts and long-run operations spending impacts, student spending impacts, and alumni impacts. Figure 9 presents the undiscounted year-by-year totals of the four impacts.

To understand what these impacts mean in present value terms, we discount them back to 2020 dollars using a discount rate of 1.5%.¹² From FY 2022 to FY 2032, the discounted short-run and long-run impacts created by the proposed college will provide a total economic impact on the NUMS economy of \$78.5 million in total added income. Table 16 presents the present value sum of the total impacts from FY 2022 to FY 2032.

FIGURE 9: TOTAL IMPACTS BY YEAR, UNDISCOUNTED



Source: Emsi impact model.

¹² We use the discount rate recommended by the Office of Management and Budget for 10-year investments. Office of Management and Budget. Circular A-94 Appendix C, http://www.whitehouse.gov/omb/circulars_a094/a94_appx-c.



TABLE 16: PRESENT VALUE TOTAL IMPACTS FROM FY 2022 TO FY 2032

	Labor income (thousands)	Non-labor income (thousands)	Total added income (thousands)	Sales (thousands)
FY 2022 – FY 2032, TOTAL				
Initial effect	\$46,903	\$5,126	\$52,029	\$167,281
Multiplier effect				
Direct effect	\$10,867	\$5,579	\$16,446	\$31,194
Indirect effect	\$1,413	\$720	\$2,133	\$4,180
Induced effect	\$8,103	\$7,088	\$15,190	\$28,161
Gross impact	\$67,286	\$18,513	\$85,799	\$230,817
Less alternative uses of funds	-\$3,322	-\$4,007	-\$7,329	-\$23,460
Net impact	\$63,964	\$14,505	\$78,470	\$207,357

Source: Emsi impact model.

Annual impacts

The economic impacts discussed thus far are those summed across the analysis years of FY 2022 to FY 2032 and discounted to present value terms. However, each of the three long-run types of impacts will create an annual impact after the final year of analysis. These break down as follows:

- **Operations spending annual impact:** The proposed college’s operational spending will increase yearly and stabilize around FY 2033. By FY 2032, the last year of this analysis, increased operations spending will add around **\$5.3 million** in total income on an annual basis, equivalent to supporting **82 jobs** per year.
- **Student spending annual impact:** Similarly, once the number of students the proposed college is able to serve stabilizes, **\$3.3 million** in income will be added per year, supporting **90 jobs** annually, as a result of spending from retained and relocated students in the region.
- **Alumni annual impact:** The proposed college will produce alumni every year, who will then accumulate in the regional workforce. By FY 2032, alumni are estimated to add **\$8.1 million** in total income to the economy per year, supporting **98 jobs** annually. This annual impact is expected to increase every year for several years as the proposed college continues to serve students and they enter the workforce.

The total annual impact from the proposed college will be at least **\$16.7 million** in added income. This is equivalent to supporting **270 jobs** every year.

Implicit multiplier

The implicit multiplier is the present value of added income divided by the capital spending on the proposed college. From FY 2022 to FY 2032, every dollar of the \$13.1 million of the proposed college’s capital spending will create a present value of **\$5.98** in added income throughout the region.

Payback period

By FY 2024, **2.9 years** after construction begins, it is expected that the impacts generated by the proposed college will have grown significantly enough to recover the costs of not only the capital investment, but the annual costs of keeping the proposed college operational.





Return on investment for the NUMS

THE benefits generated by the proposed college will affect the lives of many people. The most obvious beneficiaries are the college's future students; they will give up time and money to go to the proposed college in return for a lifetime of higher wages and improved quality of life. But the benefits do not stop there. As students earn more, communities and citizens throughout the NUMS will benefit from an enlarged economy in the form of increased tax revenues and a reduced demand for social services.

As a result of their time at the proposed college, students will earn more because of the skills they learned while attending the college, and businesses will earn more because student skills make capital more productive (buildings, machinery, and everything else). This in turn raises profits and other business property income. Together, increases in labor and non-labor (i.e., capital) income are considered the effect of a skilled workforce. These in turn will increase tax revenues in the NUMS since the local government is able to apply tax rates to higher earnings.

Estimating the effect of the proposed college on increased tax revenues in the NUMS begins with the alumni labor income per year from the alumni impact (Table 13). This has already been adjusted for various measures of attrition such as unemployment and migration. To the alumni labor income, we apply a multiplier derived from Emsi's MR-SAM model to estimate the additional added labor income created in the region as students and businesses spend their higher earnings. As labor income increases, so does non-labor income, which consists of monies gained through investments. To calculate the growth in non-labor income, we multiply the increase in labor income by a ratio of the NUMS gross regional product to total labor income in the region. We also include the taxable portions of each of the spending impacts discussed in the previous section from FY 2022 to FY 2032. To each of these, we apply the prevailing tax rates so we capture only the tax revenues attributable to the local government from this additional revenue.

A return on investment of 2.5

means that for every dollar the local government invests in opening the proposed college, the proposed college will fully recover the dollar and generate an additional \$2.50 in benefits for the NUMS economy.



Overall, local taxpayers are expected to contribute an estimated \$1.2 million in capital investment for the proposed college. By spending this \$1.2 million on the proposed college, a present value of \$4.2 million will be added in tax revenue to the NUMS from FY 2022 to FY 2032. These benefits and costs yield a benefit-cost ratio of 3.5, indicating a profitable investment. The taxpayer's average annual internal rate of return is 26.4%, which compares favorably to other long-term investments in the public and private sectors. This \$1.2 million in local taxpayer investment is also expected to generate a return on investment of 2.5, meaning that for every dollar the local government invests in opening the proposed college, the proposed college will fully recover the dollar and generate an additional \$2.50 in benefits for the NUMS economy.

Although not quantified in this analysis, there are additional societal benefits to opening a community college in the NUMS. For example, education is statistically associated with a variety of lifestyle changes that generate social savings. Studies show that as students become more educated, they commit less crimes, are healthier, and are less reliant on government programs like welfare. All of these benefit taxpayers and society as a whole in the region and state.





Enrollment sensitivity analysis

SENSITIVITY analysis measures the extent to which a model's outputs are affected by hypothetical changes in the predicted input data for the proposed college—in other words, data on revenues, expenditures, and students. This is especially important when those variables are inherently uncertain. The sensitivity analysis allows us to identify a plausible range of potential results that would occur if the value of any of the input variables is in fact different from what was expected.

The long-run operations spending, student spending, and alumni impacts discussed in the previous sections of this report are calculated using revenue, operations spending, and student enrollment estimates from the SVCEP. However, due to various factors such as COVID-19, it is possible that actual student enrollment will be higher for the proposed college. If enrollment increases, the proposed college will receive more in tuition and fees and be required to hire more faculty and staff to support the students attending the college.

In this section, we examine the long-run operations spending, student spending, and alumni impacts of the proposed college at a 10% and 20% increase in operations spending, student spending, and alumni variables. The results from the previous sections of this report are listed in the “Base case” column of Table 17 through Table 20.

TABLE 1: SENSITIVITY ANALYSIS OF THE PRESENT VALUE OF OPERATIONS SPENDING IMPACTS, TOTAL FROM FY 2022 TO FY 2032

% variation in assumptions	Base case	10%	20%
Labor income (thousands)	\$37,500	\$41,244	\$44,987
Non-labor income (thousands)	\$2,155	\$2,362	\$2,570
Total added income (thousands)	\$39,655	\$43,606	\$47,557
Sales (thousands)	\$43,690	\$48,014	\$52,338

Source: Emsi impact model.



Looking at operations spending impacts, we see that a 10% increase in the operations spending variables increases the operations spending impacts by a roughly similar percentage. Operations spending variables include payroll and non-pay expenditures. For example, for a 10% increase, we see a 9.9% increase in the total added income created (\$39.7 million to \$43.6 million). A 20% increase in these variables increases the total added income by 19.9% (\$39.7 million to \$47.6 million).

TABLE 18: SENSITIVITY ANALYSIS OF THE PRESENT VALUE OF STUDENT SPENDING IMPACTS, TOTAL FROM FY 2022 TO FY 2032

% variation in assumptions	Base case	10%	20%
Labor income (thousands)	\$9,562	\$10,501	\$11,441
Non-labor income (thousands)	\$5,403	\$5,933	\$6,464
Total added income (thousands)	\$14,965	\$16,435	\$17,905
Sales (thousands)	\$73,389	\$80,598	\$87,807

Source: Emsi impact model.

Student spending variables include total relocated students and retained students. A 10% increase in student spending variables results in a 9.8% increase in the total added income (\$15 million to \$16.4 million). Likewise, a 20% increase in student spending variables results in a 19.6% increase in added income (\$15 million to \$17.9 million).

TABLE 19: SENSITIVITY ANALYSIS OF THE PRESENT VALUE OF ALUMNI IMPACTS, TOTAL FROM FY 2022 TO FY 2032

% variation in assumptions	Base case	10%	20%
Labor income (thousands)	\$14,842	\$16,327	\$17,811
Non-labor income (thousands)	\$6,456	\$7,102	\$7,747
Total added income (thousands)	\$21,298	\$23,428	\$25,558
Sales (thousands)	\$74,753	\$82,228	\$89,704

Source: Emsi impact model.

Lastly, looking at alumni impacts, we see that a 10% increase in the alumni variables increases the alumni impacts by a roughly similar percentage (\$21.3 million to \$23.4 million). Alumni variables include the sum of alumni and their added labor income. We see similar results for the 20% increase scenario.



TABLE 20: SENSITIVITY ANALYSIS OF THE PRESENT VALUE OF TOTAL ECONOMIC IMPACTS, TOTAL FROM FY 2022 TO FY 2032

% variation in assumptions	Base case	10%	20%
Labor income (thousands)	\$63,964	\$70,131	\$76,298
Non-labor income (thousands)	\$14,505	\$15,889	\$17,273
Total added income (thousands)	\$78,470	\$86,020	\$93,571
Sales (thousands)	\$207,357	\$226,365	\$245,373

Source: Emsi impact model.

Overall, we see that a 10% increase in operations spending, student spending, and alumni variables increases the total economic impacts by a roughly similar percentage. For example, for a 10% increase, we see a 9.6% increase in total added income (\$78.5 million to \$86 million). A 20% increase in these variables increases the total added income created by 19.2% (\$78.5 million to \$93.6 million).





The effect of COVID-19 on proposed programs

ONE of the challenges of establishing a new community college is identifying programs that correspond with the demands of the regional labor market. The COVID-19 pandemic has created additional uncertainty surrounding labor market demands. This COVID analysis strives to evaluate the impact and response of job markets in the NUMS that relate to programs expected to be trained for at the proposed college.¹³ It is important to note that this analysis captures a short-run view of how programs are currently being impacted in the region by the COVID-19 pandemic. In the long-run, the programs are projected to train for jobs growing and in-demand in the region.

In this analysis, labor market impact and response are based on the change in daily new jobs advertised over the course of the pandemic thus far based on three time periods. The three time periods of COVID are defined as:

- The “Pre-COVID Period” is the month of February (2/1-2/29) and establishes the hiring conditions prior to any shutdowns in the US.
- The “COVID Impact Period” encompasses the first period of significant disruptions, from March 15 to May 31, and establishes the hiring conditions during the most acute period of disruption.
- The “COVID Response Period” begins on June 1, when social distancing rules were first lifted, and continues to the present (November 12). It establishes hiring conditions in the initial period of response.

February 1 – February 29

March 15 – May 31

June 1 – November 12

Pre-COVID Period

COVID Impact Period

COVID Response Period

¹³ The SVCEP provided a list of programs that are expected to be trained for at the proposed college based on a report prepared by the Central Pennsylvania Workforce Development Corporation regarding in-demand occupations in the NUMS. For each program, we assigned a Classification of Instructional Programs (CIP) code that closely reflects the nature of the program. It is important to note that these CIP categories are not precise matches for the subject of the programs that will be offered at the proposed college. Thus, discretion should be used in evaluating the data and interpreting how it may relate to the COVID resiliency of the potential programs.



COVID IMPACT AND RESPONSE INDEX

Index value	Index meaning	% change in job postings
5	Very high growth	≥ 100
4	High growth	76 to 100
3	Medium growth	51 to 75
2	Moderate growth	26 to 50
1	Low growth	< 25
0	No change	0
-1	Low decline	< -25
-2	Moderate decline	-26 to -50
-3	Medium decline	-51 to -75
-4	High decline	-76 to -100
-5	Very high decline	≤ -100

The COVID Impact Index is based on the change in daily average new job postings during the COVID Impact Period compared to Pre-COVID. The COVID Response Index is based on the same change in postings but between the Response Period and the Impact Period. Index scores range from -5 to +5, with higher scores indicating a more extreme change in postings from the previous period, as shown:

Before looking at the results of the COVID Impact and Response Indices by program, it is important to first consider how the pandemic has altered the economic structure of the NUMS. To do so, we examined the changes in job postings activity for the past 90 days. From August 25 to November 22, unique job postings in the region decreased from 4,169 postings to 3,369 postings. As of November 22, postings were 17% lower than they were a year ago.¹⁴ Table 21 and Table 22 display the job posting activity of the top 10 occupations with increased posting activity and decreased posting activity, respectively, from August 25 to November 22.

Two of the occupations that have ramped up posting activity—pharmacists and clinical laboratory technologists & technicians—are within the healthcare industry. Many others are entry level human resource or administrative occupations, such as human resource workers, billing & posting clerks, and receptionists & information clerks. Barbers, hairdressers, hairstylists & cosmetologists and human resources managers are tied for the occupation with the most slowed posting activity from August 25 to November 22.

14 Data from Emsi's Regional Impact Report.



TABLE 21: TOP 10 OCCUPATIONS WITH INCREASED POSTING ACTIVITY FROM AUGUST 25 TO NOVEMBER 22

Occupation	Active postings	% change
Pharmacists	7	188.7%
Social Workers	18	178.4%
Human Resources Workers	6	147.5%
Billing & Posting Clerks	8	147.5%
Receptionists & Information Clerks	9	122.7%
Accountants & Auditors	5	106.2%
Clinical Laboratory Technologists & Technicians	19	95.9%
Database & Systems Administrators & Network Architects	14	92.5%
Industrial Machinery Installation, Repair, & Maintenance Workers	6	85.6%
Building Cleaning Workers	30	85.6%

Source: Emsi's Regional Impact Report.

TABLE 22: TOP 10 OCCUPATIONS WITH DECREASED POSTING ACTIVITY FROM AUGUST 25 TO NOVEMBER 22

Occupation	Active postings	% change
Barbers, Hairdressers, Hairstylists & Cosmetologists	7	-58.8%
Human Resources Managers	3	-58.8%
Designers	10	-46.2%
Security Guards & Gaming Surveillance Officers	10	-41.1%
Customer Service Representatives	64	-39.5%
Miscellaneous Business Operations Specialists	4	-38.1%
Packaging & Filling Machine Operators & Tenders	4	-38.1%
First-Line Supervisors of Mechanics, Installers, & Repairers	7	-38.1%
Food Preparation Workers	13	-30.1%
Inspectors, Testers, Sorters, Samplers, & Weighers	4	-29.3%

Source: Emsi's Regional Impact Report.

In Table 23 and Table 24, we analyze the top 10 proposed programs with the highest COVID Response Index and the top 10 proposed programs with the lowest COVID Response Index. Six of the top 10 proposed programs with high growth in daily job postings are healthcare-related. Additionally, two of these high growth programs—Clinical/Medical Laboratory Technician and Administrative Assistant & Secretarial Science, General—train students for occupations with increased postings (see Table 21). This means these programs seem to be COVID resilient and correspond with the current demands of the regional labor market.



TABLE 23: TOP 10 PROPOSED PROGRAMS WITH THE HIGHEST COVID RESPONSE INDEX

CIP code	CIP title	COVID Impact Index	COVID Response Index
15.0702	Quality Control Technology/Technician	5.00	5.00
51.1009	Phlebotomy Technician/Phlebotomist	-2.00	5.00
49.0205	Truck and Bus Driver/Commercial Vehicle Operator & Instructor	0.86	4.32
51.1004	Clinical/Medical Laboratory Technician	-1.00	3.00
52.1803	Retailing & Retail Operations	0.40	2.32
51.0910	Diagnostic Medical Sonography/Sonographer & Ultrasound Technician	-3.00	2.00
51.3999	Practical Nursing, Vocational Nursing & Nursing Assistants, Other	1.39	1.80
52.0401	Administrative Assistant & Secretarial Science, General	3.29	1.27
51.0814	Radiologist Assistant	4.00	1.00
51.0713	Medical Insurance Coding Specialist/Coder	-1.00	1.00

Source: Proposed programs provided by the SVCEP. Index measured by Emsi.

TABLE 24: TOP 10 PROPOSED PROGRAMS WITH THE LOWEST COVID RESPONSE INDEX

CIP code	CIP title	COVID Impact Index	COVID Response Index
46.0201	Carpentry/Carpenter	-2.82	-3.00
51.0806	Physical Therapy Technician/Assistant	-3.33	-2.49
46.0503	Plumbing Technology/Plumber	-1.76	-2.02
51.0706	Health Information/Medical Records Administration/Administrator	-1.00	-2.00
51.2306	Occupational Therapy/Therapist	-2.00	-2.00
51.0805	Pharmacy Technician/Assistant	-1.90	-1.90
51.0810	Emergency Care Attendant (EMT Ambulance)	0.86	-0.86
51.0904	Emergency Medical Technology/Technician (EMT Paramedic)	0.86	-0.86
46.0302	Electrician	-0.62	-0.63
48.0508	Welding Technology/Welder	-0.15	-0.05

Source: Proposed programs provided by the SVCEP. Index measured by Emsi.

Some programs experienced high decline in daily job postings within the NUMS from the COVID Impact Period to the COVID Response Period, such as Carpentry/Carpenter and Physical Therapy Technician/Assistant. This does not mean there are no opportunities for employment in the regional labor market for alumni who would potentially graduate from these programs in the future; rather, these are programs that seem to currently not be positively responding to COVID-19 in the proposed college's service region. For example, due to various COVID-19 restrictions, some construction occupations such as carpenters were forced to cease work during the COVID Impact Period. Similarly, many healthcare facilities performing non-emergency medical care such as physical



therapy offices limited the number of patients they saw, resulting in less demand for workers to serve those patients.

In order to accurately evaluate workforce demand in the NUMS, it is important to consider regional job counts prior to the Pre-COVID Period. The regional job count for carpenters was 664 in 2019, which is above average for an area of its size. It is also expected that by 2030, the job count for carpenters will increase by 4.2%. Likewise, the job count for physical therapy assistants is expected to increase by 13.8% from 2019 to 2030. This indicates that pre-COVID, there were many opportunities for employment in the regional workforce for graduates of the Carpentry/Carpenter and Physical Therapy Technician/Assistant programs. These employment opportunities will likely return over time as the economy recovers from the pandemic. Similarly, emergency medical technicians & paramedics, an occupation with almost 300 regional jobs in 2019, is estimated to see a job count increase of 15.5% by 2030.¹⁵

Although these projections do not reflect the impact of COVID-19 on future labor markets, we are starting to see evidence that industries impacted by the pandemic are beginning to bounce back to their pre-COVID levels. Therefore, discretion should be used in evaluating the data and interpreting what proposed programs will best serve the regional workforce.

¹⁵ Emsi's labor market data.





Conclusion

THIS analysis quantifies the economic impact of the proposed Susquehanna Valley Community College on the NUMS from FY 2022 to FY 2032. The total capital investment for the proposed during this timeframe is expected to come from a combination of local, state, federal, and other sources and totals \$13.1 million. The opening of a new community college in the NUMS will not only provide affordable higher education to regional students and create new jobs for faculty and staff, but will also generate a significant amount of new economic activity within the regional economy. This new economic activity will amount to a present value of **\$78.5 million** in total added income.

An estimated \$1.2 million of the proposed college's capital investment is expected to come from the local government. In return, local taxpayers will receive an estimated present value of **\$4.2 million in added tax revenue** stemming from the higher student earnings and increased output of businesses from the impacts discussed above. These benefits and costs yield a **benefit-cost ratio of 3.5**, indicating that the proposed college is a profitable investment for local taxpayers.

In addition to quantifying the economic impact of a new community college in the NUMS, this study also performed a sensitivity analysis around the student enrollment, revenues, and operations spending estimates provided by the SVCEP. In the event actual enrollment at the proposed college increases, the proposed college will receive more in tuition and fees and be required to hire more faculty and staff to support the students attending the college. Our sensitivity analysis found that in the case of a 10% and 20% increase in operations spending, student spending, and alumni variables, the total economic impacts of the proposed college will increase proportionally.

Lastly, this report included a COVID analysis that analyzed the impact of the pandemic on programs expected to be offered at the proposed college. This is done by calculating COVID Impact and Response Indices by proposed program, which are based on the change in daily new jobs advertised over the course of the pandemic thus far. The preceding analysis provides a data-driven foundation to help the proposed college assess and respond to the impacts of COVID-19 in its service region.



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Appendix 1: Glossary of terms

Alternative use of funds A measure of how monies that are currently used to fund the proposed college might otherwise have been used if the proposed college did not exist.

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 proposed college is not constructed.

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.

Discounting Expressing future revenues and costs in present value terms.

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 region 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 proposed college and the higher earnings of its 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 region, 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 Income created in the economy as the proposed college and its students spend money in the region. It consists of the income created by the supply chain of the industries initially affected by the spending of the college and its 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).

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

Appendix 2: Example of sales versus income

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 region 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.

Appendix 3: 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 regional 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.

Appendix 4: Retained student variable sensitivity analysis

For this analysis, we assume a retained student variable of 61%, which means that 61% of the proposed college's expected students who originated from the NUMS would leave the region for other opportunities, whether that be education or employment, if the college does not open. The money these retained students will spend in the region for accommodation and other personal and household expenses is attributable to the proposed college.

Table 25 presents the results of the sensitivity analysis for the retained student variable. The assumption increases and decreases relative to the base case of 61% by the increments indicated in the table. The student spending impact is recalculated at each value of the assumption, holding all else constant.

Student spending impacts attributable to the proposed college range from a high of \$22.1 million when the retained student variable is 92% to a low of \$7.9 million when the retained student variable is 31%. This means as the retained student variable decreases, the student spending attributable to the proposed college decreases. Even under the most conservative assumptions, the student spending impact on the NUMS economy remains substantial.

TABLE 25: SENSITIVITY ANALYSIS OF RETAINED STUDENT VARIABLE

% variation in assumption	-50%	-25%	-10%	Base case	10%	25%	50%
Retained student variable	31%	46%	55%	61%	67%	76%	92%
Student spending impact (thousands)	\$7,860	\$11,412	\$13,544	\$14,965	\$16,386	\$18,517	\$22,070