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The Economic Impact of Academic Centers and Institutes on State-Level GRP

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Abstract: The objective of this paper is to measure the impact of public postsecondary centers and institutes (C&Is) on the employment and economic output on Florida's economy. We use the Florida REMI model to forecast both direct and indirect economic impacts over multiple-year time frames. Our findings indicate that C&Is contribute significantly to the Florida economy. These economic benefits extend to job creation; generation of GRP, personal income and state taxes.

Keywords: Economic impact, centers and institutes, REMI model, economics of education.

JEL Classification I21

1. Introduction

Francis Bacon, the notable 16th century philosopher, believed that "Knowledge is power" (Meditationes Sacrae, 1597). If Bacon was accurate, universities and their research centers are the catalysts for the power producers. Those who receive knowledge from universities bring more economic power to society by being more productive to them (Griliches, 2000; Morgan, 2002). The benefits of such educational institutions spill over to society through inventions and innovations. Indeed, since Adam Smith[1], economists have studied the impact of educational institutions on economic growth. Remarkably, there have been many studies on the impact of education on economic development since the creation of endogenous growth theories in the 1980s. Romer (1986; 1987; 1989), Lucas (1988) and Robelo (1991) put education at the core of economic growth. They argue that education is the engine of an economy. Therefore, universities are increasingly considered to be a

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[1] By saying the following words in the `Wealth of Nations`, Adam Smith was mentioning the impact of education on the labor productivity: "The difference between the most dissimilar characters, between a philosopher and a common street porter, for example, seems to arise not so much from nature as from habit, custom, and education." (Book 1, Chapter 2)

central part of local economy (Huggins & Cooke, 1997). They are stimulating jobs, fostering new businesses, promoting innovation, empowering workers, improving the quality of life, and increasing production.

The purpose of this paper is to measure the impact of public postsecondary centers and institutes (C&Is) on Florida's economy. This study measures the increase in employment and economic output generated by C&I activities across the broader statewide economy. The net economic stimulus from C&Is is estimated by summing C&I external and internal expenditures for FY 2000-01. External expenditures include contracts and grants (government and private sponsors), auxiliary fees/services, and other external sources. Internal expenditures include all state (SUS-appropriated) expenditures. The sum of these dollars represents all C&I expenditures used for salaries, materials and equipment, travel and all other C&I expenditures.

This analysis measures the short-term, direct and indirect economic increases flowing from C&Is. Short-term economic impacts are the net changes in regional output, earnings, and employment that are due to new dollars entering into a region from a given enterprise or economic event. In this study, the enterprise is the State University C&Is, and the region is Florida. Since the C&Is already exist, we estimate their impact on the Florida economy by removing them from the economy. In order to allow ease in interpretation of the results, we report the C&Is affects as a positive value (i.e., reversing the signs of the variables). The effects of expenditures external to Florida (termed leakages) are not included in the impact estimates. Since the state level covers a larger economic area than that of the county level, a greater portion of direct expenditures are captured, resulting in less leakage at the state level.

This study did not quantify the intangible benefits generated by the presence of C&Is to the local economy, such as teaching and instruction, quality of life enhancements, cultural opportunities, intellectual stimulation (through publications, presentations, public service), and creation of spin-off companies, among others.

2. Review of University Economic Impact Studies

We examined previous university economic impact studies to determine methodologies pertaining to benefit-cost analysis, measurement (input output models such as REMI,

IMPLAN or RIMS III), and what time frame to use (long-term or short-term). Most of the studies estimated the economic impact of university center and institute spending from a long-term perspective by calculating rates of return to education.

A University of Waterloo study used the REMI model and provided one of the most extensive outlooks, including spin-off companies and intellectual capital as economic activities (PWC, 2001). The studies reported, for the year 1999, $1.1 billion value added and 23,326 jobs in the local economy were due to the university activities. A University of Connecticut study also used the REMI model in its analysis. In addition to deriving the economic benefit of the University of Connecticut on the local economy using university expenditures, they examined other economic activities as well, including visitor expenditures, community service, and spin off companies (CCEA, 2002). The study concluded that the university generated 3.3% of Gross State Product and created 26,156 jobs in the FY2001.

The National Association of State Universities and Land-Grant Colleges (NASULGC) conducted a survey among 96 member institutions and reported the following findings: The average return of $1 dollar investment by state government in a public university was $5; every $100 expenditure by NASULGC institutions stimulated additional $138 spending in the local economy; on average the 96 institutions created 6,562 jobs in the local economies. The study mentioned several impacts of the public universities on the local economy, including the ratio of dollar of state appropriated funding the university received relative to the dollar amount in total spending in the local economy, the amount the university generated in tax revenues, number of patents, among others (NASULGC, 2001).

Berman (1990) examined the economic impact of industry-funded university R&D based on the data for the years 1953-1986. He found that university funding increased the industry R&D expenditures. The funded research resulted in technological innovation in industry.

The Selig Center for Economic Growth estimated the economic benefits of the University of Georgia to the Athens, Georgia community using university-related expenditures and including visitor expenditures and spending by students (SCEG, 1999). The study

estimated that for every $1 the university spends, there is 44 cents of additional induced spending by the community.

Harris (1997) analyzed the impact of the University of Portsmouth on the local economy based on expenditures approach. He found that the local spending increased by £38.5 million due to the multiple impacts of the university's expenditures. The same study also found that this spending created jobs for 3,375 people in the region.

The University of South Carolina (USC, 2000), provided economic benefit estimates for South Carolina and its' regions. In addition, they calculated the internal rate of return for a student's investment and the state return on a bachelor's and graduate degree. The study found that the return for the state on a bachelor's and graduate degree are $3.45 and $6.75, respectively. The individuals who graduated from the University of South Carolina had even higher return than the state, which was over 20 percent. The University of Arizona (Charney & Pavlakovich, 2001) performed an economic impact analysis of its' technology park on the economy of two adjacent counties, with a focus on jobs, wages, and total output (sales). The study found that every job created at the park induced additional 1.1 jobs and every one-dollar output produced by the park added on additional 85 cents to the local economy.

The University System of Maryland, through the Jacob France Institute (JFI, 2002), studied the economic and fiscal impact of USM on the Maryland economy, workforce development and USM contribution to economic development using Regional Input Output Modeling System (RIMS II) as their input output model. The study found that USM institutions make a significant contribution to Maryland human capital, business activities, jobs creation, and tax revenues.

Arizona State University (CBR, 1999) conducted an economic impact study of ASU on the state of Arizona using data from university, employee, student and visitor expenditures, and the IMPLAN model. The study measured the secondary economic impacts of the ASU as an additional 12,530 jobs and $1 billion spending in the local economy.

In summary, the university economic impact studies ranged from a short time frame using university expenditures to determine economic impact, to more extensive analyses

including university, employee and student expenditures, survey data, spin-off companies, among other intangible benefits of the university on the state and local economy. All related studies confirm the significant direct and indirect impacts of universities and research centers on the local economy in terms of the increase in the production, employment, invention, innovation, and human capital. As Martin (1998) found for the Canada research expenditures, the dynamic impact of universities is well beyond their estimated static impacts.

3. The REMI Model

REMI-2000 is a widely accepted and used dynamic integrated input-output and econometric model. REMI is used extensively to measure proposed legislative and other program and policy economic impacts across the private and public sectors of the state by the Florida Joint Legislative Management Committee, Division of Economic & Demographic Research, the Florida Department of Labor and other state and local government agencies. In addition, it is the chosen tool to measure these impacts by a number of universities and private research groups that evaluate economic impacts across the state and nation.

The REMI model used for this analysis was specifically developed for the state of Florida, and includes 172 sectors. REMI's principal advantage is that it can be used to forecast both direct and indirect economic effects over multiple-year time frames. Other input-output models primarily are used for a single year analysis.

Input output (I/O) models are basically accounting tables which trace the linkages among industry purchases and sales within a given county, region, state or country. The I/O model produces multipliers that are used to calculate the direct, indirect and induced effects on jobs, income and GRP generated per dollar of spending on various types of goods and services in Florida. REMI combines these capabilities plus the ability to forecast effects of future changes in business costs, prices, wages, taxes, etc.

REMI was founded in 1980, and continues to be enhanced to date. The entire regional economy (i.e., Florida) is modeled as interactions between five linked groups of economic

variables; output, labor and capital demand, population and labor supply, wages, price, and profits, and market shares of national and local firms operating in the region.

4. Economic Impact Overview

Economic impacts are effects on the levels of activity in a given area. They may be expressed in terms of 1) business output (or sales volume) 2) value added (or gross regional product) 3) wealth (including property values) 4) personal income (including wages), or 5) jobs. Any of these measures can be an indicator of improvement in the economic well-being of area residents. The net economic impact is viewed as the expansion (or contraction) of an area's economy, resulting from changes in a facility or project, or in assessing the economic impact of an already existing facility or project. The net economic effect would take into account the probability that in the absence of the facility, or project, the monies would be reallocated to other facilities and/or projects. Economic effects are different from the valuation of individual user benefits and the broader social impacts (amenity value) of a facility or project. However, assuming they can be quantified, they may be included to the extent they affect an area's level of economic activity (Weisbrod & Weisbrod, 1997).

Economic impacts also may be examined in conjunction with fiscal impacts, which are changes in government revenues and expenditures. Economic impacts such as changes in GRP or personal income can affect government tax revenues by expanding or contracting the tax base. In addition, employment and/or population shifts can affect government expenditures by changing demand for public services.

5. Methodology

As a part of our modeling strategy, we examined both the revenue and the expenditure approach regarding the impact of C&Is on the Florida economy. The revenue approach allows the REMI model to redistribute the expenditures according to sectors (based on actual historical data). For the expenditure approach, C&Is' actual FY 2000-01 expenditures were used to calculate the economic impact. This approach allowed us to achieve a greater level of detail by capturing the detailed economic impacts of the system

via the specific expenditure path using actual data rather than the estimated paths provided by the REMI model. Thus, the expenditure approach was the selected method for this analysis.

The definition of C&I economic impact is the difference between existing economic activity in Florida and the level of economic activity that would exist in the absence of university C&Is. Since the C&Is already exist, we measured their impact on the state economy by first removing them from the economy. The difference between the economy with C&Is and the economy without C&Is represents the net C&I economic impact. By using the Regional Economic Model, Inc. (REMI, 2000) analysis, we capture and present the positive net economic impacts of C&Is on the state of Florida. Measured economic impacts include increases in:

1) Florida Gross Regional Product (or State Output)
2) Personal Income (Including Wages)
3) Number of Jobs Created

The expenditure approach disaggregates the various C&Is direct expenditures (e.g., salaries, equipment purchases, travel, etc.) by specific economic sector to calculate the economic impacts. The data on FY 2000-01 C&I expenditures were collected from each SUS institution and from the annual C&I expenditure reports submitted to the Division of Colleges and Universities (DCU).

The direct expenditures were divided into salaries, expenses, OCO (operating capital outlay), electrical, special category, graduate, house staff, and other categories. We applied the percentage breakout from the expenditures report data to the expenditures collected from each State University System institution, and used the category assignments as variables in the REMI model. Table 1 presents the C&I expenditures and their assorted breakouts for FY 2000-01.

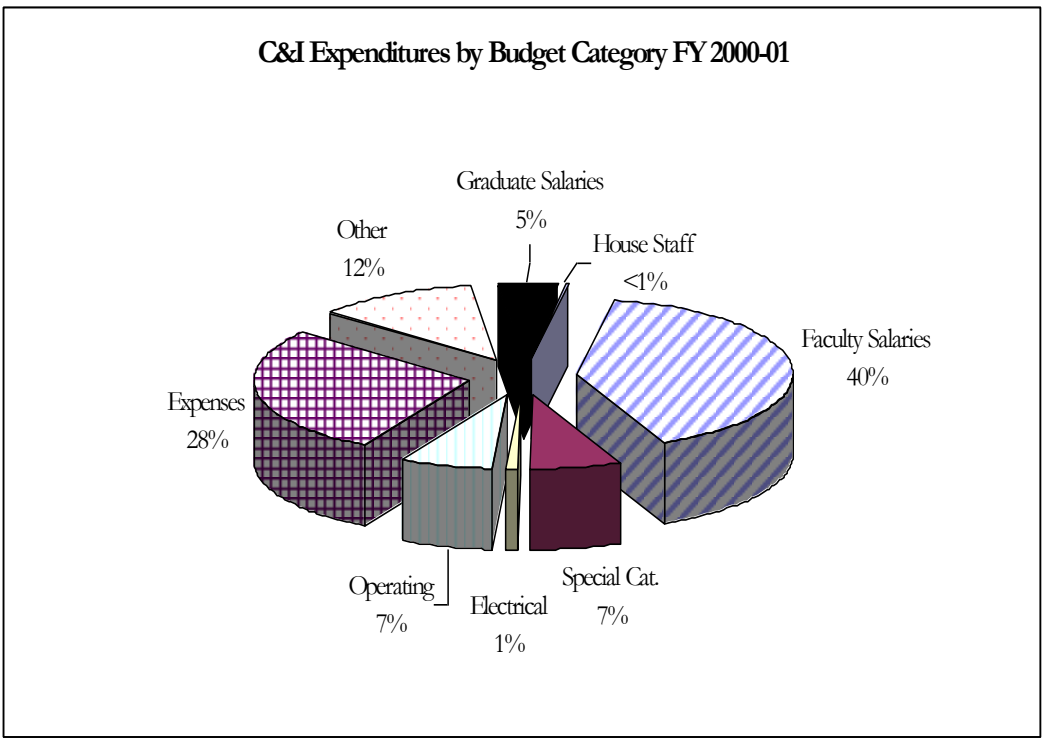
Table 1. C&I Expenditures by Funding/Expenditure Category FY 2000-01

C&I	SUS-Expenditure	External	Total Expenditure
Faculty	$50,870,09	$71,219,37	$122,089,47
Special	$7,237,25	$13,722,39	$20,959,64
Electric	$2,550,26	$349,814	$2,900,08
Operatin	$5,532,50	$15,152,07	$20,684,57
Expense	$14,614,51	$69,566,57	$84,181,08
Other*	$4,855,87	$31,422,08	$36,277,95
Graduate	$3,116,18	$10,702,91	$13,819,10
House	$5,737	$571,339	$577,076
Total	$88,782,42	$212,706,56	$301,488,98

* Includes libraries and data
** Includes primarily sub-
*** Includes salaries and other for UF and USF medical staff

Figure 1 provides a percentage breakout of the expenditure categories in terms of the total budget. For the purpose of the economic impact analysis, the categories we used were SUS funds and external expenditures. The salaries category included salaries for all faculty and staff. The OCO category included equipment greater than $1,000 in value. Expenses included such items as travel, materials and supplies, etc. The special category only included those items directed for libraries and data processing (Jones, 2002). The graduate category included salaries for graduate students, and house staff (we only included salaries and other expenses for University of Florida and University of South Florida medical staff and health centers). The “other” category was primarily used for sub-contracts.

Figure 1: Percent of C&I Expenditures for FY 2000-01



The C&I's internal and external expenditures were then entered into a REMI model that includes cross linkages among every sector of the Florida economy. As C&Is expend dollars, further demand for goods and services across other sectors of the Florida economy are generated. The direct C&I spending creates a secondary "multiplier" cycle of spending that further increases income, jobs and total state economic activities referred to as state output.

6. Model Assumptions

This study provides estimates of only the direct, pecuniary/financial benefits (or "return") generated for the state (income, employment, taxes) as a result of the "investments" that the state makes in C&Is via SUS-appropriated funds through the Florida Legislature. The

"returns" that are estimated using this analysis are exclusively associated with external contracts, grants and other awards brought into the universities by C&Is during fiscal year 2000-01. This analysis excludes "returns" to the state that are not financial benefits (these are known as "*non-pecuniary/non-market" or "intangible*" benefits). These intangible benefits include those associated with the teaching, research and public service activities of C&Is. Therefore, the assumptions used to estimate the economic return to the state through its investments in C&Is in this report can be characterized as conservative.

It is important, however, to recognize that the benefits to the state of Florida associated with these C&I intangible benefits (e.g., value of new medications or high tech products produced and commercialized, quality of life enhancements, teaching, research, publications, presentations, public service, and a host of other cultural and amenity values) are significant. The amenity values or benefits to the community by having a research university present (and enhanced by the multi-faceted activities of C&Is) can be significant. The model assumptions are:

1) The base model assumes a constant rate of growth for the economy;
2) The expenditure approach model used actual FY 2000-01 C&I expenditures (by category: salaries, expenses, etc.) for Type 1, 2, 3 C&Is and Type 1, 2 C&Is;
3) Total SUS state investment (expenditures) in FY 2000-01 was $88.8 million;
4) This state investment leverages an additional $212.7 million in additional external contracts and grants, fees and private expenditures yielding a total of $301.5 million in FY 2000-01 for all expenditures made by C&Is statewide.
5) We assumed that, in the absence of C&Is, the SUS investment ($88.8 million) would be reallocated to other Florida higher educational activities; and;
6) REMI results were expressed in terms of impacts on GRP, employment, and personal (disposable) income.

7. Results of the REMI Analysis

We assumed that in the absence of state expenditures allocated to support C&Is, the initial state's investment of $88.8 million would be reallocated to support other higher education needs. As our modeling strategy, we used the university C&Is' expenditures to calculate the economic impact via specific expenditure paths. There are three types of C&Is based on certain criteria. Type 1 C&Is should have a statewide mission and involve two or more

universities. The vast majority of Type 2 C&Is are an extension of departmental activities and receive state appropriated funds through university budget allocations. Type 3 C&Is are typically collections of faculty within a single university with an interest in, and the skills for, a particular problem, and who are not affiliated with a single department or college. Two scenarios were run, the first including Type 1, 2, 3 C&Is, and the second including Type 1 and 2 C&Is, only. The results were expressed in fixed 1992 dollars. To update the results to a FY 2000-01 base year, the dollars were inflated using a REMI-generated Consumer Price Index. Because expenditure multipliers often require decades to completely exhaust their iterative impacts, discounting analysis was used to present the economic impacts over the period FY 2000-01 to FY 2034-35.

The need to discount stems from the fact that, even when dealing with constant dollars, the value that we place on income and expenditures depends on when they occur (e.g., a dollar received a year from now is worth less than the dollar received today) because of the time-value of money. Future values need to be converted to the common basis of today's value, referred to as the present value, in order to compare them. The present value of a stream of future values is the sum of the present values of each element of the stream. The following results present the positive net economic impact of C&Is on the state of Florida. The present value (PV) of a future cost or benefit is determined by the formula:

$$PV = s / (1+r)^n$$

Where s, r, n stands for stream, discount rate, and year respectively.

The following results present the positive net economic impact of C&Is on the State of Florida economy. Table 2 summarizes the total economic impact of C&Is on the Florida economy. The table shows the economic impacts (for Type 1, 2, 3 and Type 1, 2 C&Is) on employment, gross regional product (GRP), real disposable income (Wages), and taxes from the C&I external expenditures for FY 2000-01. Gross Regional Product (GRP or state output) is the dollar value of final goods and services produced across the Florida economy over the FY 2000-01 time period.

Table 2: Results of REMI Analyses: Employment, Output (GRP), Disposable Income (Wages) and State Taxes Attributable to C&Is Expenditures

Summary of REMI-Generated Expenditure Approach Results For Types 1, 2 & 3 C&Is (2001-2035)	
Net Present Value of GRP	$269,416,041
Net Present Value of Taxes	$18,162,728
Net Present Value of Wages	$243,924,273
Number of Jobs*	6,955

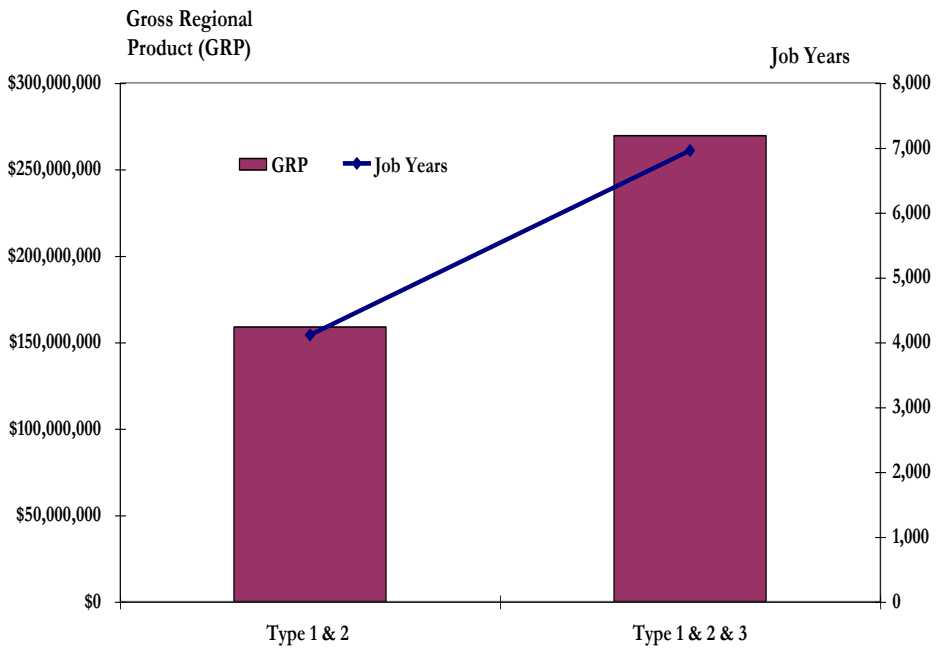
Summary of REMI-Generated Expenditure Approach Results For Type 1 & 2 C&Is (2001-2035)	
Net Present Value of GRP	$158,819,204
Net Present Value of Taxes	$10,706,824
Net Present Value of Wages	$145,233,082
Number of Jobs*	4,112

* Note: REMI output results for employment are in terms of job years (one job/year)

As also depicted in Figure 2, for Type 1, 2, 3 C&Is, GRP was estimated to increase by $269 million from C&I expenditures from external funding sources. This C&I-generated rise in state output created considerable direct and indirect increases in employment across the state. Table 2 indicates that 6,955 jobs were created from these spending increases. In turn, this employment increase also generated higher wage and salary earnings. Table 2 illustrates that direct and indirect personal (or disposable) incomes increased by $244 million from these C&I externally funded research grants and awards.

For Type 1, 2 C&Is, as also shown in Figure 2, GRP was estimated to increase by $159 million from C&I externally funded spending. This C&I-generated rise in state output created considerable direct and indirect increases in employment across the state. Table 2 indicates that 4,112 jobs were created from these spending increases. In turn, this employment increase also generates higher wage and salary earnings. Table 2 illustrates that direct and indirect personal (or disposable) incomes increased by $145 million from these C&I externally funded research grants and awards.

Figure 2: FY 2000-2001 C&I Economic (GRP) and Employment Results



8. Return on Investment and Benefit/Cost Ratio Calculations: An Explanatory Note

The calculations of the Return on Investment (ROI) and the Benefit/Cost (B/C) Ratio utilize the same initial numerical data for the numerator and the denominator – however, the B/C ratio is expressed as a ratio of two numbers, while the ROI is most commonly expressed as a percentage by multiplying the ratio by 100. The B/C ratio is an expression most commonly used for economic evaluations (i.e., by economists), while the Return on Investment is more commonly used for financial evaluations (i.e., by business-oriented professionals). However, both are equivalent ways to express the relationship between cost (initial investment) and benefit (or return).

9. Return on Investment Analysis

Section 240.706 of the Florida Statutes (FS) directs the Council for Education Policy, Research and Improvement (CEPRI) to assess the "return on the state's investment in research conducted by public postsecondary institutions". A focus of this assessment is on "research" centers and institutes (C&Is) in Florida's public universities. A classic text-book approach for calculating return on investment (ROI) involves an arithmetic comparison of the initial investment with the value of the net benefits or returns resulting from that investment.

The REMI model allows for a robust estimate of the ROI using discounted data, present valued over a 35-year period. Given the known dynamic nature of the REMI model, the calculated value of the 35-year ROI estimate was less than the FY 2000-01 annualized ROI estimate as was anticipated (ROI_{REMI} = 217% for Types 1, 2 and 3 C&Is; ROI_{REMI} = 128% for Types 1 and 2 C&Is). This ROI estimate implies that for each state dollar invested in C&Is (multiplied and discounted over a 35-year period), the state realizes a return of $2.17.

10. Benefit Cost Analysis

The "benefits" to the state of Florida from a conservative perspective were defined as the amount leveraged by the state's investment (i.e, all external expenditures). The "costs" to the state of Florida were defined as the initial state investment ($88.8m) assumed to be redistributed to alternative higher education spending (i.e., a measure of the opportunity cost). The REMI model calculated the 35-year, multiplied net present value of the opportunity cost of the initial state investment of $88.8 million to be $124 million. In summary, if funding for C&Is were reallocated across Florida's higher education system, the state economy, according to REMI output results (See Table 2), would result in a decline of $269.4 million (with an overall net decline of $145 million in GRP and 4,502 in jobs).

- Benefit to the state = $269.4 million;
- Cost to the state (opportunity cost of $88.8 million) = $124 million;
- B/C_{REMI} = 2.17 (Type 1, 2 and 3)
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11. Conclusions

The results of the economic analysis using the REMI model indicated that C&Is contribute significantly to the Florida economy. The economic benefits extend to job creation; generation of GRP, personal income and state taxes, from the expenditures made by all types of C&Is. The following are the primary contributions that are attributable to C&I expenditures from all funding sources in Florida:

- For every $17,829 spent by the state of Florida on C&Is, one job is created; in addition, the external funds generated by these C&Is leverage an additional 6,955 jobs.
- For every dollar of state support spent on C&Is, GRP increases by $2.17;
- For every dollar of state support spent on C&Is, income increases by $1.96;
- Given the FY2000-01 state investment, C&Is expenditures results in additional $18 million in tax revenues;
- The ROI_{REMI} for Types 1, 2 and 3 C&Is is 217%; the ROI_{REMI} for Types 1 and 2 C&Is is 128%.
- The B/C_{REMI} for SUS C&Is is 2.17.
- The benefits of SUS Centers and Institutes are substantially greater than the state of Florida investment cost .

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