ECONOMIC BENEFITS IN NORTH CAROLINA OF THE UNIVERSITY OF NORTH CAROLINA CAMPUSES

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Executive Summary

The institutions of the University of North Carolina System are engaged in three missions: teaching, research, and service. The purpose of this report is to quantify – in monetary terms where possible – the annual economic impact of the System's activities on the North Carolina economy. The annual impact of the teaching function is measured as the expected net lifetime increment to earnings of the yearly graduates who remain working in North Carolina after receiving their degree. The yearly impact of research is calculated as the annual monetary value of federal and private funding brought to North Carolina by UNC System faculty and staff. Unfortunately, an easily calculated monetary value of the service function was not available. Therefore, several non-monetary indicators of service (or outreach) are provided suggesting the range and scope of outreach by UNC System faculty and staff.

Using 2006 as the benchmark year, the results show the economic impact of the UNC System to be considerable in the state. The future productive value of annual graduates is put at $7.4 billion. Federal and privately funded research add almost $1 billion, annual spending by out-of-state students contributes over $300 million, and service efforts touch between one-third and one-half of all residents each year. The total direct annual impact is $8.7 billion and $10.4 billion with multiplier effects. If the UNC System was ranked as an industry in the state, it would be the 11th largest among 43 private sector industries. Due to the inability to accurately measure the ultimate impacts of research and service activities, these monetary values likely understate the UNC System's true economic impact.

INTRODUCTION

The University of North Carolina System has had a major influence on North Carolina for over two centuries. Today, through the efforts of the faculty, students, and staff of the System's sixteen campuses, thousands of North Carolina residents, businesses, and institutions are touched each year by the programs and activities of one of the nation's leaders in public higher education.

These programs and activities are numerous and varied, but they can be summarized under three categories: teaching, research, and service. Teaching activities are primarily – but not confined to – developing learning and skills among students enrolled in degree programs. Research is focused study by faculty, staff, and students on improving the understanding of phenomenon and relationships that can ultimately result in new discoveries and findings to improve the quality of life. Service includes those activities which extend the teaching and research of faculty, staff, and students outside the bounds of academia and directly to the people and communities of the state.

Certainly it is difficult to quantify all the benefits of the teaching, research, and service efforts of the University of North Carolina System campuses. For example, the enhanced appreciation a student receives for the great works of literature from a college course, the added knowledge gained about the lifespan of primitive life from research on coastal estuaries, or the enjoyment attained by attendees at university-sponsored cultural and sporting events are all difficult – indeed impossible – to measure in monetary terms.

Still, it is important, where possible, to benchmark the value of university activities for several reasons. Such benchmarks give direct users of the activities – students, those applying research findings, and beneficiaries of university services – some sense of the returns they receive. The measures also provide public sector decision-makers, particularly those in North Carolina's state government, with values that can be compared to the valuable investments made by the public sector in the state's public university system. Finally, the measures can be compared against similar measures for private sector industries to gauge where the University of North Carolina System ranks as an economic sector in North Carolina.

This paper therefore seeks to identify and quantify new resources – usually measured in income or spending – created in or brought to North Carolina as a result of the activities of the University of North Carolina System campuses. As a result, activities which only reallocate resources already in the state are not included. Examples of excluded activities are room, board, and other expenses of in-state students, spending at campus cultural and sporting events, and operating budgets of the UNC System institutions funded by North Carolina state government resources. The arguments for exclusion are that room, board, and other spending by in-state students would have occurred even if the individuals weren't in college. Likewise, spending by attendees at UNC System cultural and sporting events is a re-direction of North Carolina resident spending on leisure activities.[2] Further, publicly raised state resources could always be spent on other public functions in the state or be left with taxpayers to spend.

Following this introduction, the report is divided into five sections. Three sections are devoted to measuring the benefits of the teaching, research, and service functions of the university system. Next is a section that places the economic impact of the University of North

Carolina System in the context of the state economy. A concluding section provides a summary of the findings.

IMPACTS OF TEACHING

Teaching develops, what economists call, the "human capital" of students. Like the capital embodied in the machinery and technology of the modern factory and office, human capital represents the knowledge and skills of people. When these knowledge and skills are developed to a higher level, people are more productive as workers. The marketplace recognizes this greater productivity by paying workers with enhanced knowledge and skills a higher salary.

Therefore, one measure of the economic value of a college degree is the additional salary earned by college graduates compared to non-college graduates. However, the value of a college degree goes beyond a one-year comparison, as say between a college graduate earning $50,000 and a high school graduate earning $20,000. Instead, the degree's value is the *lifetime* of additional salary earned by the college graduate. This lifetime value represents the embodiment of additional productivity of the college graduate. It is measured by a concept called the *net present value of expected additional future earnings.* This is the value, in the purchasing power of today's dollars, of all the expected additional salary (net of the graduate's college costs) over the graduate's work lifetime from having the college degree. The concept is directly comparable to the market value (price) of a unit of machinery or technology, where that price also represents the additional productivity expected from the unit during its useful lifetime.

It should be recognized the net present value of additional future earnings from having a college degree is an approximation to the worth of that degree, and arguments can be presented that the value both overstates and understates the true worth. It can overstate a degree's value if inherent traits and skills of the graduate, or skills learned outside of college training, contribute significantly to the graduate's lifetime earnings. In contrast, the measure can understate the value of a college degree if there are significant benefits from the degree that aren't captured by the associated higher salary. These unmeasured benefits can be individual in nature, such as the greater enjoyment college graduates might receive from the fine arts, history, domestic and foreign cultures, and current affairs. Or, the unmeasured benefits can be social in nature. For example, expected higher future salaries may motivate college graduates to take better care of their physical health and to be less likely to engage in criminal activities. If so, then government spending on health care and on law enforcement and incarceration may be lower as a result, and the reduced government expenditures on these functions can be viewed as a societal benefit.

Accepting these cautions, this section reports the results of measuring the value of degrees from the University of North Carolina System institutions by the net present value of expected additional future earnings associated with the degree. The results were obtained by applying the following steps. First, for each institution, a graduating class was sorted by degree (bachelors, masters, doctorate, law, medical) and major. Then, the tuition and fees, costs of books and supplies, and foregone earnings paid by each graduate over their college years were identified and summed. This sum represents the direct monetary cost to the student of the college degree.[3] Next, the average salaries of recent UNC System graduates with specific degree-majors who have been working full-time in North Carolina were identified for each institution.[4] From each of these salaries was subtracted the alternative salary the graduate would

have earned if the college degree had not been obtained. For bachelors degrees, the alternative salary is that of a high school graduate in North Carolina; for masters, law, and medical degrees, it is the average salary of a bachelors degree; and for doctorate degrees, it is the average salary of a masters degree.[5] Last, assuming the graduate works until age 67, future additional salary dollar amounts are adjusted to current purchasing power dollars, the graduate's college costs are subtracted, and a *net present value of expected additional future earnings* amount is obtained for each degree-major in each institution.[6] Multiplying this value by the number of graduates in a class with that degree major and who stays to work in North Carolina yields aggregate values.[7]

Table 1 shows the aggregate results, summed over all degrees and majors, for each institution and the total for the University of North Carolina System. It is based on the graduating class of 2003-04, the latest for which the salary data were available, with the results expressed in 2006 purchasing power dollars. Results for the University of North Carolina School of the Arts are not included due to the unique nature of the School's programs and graduates.[8]

The results are impressive. Based on the salary increment they are expected to receive over their work lifetime, the 2003-04 UNC System graduating class will directly generate over $7 billion of additional income in the state, measured as a single amount in 2006 dollars. When the impacts of the re-spending of this income within North Carolina are accounted for – the so-called *multiplier effect* – the value increases to almost $9 billion.[9]

Table 1. Expected Aggregate Net Present Value of Additional Lifetime Income Earned by Graduates of UNC System Institutions Who Remain Working in North Carolina, 2003-04 Graduating Class, in 2006 Dollars [a]

Institution	Without Multiplier Effects	With Multiplier Effects
Appalachian State University	486,005,936	583,207,123
East Carolina University	793,635,690	952,362,828
Elizabeth City State Univ.	25,048,073	30,057,688
Fayetteville State Univ.	102,411,554	122,893,865
N.C. Agril. & Tech. State Un.	168,774,550	202,529,460
North Carolina Central Univ.	219,533,045	263,439,654
North Carolina State Univ.	1,400,442,255	1,680,530,706
University of NC at Asheville	29,209,093	35,050,912
Univ. of NC at Chapel Hill	1,443,952,217	1,732,742,660
Univ. of NC at Charlotte	981,809,907	1,178,171,888
Univ. of NC at Greensboro	743,071,824	891,686,189
Univ. of NC at Pembroke	154,867,404	185,840,885
Univ. of NC at Wilmington	375,991,188	451,189,426
Western Carolina University	297,087,750	365,505,300
Winston-Salem State Univ.	185,086,993	222,104,392
System Total	**$7,406,927,479**	**$8,888,312,975**

[a] Calculations from the University of North Carolina School of the Arts not included.

Source: Calculations using data from the UNC System General Administration and the Employment Security Commission of North Carolina

It is informative to calculate the return on the state's investment in the University of North Carolina System represented by the income values in Table 1. Four such returns are estimated. The first (*Return 1*) takes the aggregate cost in state appropriations to the UNC System institutions for the class of 2003-04 and divides it into the system-total net income increment, without multiplier effects, from Table 1. The second measure (*Return 2*) takes the same aggregate cost and divides it into the system-total net income increment, with multiplier effects, from Table 1.[10] The third measure (*Return 3*) divides the aggregate cost into an estimate of the state and local public revenues derived from the system-total net income increment, without multiplier effects, from Table 1, and the fourth measure (*Return 4*) divides the aggregate cost into an estimate of the state and local public revenues derived from the system-total net income increment, with multiplier effects, from Table 1.[11] In essence, Return 1 and Return 2 answer how much *private sector income* of graduates is associated with each dollar of state funds appropriated to instructional costs for those graduates, whereas Return 3 and Return 4 address how much *public sector revenue* from graduates is associated with each dollar of state funds appropriated to instructional costs for the graduates.

The results for Return 1, Return 2, Return 3, and Return 4 are in Table 2 and again they are significant. Returns 1 and 2 show between $9 and $12 of lifetime income is associated with every dollar of state appropriations to UNC System instruction. Returns 3 and 4 indicate that between $1.4 and $1.6 of state and local public revenue in North Carolina is associated with every dollar of state appropriations to UNC System academic instruction.

Table 2. Alternative Rates of Return to State Appropriations for UNC System Instructional Spending ($ of return per $ of public expenditure)

Return 1	9.65
Return 2	11.59
Return 3	1.37
Return 4	1.62

Source: Calculations using data from Table 1 and budgetary information from the North Carolina Office of State Budget and Management.

One other impact of the teaching function is the additional annual spending in North Carolina generated from out-of-state students attending campuses of the University of North Carolina System. This spending is assumed to be approximately $10,000 annually.[12] In 2006, this spending from out-of-state students is estimated at $316,360,000. Adding multiplier effects increases the impact to $379,632,000. Revenues from out-of-state student tuition and fees aren't included under the assumption those revenues offset the associated public costs for the students.

IMPACTS OF RESEARCH AND SPONSORED PROGRAMS

A second mission of University of North Carolina System institutions is research.[13] The research activities span many topics and many activities, including improving health care and finding treatments and cures for illnesses and diseases, developing and adapting new sources of

energy, mitigating pollution and environmental degradation, improving the economic and social dimensions of life for North Carolinians, and increasing our understanding of climate change, damaging storms, and shifting weather patterns – to name only a few.

The economic impact of these research activities ultimately rests on an evaluation of the practical applications of the research results. So, for example, the impact of research that results in improved predictability of the timing and path of hurricanes would be calibrated by the resulting reduction in lives and injuries and property saved as a result of implementing the research's recommendations. Or, a research program that discovers methods to improve energy efficiency would be measured by the market value of associated reduced energy usage. Other impacts of research include helping to attract, retain, or expand businesses, which in some cases is encouraged by university research capacity.

Unfortunately, deriving such economic impacts of research programs is project specific and very time consuming.[14] We can, however, quantify some of the outcomes of research activities. Technology transfer, or the sharing of university-based knowledge and inventions with the specific purpose of developing new technologies and products, often results in measurable economic impacts. The UNC System's six campuses with established technology transfer offices report annual activity to the Association of University Technology Managers. The 2006 survey, the most recent with information from all six campuses, shows those campuses reported 435 inventions, filed 272 patents, managed 963 licensing agreements, and received over $6 million in licensing income. Sixteen UNC System-based spin-off companies were also launched in 2006.

Another alternative to assessing the impact of the UNC System research enterprise is to measure the research funds attracted by UNC System institutions from non-state sources.[15] This information is presented in Table 3, for the fiscal year 2006-07 and in 2006 dollars, for each institution and in total. The amount of federal funding has been reduced by 2.4% to account for North Carolina's share of federal tax collections.[16] The "total funding with multiplier" uses a multiplier of 1.2 and, again, accounts for the re-spending of funds within the state. For the UNC System, the results show almost one billion dollars of funding without including multiplier effects and over $1.1 billion of funding with the inclusion of multiplier effects.

The "payoff" to North Carolina from research can be added to the returns from teaching to see a total return from these two activities relative to state appropriations, as given in Table 4. The research returns augment the teaching returns to give total returns from the two functions to between 12 and 15 for income and 1.7 and over 2.1 for state and local public revenue.

IMPACTS FROM SERVICE

UNC System service includes activities by faculty and staff outside of the formal classroom and laboratory and in the community, working with residents, businesses, non-profit organizations, and governmental officials to enhance knowledge and skills so that better private and public decisions can be made and outcomes improved. Services activities work with "real" situations and "real" decision-makers in "real" time.

Table 3. Federal and Privately Funded Research and Sponsored Programs at UNC System Institutions, 2006-07 Fiscal Year, 2006 Dollars [a]

Institution	Federal Funding	Private Funding	Total w/o Mult.	Total with Mult.
Appal. St. Univ.	4,199,156	3,998,801	4,604,423	5,525,308
East. Car. Univ.	13,309,258	19,340,914	15,783,151	18,939,781
Eliz. City St. Un.	8,085,162	2,173,234	8,153,163	9,783,795
Fay. State Univ.	9,385,335	1,038,610	9,393,335	11,272,002
NC A&T Univ.	34,409,027	4,318,032	36,149,548	43,379,458
NC Central Univ	19,739,429	2,786,441	19,739,429	23,687,315
NC State Univ.	102,802,578	51,213,734	122,885,987	147,463,077
UNC-Asheville	2,948,162	315,190	2,948,162	3,537,794
UNC-CH	432,486,144	136,254,084	458,677,870	550,413,444
UNC-Charlotte	19,023,614	8,774,717	23,308,112	27,969,734
UNC-Greens.	20,345,403	8,730,270	21,092,118	25,310,542
UNC-Pembroke	1,993,886	520,314	1,993,886	2,392,663
UNC-Wilm.	11,961,641	2,979,661	12,568,798	15,082,558
West. Car. Univ.	3,482,641	1,437,453	3,482,641	4,179,170
W-S State Univ.	11,500,378	444,657	11,500,379	13,800,455
UNC – GA[b]	10,275,391	6,248,060	11,177,191	13,412,630
System Total	**705,947,211**	**250,574,171**	**956,521,382**	**1,147,825,658**

[a] Federal funding includes a reduction of 2.4% to account for the share of federal government tax receipts by North Carolina residents. No data available for the North Carolina School of the Arts.

[b] Funds allocated to the UNC General Administration instead of any particular institution.

Source: UNC – General Administrations and author's calculations.

Table 4. Alternative Rates of Return to State Appropriations for UNC System Instructional and Research Spending ($ of return per $ of public expenditure)

Return 1	12.58
Return 2	15.11
Return 3	1.76
Return 4	2.11

Source: Calculations using data from Tables 1 and 3 and budgetary information from the North Carolina Office of State Budget and Management.

The service work (also termed "outreach") conducted by UNC System faculty and staff is broad and touches almost every aspect of life in North Carolina. UNC System faculty and staff work with farmers, with agribusiness companies, with businesses both large, small and start-up, with families, children, and young adults, with injured and ill patients, with employers, employees, and retired persons, with those seeking skills for work as well as those looking for pleasurable knowledge, and with local and state elected and non-elected officials. The service work is delivered through a wide variety of methods and organizations, ranging from the statewide Cooperative Extension Service which has offices in every county, to UNC Healthcare with several hospitals and clinics, to work done by individual faculty.

As with research activities, gauging the economic impact of service activities is difficult. Many of the activities don't have a direct market value attached to them. The impacts of the

activities are often difficult to separate from other factors that are occurring at the same time. Also there's the issue that the impacts of service programs may only occur over a long period of time. Thus, longitudinal studies which carefully separate the effects of UNC System service activities from other determinants of outcomes would need to be conducted to accurately calibrate service impacts.[17]

Such longitudinal studies are not available for UNC System service activities. Instead, this report presents less comprehensive, yet still meaningful, indicators of the activities' impacts by listing non-monetary measures of the quantity of service activities. (Table 5). The list is not comprehensive and certainly misses some important programs. It also misses activities that aren't easily documented or quantified, such as public information provided by faculty and volunteer services by faculty and staff.

Nonetheless, the numbers strongly suggest and substantiate that UNC System service activities touch a large number of North Carolinians and North Carolina communities. It is not an exaggeration to say that faculty and staff of the UNC System interact with residents, businesses, organizations, and governments in every North Carolina county and virtually every town and municipality.

Table 5. Selected Indicators of UNC System Service Activities (fiscal year 2007-2008 unless otherwise stated)

UNC Healthcare	
Clinic visits	741,980
Surgical visits	22,327
ER visits	61,200
Discharges (incl. newborns)	35,934
Uncompensated indigent care costs	$226.8 million
Area Health Education Centers (AHEC)	
Total clinic visits	505,642
Specialty clinic visits	18,848
Middle and high school health careers recruitment program	37,400
Continuing education programs attendees	206,834
Student months of community placement	10,489
ECU Physician Practice	
Outpatient visits	335,000
Emergency room visits	83,330
Surgical procedures	11,652
Birth deliveries	2,823
HIV positive patients	1,190
Indigent patients served	20,500
Uncompensated indigent care costs	$9.5 million

Table 5, continued

North Carolina Cooperative Extension Service	
Face to face contacts	2,153,332
Non face to face contacts	3,888,320
Participants in meetings/workshops/training	556,054
North Carolina Industrial Extension Service[a]	
Number of jobs retained or created	3,010
Small Business and Technology Development Center	
Clients counseled	5,184
Training attendees	5,872
Number of jobs retained or created	7,667
Government contracts to clients	$1.1 billion
UNC School of Government	
Public official program attendees	approx. 15,000
Public official courses and programs	approx. 200
Center for School Leadership Development	
Teachers, principals, and administrators served	29,891
Contact hours	642,263
Local education agencies served	115
NC Center for the Advancement of Teaching	
Teacher seminar/program attendees	5,101
Teacher professional development attendees	883
Patents by faculty[b]	
Number of applications filed	1,293

[a] 2005-2008

[b] 2001-2005

Table 5, continued

Sources: www.unchealthcare.com; AHEC Director's Office; ECU Brody School of Medicine; North Carolina Cooperative Extension Reporting System; UNC-General Administration; www.ies.ncsu.edu; North Carolina Industrial Extension Service; Small Business and Technology Development Center; UNC School of Government; Center for School Leadership Annual Report; NC Center for the Advancement of Teaching; UNC Tomorrow Report.

THE UNC SYSTEM AS AN INDUSTRY

The UNC System impacts that can be easily quantified in financial terms are the investment value of the annual degrees awarded (Table 1) and the annual federally and private funded research (Table 3).[18] As already shown, these annual combined values are impressive: in 2006, $8.7 billion without multiplier effects, and $10.4 billion with multiplier effects. For several reasons already noted (most importantly - the monetary impacts of service activities are omitted, and the ultimate impacts of research aren't used), these totals are likely to be lower-bounds of the System's annual economic impact in North Carolina.

The $8.7 billion can be viewed as the annual (in 2006) economic "production" from the UNC System in the state. As such, it can be compared to the annual economic production values of other industries operating in North Carolina. This is done in Table 6 using the U.S Bureau of Labor Statistic's values for "gross state product" in the state's major industries.[19] Direct values (without multiplier effects) are used.

Table 6. Gross State Product Values for Private Industries and the UNC System in North Carolina, 2006, Billions of Dollars.

Banking	$43.5
Real estate	$33.0
Retail trade	$23.4
Wholesale trade	$20.0
Food product manufacturing	$18.6
Construction	$18.1
Professional & technical services	$17.8
Chemical manufacturing	$14.0
Ambulatory health care services	$13.0
Administrative and support services	$9.1
UNC System	**$8.7**
Hospital and nursing care facilities	$8.2
Management of companies	$7.8
Utilities	$6.7
Restaurants	$6.6
Broadcasting & communication	$6.6
Computer & electrical product manufacturing	$5.8
Insurance	$5.1
Agriculture, forestry, & fishing	$5.0
Truck transportation	$3.9
Water, rail, and air transportation	$3.9
Fabricated metal product manufacturing	$3.9
Machinery manufacturing	$3.9
Transportation equipment manufacturing	$3.4
Software publishing	$3.2

Table 6, continued

Educational services	$2.9
Textile products	$2.9
Electrical equipment & appliance manufacturing	$2.8
Arts, entertainment, & recreation	$2.7
Securities investments	$2.6
Furniture	$2.4
Rental & leasing services	$2.1
Social assistance	$2.0
Lodging	$2.0
Wood product manufacturing	$2.0
Non-metallic product manufacturing	$1.9
Apparel manufacturing	$1.6
Paper manufacturing	$1.6
Miscellaneous manufacturing	$1.5
Primary metal manufacturing	$1.5
Printing manufacturing	$1.1
Warehousing & storage	$1.0
Mining	$0.6

Source: U.S. Bureau of Economic Analysis; Table 1; Table 3.

The table shows that if the UNC System were classified as an industry, its annual production in the state would rank 11th among 43 private sector industries.[20] The annual production of the System would rank ahead of all but two manufacturing sectors (food manufacturing and chemicals), and would also exceed sectors such as transportation, utilities, food service, hospitals, agriculture, communications, lodging and recreation, and insurance and securities investments. Furthermore, this ranking of UNC System production is likely to be low for two reasons. First, as already emphasized, the calculated production value for the UNC System includes modest monetary values for the System's research function and no monetary values for its service function. Second, embedded in the production values of the other private industries is the productivity of many UNC System graduates. If the monetary value of this productivity was subtracted from the private industries, their remaining values and rankings would fall and the UNC System's ranking would rise.

CONCLUSIONS

This report has documented the very significant impact of the UNC System to the economy of North Carolina. Each of the System's three functions – teaching, research, and service – make valuable and large contributions to North Carolina each year.

The monetary value of the teaching function was measured as the net present value of the estimated increments to lifetime income of the System's annual graduates who remain working in the state. These increments are expected to represent the enhanced productivity the graduates

bring to the state's economy. Using the class of 2006 as an example, the annual aggregate value of teaching was $7.4 billion, with an additional $300 million added by out-of-state student spending. The monetary value of the research function was taken as the annual value of non-state funded research from federal and private sources. In 2006, this funding totaled almost $1 billion. These values are direct impacts; adding "multiplier" impacts increase them even more. A monetary value was not calculated for the service function. Instead, the impact of this activity was indicated by various "contact" quantities, such as the number of patients treated by UNC Healthcare, the number of persons receiving information or training from the North Carolina Cooperative Extension Service, and the number of patents generated by UNC System faculty and staff.

If the monetary values of the teaching and research functions are combined and treated as the annual "production" of the UNC System, then in 2006 the System was the 11th largest industry among 43 total private industries in the state. Furthermore, the System yielded between $12 and $15 of income for every dollar of state-funded appropriations, and between $1.70 and $2.10 of state and local public revenues for every dollar of state-funded appropriations in 2006.

While impressive, these numbers are likely to understate the UNC System's positive impact on the North Carolina economy. The gains from teaching don't include some positive social benefits observed for college graduates, such as their improved health condition and reduced crime rates – both outcomes which reduce subsequent public expenditures. The benefits from research spending would likely be much larger than those reported if the ultimate value of the research findings and their implementation – such as reduced levels of illness and injury, gains in worker productivity, and jobs and incomes created from commercial spinoffs of the

research – could be measured and captured. Of course, there was no attempt to place a monetary value on the service function, and clearly, of course, service activities of the UNC System do generate positive economic value. Finally, in the ranking of annual UNC System "production" against those of other private industries in the state, the production values of the other industries certainly include the productivity of UNC System graduates who work in those industries. If that productivity was able to be subtracted from the output of the private industries, the UNC System's ranking would rise.

These conclusions suggest the monetary benefits for the UNC System presented in this report are minimal values, and the impact of the System is much larger. How much larger would require a significantly greater evaluation of the System's activities, but particularly of the research and service functions. Nonetheless, the presented values can be generated rather easily on a regular basis and can be used to provide at least a baseline measure of the UNC System's on-going contribution to the state. And although understated, these measures show – without a doubt – that the campuses of the University of North Carolina System are a vital and integral part of North Carolina's present and future.

ENDNOTES

[1] The invaluable statistical assistance of Xiaoyun Yang, Director of Information Reporting Services at the University of North Carolina – General Administration, is greatly appreciated. Leslie Boney and Norma Houston of the UNC-General Administration also provided valuable comments and information.

[2] New spending for the state could be generated at these events by out-of-state attendees (as, for example, by fans of the opposing sports team who travel from another state to watch their team play a UNC System team), but such spending could be offset by losses when fans of a UNC System campus team travel to another state to attend similar games.

[3] Room and board costs aren't included because such costs would also be incurred if the individual was not in college. Tuition and fees are from the UNC General Administration and vary by institution, degree, and in-state and out-of-state student. The costs of books and supplies are from The College Board, *Trends in College Pricing, 2007*. The foregone earnings are an opportunity cost to the student and a productive cost to the economy. They are calculated as 75% of the annual salary of the next lowest degree for the student (high school degree for bachelor degree, bachelor degree for master, law, and medical degrees, and master degree for doctorate degrees) – the 75% accounts for the ability of the student to work full-time during the summer – minus what the typical student earns during the school year by working. Based on survey data, these school year earnings are assumed to be $7500 for undergraduates and $10,000 for students in graduate and professional programs (Jonathan Orszg, Peter Orszg, and Diane Whitmore, "Learning and Earning: Working in College", Upromise, Inc., August 2001; and Tina Tuttle, "College Students Working: The Choice Nexus", IPAS Topic Brief, April 2005).

[4] The salary data are from the UNC System General Administration and the Employment Security Commission of North Carolina. Only annualized salaries of graduates working at least three quarters were used.

[5] The value of earlier degrees earned in another year or at a non-UNC System institution would be assigned to that year or that institution.

[6] The age of 67 is used for retirement from work because it is the age to receive full Social Security benefits for individuals born after 1960. The "real discount rate", or the rate at which individuals willingly trade current dollars for future dollars after accounting for inflation, is assumed to be 3% annually (James Girola, "The Long-Term Real Interest Rate for Social Security", U.S. Department of the Treasury, Research Paper No. 2005-02, March 30, 2005). In recent decades, the payoff to more education has been increasing on trend (Claudia Goldin and Lawrence Katz, *The Race Between Education and Technology*, Cambridge, MA: Harvard

University Press, 2008). This means the additional salary earned by individuals with the next highest degree has been increasing. To account for the likelihood that this trend will continue, the additional salary associated with the next highest degree is assumed to increase 1% annually, which is a modest average of the changes this decade (U.S. Bureau of the Census, *Statistical Abstract of the United States*). The college costs of the student are also converted to the same purchasing power dollars as the additional earnings before being subtracted from the present value of the aggregate additional earnings.

[7] Again, data on the percentage of graduates by institution and by degree-major who, in their first year after graduation, have remained to work in North Carolina are kept by the UNC System General Administration.

[8] The University of North Carolina School of the Arts has both high school programs as well as undergraduate programs. High school graduates from the School typically enroll in colleges or universities and therefore their results are not applicable to the analysis. Data on the salaries of the School's college program graduates were limited and often showed starting salaries lower than those for high school graduates. This is likely due to the unique job market for fine arts graduates, where the time required to attain a salary commensurate with the graduate's training can be much longer than in other professions. For these reasons the results for the School are not displayed.

[9] The multiplier accounts for the additional income generated in the state when graduates spend their salaries at North Carolina businesses and retail outlets. A multiplier of 1.2 is used in Table 1 (Mig, Inc., *IMPLAN for North Carolina*). Multipliers do not account for re-spending on products and services from out-of-state sellers or on products or services made outside the state. Hence, for example, the multiplier associated with an auto purchase in North Carolina will be modest because the majority of the value of the vehicle was made outside of North Carolina.

[10] The aggregate cost in state appropriations excludes the institutions' tuitions and fees because these revenues are kept by each institution.

[11] Aggregate costs for a class are summed over the number of years required to educate and graduate that class, assuming four years for bachelors degrees, two years for masters degrees, three years (beyond masters level) for doctorate degrees, three years for law degrees, and four years of professional training for medical degrees. The sums are expressed in present value terms. The public revenues include all state and local taxes and fees and are taken as a percent of personal income using the latest available data.

[12] The College Board, *Trends in College Pricing, 2007*.

[13] Included in this category are also sponsored programs. Sponsored programs are scholarly, professional, and creative activities that University personnel conduct with support from external funding, such as grants, contracts, and cooperative agreements.

[14] For an example, see Brad J. Bowland and Michael L. Walden, *The Economic Impact of the Department of Marine, Earth, and Atmospheric Sciences at North Carolina State University*, Department of Agricultural and Resource Economics, North Carolina State University, June 1995.

[15] State (North Carolina) sources of research funding are omitted because the argument can be made those state funds could be spent on other public programs or left in private hands and spent, with both forms of spending generating economic impact.

[16] In other words, this reduction accounts for the fact that 2.4 percent of the federal funding comes from North Carolina taxpayers, so this amount is not a net gain.

[17] For a review of the issues in calculating service impacts, see Dean Birkhaeuser, Robert Everson, and Gershon Feder, "The Economic Impact of Agricultural Extension: A Review", *Economic Development and Cultural Change*, 39, 3, April 1991, 607-650.

[18] The monetary values from service activities in Table 6 are not included because those spending amounts appear in the economic activities of the private firms.

[19] Gross state product for a given industry measures the value of output produced by that industry within North Carolina. As such, it excludes the value of any inputs purchased from outside the state and used in the production. Therefore, its value is usually less than the sales value of the output. The multiplier impacts are also not included with these values. The sectors are three-digit NAICS (North American Industry Classification System) industries except in the case of retail trade, wholesale trade, and construction, which are at the two-digit level. Greater detail was not available for these three industries.

[20] Government sectors, including the military, are excluded.