THE ECONOMIC IMPACT OF THE

WAKE COUNTY PUBLIC SCHOOL SYSTEM

INVESTING IN EDUCATION

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The Wake County Public School System (WCPSS) has large and significant economic impacts on the local economy. Every $1.00 spent and retained in the local economy from the WCPSS operating budget results in total county spending of $1.76, and every one direct WCPSS job is associated with another 0.34 jobs in the Wake County economy. Also, every $1.00 spent and retained locally from the WCPSS capital budget results in total county spending of $2.23 and is associated with 9.6 jobs in the region.

More important are the three major *outputs* of WCPSS: the economic value of degrees awarded, the future reduction in public costs associated with individuals attaining a high school degree, and the impact on local property values and revenues from the academic performance of WCPSS students.

The economic value of degrees awarded by WCPSS is measured as the expected increase in lifetime earnings of high school graduates compared to high school dropouts. For each of the recent five WCPSS graduating classes, this value ranges between $1429 million and $1617 million (in current 2015 dollars). Also, as a result of recent improved academic performance of WCPSS graduates, their increased likelihood of finishing college is valued at an average $105.9 million (in current 2015 dollars) for each of the last five graduating classes.

Considerable research has found that individuals graduating from high school are less likely to engage in criminal behavior and to use public assistance and are more likely to lead healthy lifestyles, compared to high school dropouts. This means high school graduates reduce future public crime costs, public welfare costs, and public health costs.

For each of the recent WCPSS graduating classes, the reduction in these costs is estimated at between $565 million and $639 million (in current 2015 dollars).

Lastly, WCPSS can impact local wealth – specifically real property values – in two ways. One is through the additional spending that high school graduates create compared to high school dropouts. This impact was estimated to create an average of $86 million in additional county property values and $0.7 million in higher county real property tax revenues for each recent class of WCPSS graduates.

The second and more significant local wealth impact comes from the positive response of residential property values to improved academic performance of WCPSS students. All standard measures of academic performance of WCPSS seniors have improved – on trend - in recent years. Research shows that improved academic performance of public school students has significant positive impacts on local residential property values. Using the results of this research, it is found that WCPSS' recent improved academic results have resulted in Wake County residential property values that are $11.2 billion higher compared to the levels without the improvement in academic performance. The corresponding gain in annual property tax revenues to Wake County is $89.6 million.

The economic impact of WCPSS is summarized as follows:

Inputs

- Every $1 spent and retained in Wake County by the WCPSS operating budget results in $1.76 of Wake County spending
- Every direct WCPSS job is associated with another 0.34 Wake County jobs
- Every $1 spent and retained in the region by the WCPSS capital budget results in $2.23 of Wake County spending
- Every $1 million spent by the WCPSS capital budget results in 9.6 Wake County jobs

Outputs

- Each recent WCPSS graduating class generated between $1429 million and $1617 million in additional lifetime income (in 2015 purchasing power dollars; noted below as 2015$)
- As a result of improved academic performance of recent WCPSS graduates, their increased likelihood of completing college is valued at average $105.9 million for each of the last five graduating classes
- Each recent WCPSS graduating class is associated with a lifetime reduction in public crime, welfare, and health care costs between $565 million and $639 million (2015$)
- The additional spending of each WCPSS graduating class adds $86 million to local property values
- The recent improvement in WCPSS academic performance is estimated to have resulted in Wake County residential property values that are $11.2 billion higher compared to levels without the improvement in academic performance

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GENERAL LIMITING CONDITIONS

All practical and reasonable efforts have been used to make the analysis and conclusions developed in this study reflect the best possible estimates of economic impact. The study is based on numerous data, assumptions, and parameters provided by the client and other sources cited in the study. No responsibility is assumed for inaccuracies reported by the client or any other data source used in developing and preparing the study. No warranty or representation is made by Dr. Walden or North Carolina State University that any of the values or estimations in the report has been, or will be, actually achieved.

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INTRODUCTION

The Wake County Public School System (WCPSS) serves over 155,000 students in pre-K to grade 12 programs in 171 schools and with an annual budget of over $1.5 billion. It is among the top employers in Wake County. Given its size and significant task of equipping students with necessary knowledge and skills for the modern workforce and for success in post-secondary education, the economic impact of WCPSS is sure to be large. However, no specific measures of this impact are currently available.

The objective of this report is to provide such impact measures for the local economy. Here, "local" is defined as Wake County.[1] This geographic focus is appropriate given that a major source of funding for WCPSS is from taxpayers in Wake County. Economic impacts are measured both in terms of dollars and employment and, where appropriate and possible, locally generated public revenues.

The economic impacts of WCPSS are measured in four categories as shown in Figure 1:

Impact 1. The impact on county spending and employment of WCPSS' annual budgets, including the spending by WCPSS on salaries, supplies, and other operational support which generates income to employees and vendors. Employees and vendors will, in turn, re-spend a portion of these funds in the local economy, thereby establishing a "ripple", or "multiplier" total impact of WCPSS' budget. The

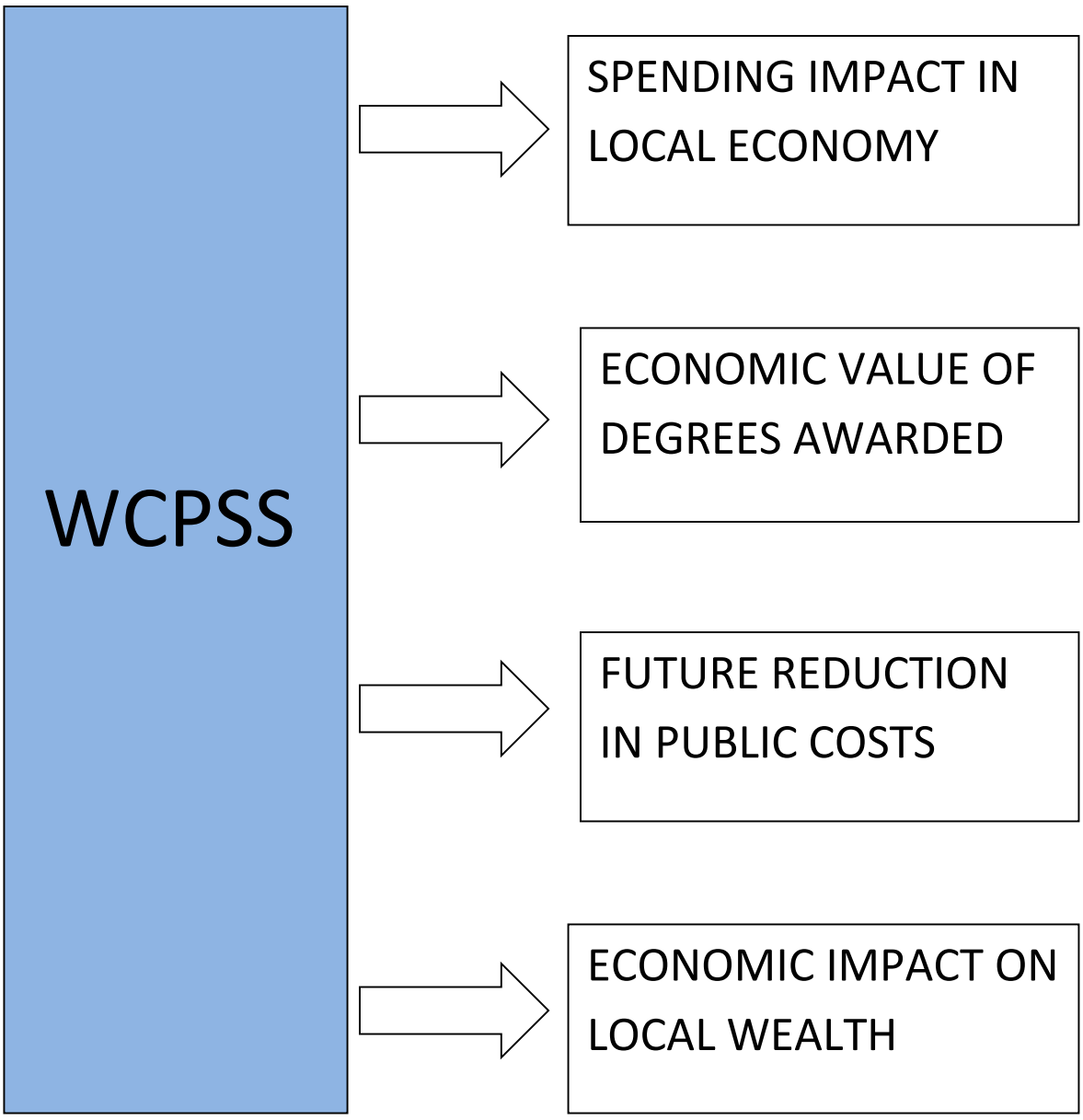
[1] From a broader perspective, Wake County is part of the Raleigh-Durham-Cary Combined Statistical Area, a region of 1.8 million people in nine counties.

components of this total impact of WCPSS' budget – as well as the total impact itself – are estimated. The analysis is performed separately for the WCPSS operating budget and capital budget.

Impact 2. Economic value of degrees awarded: There are two components to this impact. First, as a result of the skills they acquire in school, the graduates of WCPSS have a higher economic value in the job market than individuals who have not attained a high school diploma. This value is approximated by the difference in lifetime incomes of WCPSS graduates and non-graduates. Second, research has shown that improved academic performance of high school graduates leads to improved academic performance in college and a greater likelihood of attaining a college degree. This means improved academic performance of WCPSS graduates who attend college can be linked to a portion of the added lifetime earnings received by college graduates.

Impact 3. Future reduction in public costs: Increases in high school graduates have been shown to be associated with positive public outcomes, such as reduction in crime rates and welfare and public health care costs. Estimates are calibrated for these benefits.

Figure 1. Economic Impacts of WCPSS.



Impact 4. Economic impact on local wealth: Considerable research also indicates citizens value well-performing schools. Economically, this value is incorporated into a premium in local property values. The impact on local property values indicated by recent trends in the performance of WCPSS is estimated.

Taken collectively, these four impacts will show the economic clout of WCPSS is large and significant.

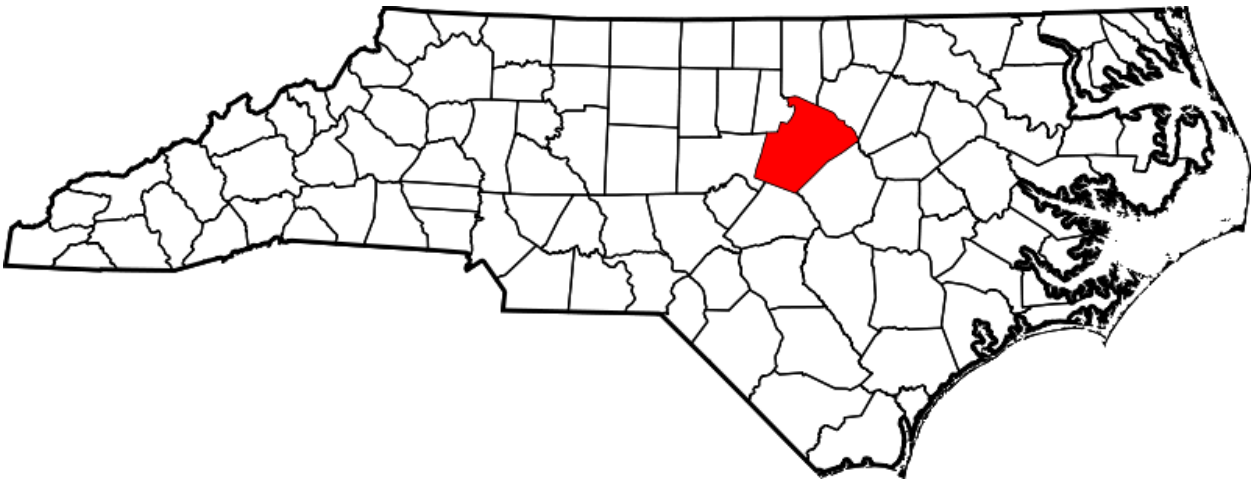
For ease of presentation, the report is divided into several sections. The next section provides context for the WCPSS impact assessment by summarizing recent trends in the economy of Wake County. Then follow four sections, each devoted to results for one of the aforementioned economic impacts. The final section provides conclusions and a summary of the findings.

WAKE COUNTY

Wake County is located in the central part of North Carolina and is the major county in the "Triangle" region anchored by the cities of Raleigh, Durham, and Chapel Hill. Wake County is 835 square miles in size and is home to approximately 975,000 residents. Wake County produces an estimated $52 billion in annual economic output.[2] Figure 2 shows the location of Wake County in the state.

[2] Output is value-added. Data are for 2013, the latest available.

Figure 2. Location of Wake County in North Carolina.



Although the county certainly suffered during the recent nationwide recession, it weathered the downturn relatively better than the nation. The Wake County unemployment rate peaked at 9.0% in early 2010, but by mid-2015, the Wake County unemployment rate had dropped to near 5%.[3] Both rates were less than national levels.

A major reason for Wake County's better relative economic performance in recent years is its economic structure. Table 1 compares the county's employment profile by industry to that of the nation. Wake County has relatively fewer of its workers employed in the manufacturing

[3] Unemployment rate numbers are not seasonally adjusted and are from the U.S. Department of Commerce.

Table 1. Economic Structure of Wake County Compared to the Nation, 2013.

Percent of Total Employment

Sector	Wake County	U.S.
Agriculture	0.2	2.0
Manufacturing	9.4	10.5
Trade, Transportation, Utilities	16.1	19.2
Information	2.7	2.1
Financial Services	7.0	6.6
Construction	5.9	6.1
Professional and Business Services	17.6	11.0
Education and Health Services	21.2	23.0
Leisure and Hospitality	8.9	9.7
Other Services	5.3	5.0
Public Administration	5.7	4.8

Data are based on place of work

Source: U.S. Census, *American Community Survey, 2013*; based on population age 16 and over

and trade/transportation/utilities sectors and relatively more in the information, professional/business services, information and public administration sectors. Manufacturing is always more adversely affected during recessions because buyers can more easily postpone purchases of manufactured products. In contrast, professional and information services sector jobs and some public administration jobs are less affected and more stable during economic downturns, and information has been a long-term growth sector. Therefore, Wake County has an economic structure that is better able to withstand recessions.

Table 2. Key Socioeconomic and Demographic Data of Wake County Compared to the Nation, 2013.

Factor	Wake County	U.S.
Population	974,289	316,128,839
Median household income	$65,160	$52,250
% of population aged 65 and over	9.7	14.1
% of persons aged 25 and over with a high school degree	88.2	86.6
% of persons aged 25 and over with a bachelor's degree	36.1	29.6
Population growth rate, 2000-2013 (%)	55.2	12.0

Sources: U.S. Census Bureau; U.S. Department of Commerce

Table 2 compares key socioeconomic and demographic information between Wake County and the nation. Median household income in Wake County is 25% higher than the national average. Wake County is a young region, with the relative size of the elderly population 30% under the rate for the nation. Wake County is also a very educated area – the percentage of adults with a bachelor's degree or more is almost 7% points above the national rate – and this characteristic is directly linked to the county's high income and comparatively low unemployment rate. Population growth in Wake County in the past thirteen years (2000-2013) has been 4.6 times faster than the same rate for the nation.

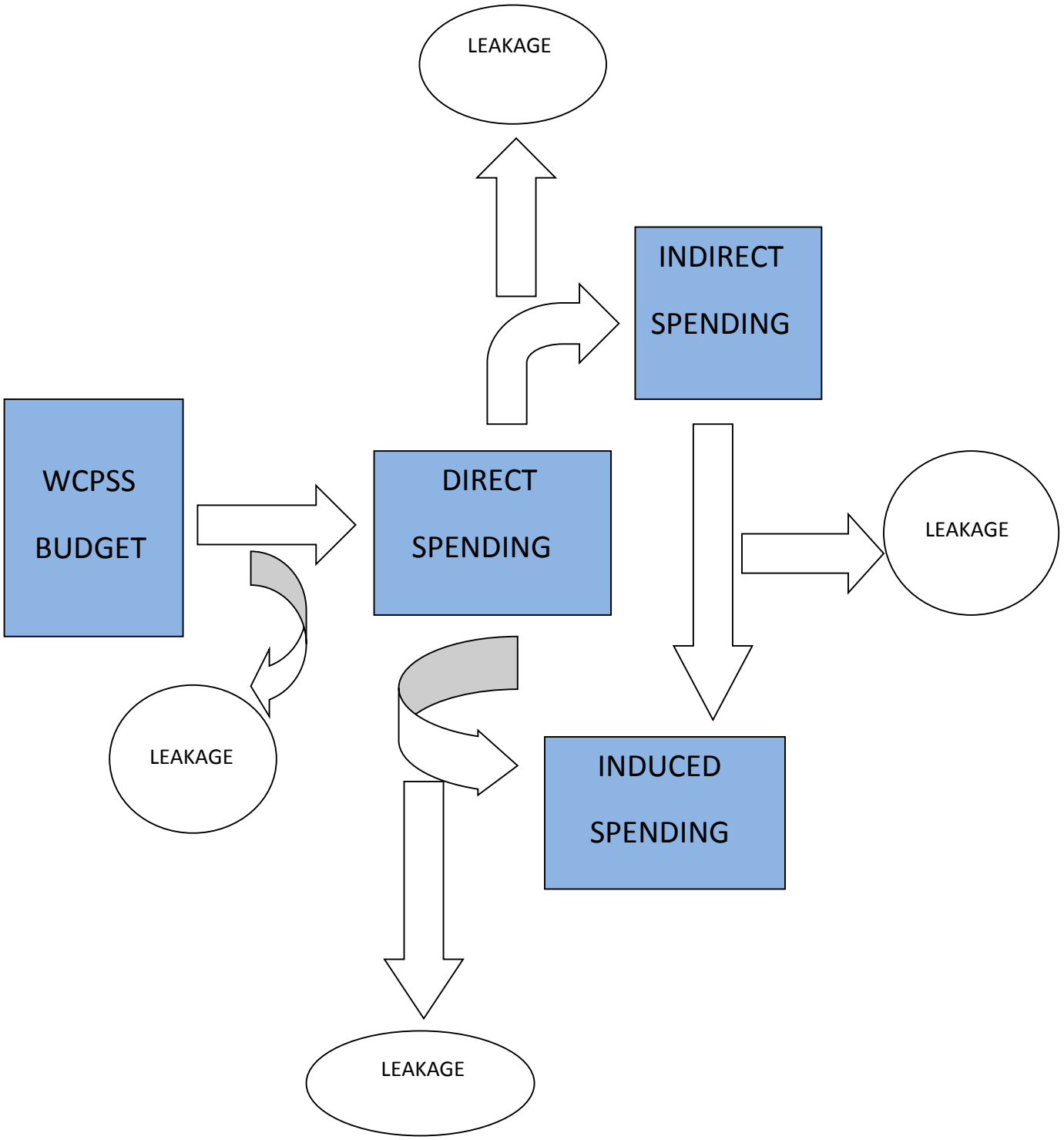
SPENDING AND EMPLOYMENT IMPACTS OF WAKE COUNTY PUBLIC SCHOOLS

Economists group economic impact of spending by either a private firm or public institution (like the WCPSS) into three categories (Figure 3). The first is the *direct economic impact* ("direct spending" in Figure 3). This is the spending that goes to salaries of WCPSS faculty and staff and businesses selling directly to WCPSS. It can be thought of as the "first round" of economic impact.

The *indirect economic impact* ("indirect spending" in Figure 3) calibrates the additional spending and jobs created from the direct spending that is made to local supplier firms and subsequent spending interactions between those firms. For example, the local firm that maintains the WCPSS copying machines may, in turn, spend additional funds on parts, and so local firms supplying such parts would realize an increase in revenue and may add jobs as a result. The indirect economic impacts are often called "second round" effects.

The third category is the *induced economic impact* ("induced spending" in Figure 3). Considered to be the "third round" impact, this impact accounts for spending and job creation resulting from consumer retail spending associated with both the direct and indirect effects. For example, WCPSS employees will spend a significant part of their salaries in the local economy on various consumer products and services. Likewise, the employees associated with the firms of the "indirect effect" will do the same. This induced local spending becomes revenues to local firms that then serve as the basis for further job creation.

Figure 3. Flowchart of Economic Impact of WCPSS Spending.



Notice in Figure 3 there are four ovals labeled "leakage". This is spending which goes to businesses and vendors outside the region and therefore is not available for "re-cycling" within the region. Taxes paid to the federal and state governments, purchases made from out-of-region suppliers, and mortgage payments made to an out-of-region investor are good examples of leakage. Leaked funds reduce the total economic impact of any initial amount of spending.

"Multipliers" are commonly used to estimate indirect and induced economic impacts from the direct effects. The multipliers give the additional, or multiple, effects of the indirect and induced impacts over and above the direct effect. Multipliers are based on the economic structure of the local economy and so vary by region. In this report, multipliers for Wake County are taken from IMPLAN ("*im*pact *plan*ning"), a software program developed for local economic impact analysis and unique for each county.

This section documents the total economic impacts – direct, indirect, and induced – of WCPSS on the local economy. The analysis will reveal the relative importance of WCPSS' expenditures to local businesses and vendors. Impacts are displayed in both dollar and employment terms. Impacts are also calculated separately for the WCPSS operating budget and WCPSS capital (construction) expenditures.

Impact of the WCPSS Operating Budget

The WCPSS operating budget is large. Over the last five fiscal years (2011 – 2015) WCPSS spent an average annual amount of $1314.1 million.[4] However, as related above, this

[4] In 2015 purchasing power dollars.

spending does not capture the full economic impact of WCPSS. WCPSS spending sets off a chain reaction of other spending and re-spending in the county economy as businesses and households alike take funds received from WCPSS and purchase products and services from vendors in the area.

The majority of the WCPSS operating budget goes to employees in the form of salaries and benefits. Hence, the major broader regional impact of the WCPSS operating budget will be from the spending and re-spending of employee compensation. However, all employee compensation will not be available for recirculation through the county economy. Federal and state taxes will come "off the top" and will immediately flow outside the county with no assurance of returning. Mortgage payments made to an out-of-county lender, insurance premiums paid to a provider in another state, and on-line purchases to out-of-county sellers are other examples of funds that won't be recycled locally. Similarly, non-employee compensation purchasing from out-of-county vendors are not available for recycling. From an analysis of county spending patterns, the total of "leaked" funds are set at 32% of the WCPSS operating budget.[5]

Table 3 shows the county impact of the five-year annual WCPSS operating budget separately for direct, indirect, induced, and total spending and employment impacts after subtracting the initial leakage. The average annual budget over the five-year period of $1314.1 million, after subtracting the leakage rate of 32%, becomes a direct effect of $893.6 million.

[5] Derived from the IMPLAN data for Wake County, North Carolina.

The spending creates an indirect effect of $210.3 million and an induced effect of $473.1 million, for a total effect of $1577.0 million. Comparing the total spending effect of $1577.0 million to the direct effect of $893.6 million, the results indicate that:

EVERY OPERATING $1.00 SPENT BY WCPSS AND RETAINED IN THE COUNTY RESULTS IN TOTAL COUNTY SPENDING OF $1.76

Table 3. Annual Spending and Employment Impacts of Average WCPSS Operating Budget Remaining in Wake County for Spending.

Impact	Spending (2015$ millions)	Employment
Direct effect	893.6	18143
Indirect effect	210.3	1787
Induced effect	473.1	4468
Total effect	1577.0	24398

Source: WCPSS annual budgets; IMPLAN for Wake County, North Carolina; and calculations by the author

The employment impacts shown in Table 3 are also substantial. The direct effect of 18143 jobs is the five year annual average employment at WCPSS.[6] To this is added 1787 indirect effect jobs and 4468 induced effect jobs, for a total county employment impact of 24398 jobs. Therefore, on average:

EVERY ONE JOB IN WCPSS IS ASSOCIATED WITH A TOTAL OF 1.34 JOBS IN THE COUNTY. OR, STATED ANOTHER WAY, EVERY ONE JOB IN WCPSS CREATES ANOTHER 0.34 JOBS IN THE COUNTY

It is also instructive to see the impact of the WCPSS operating budget on individual economic sectors within the county.[7] This information is provided in Table. 4. On the spending side, the top five sectors impacted are real estate, trade, financial services, health care, and professional services. Since a large majority of the WCPSS operating budget spending is ultimately generated through consumer spending, it is logical these are the top impacted sectors. On the employment side, the top five sectors impacted are trade, leisure/hospitality, health care, professional services, and personal services. The rankings of spending impacts and employment impacts by economic sector do not exactly correspond due to variation in the labor intensity of different industries.

[6] Full-time equivalent numbers.

[7] The economic sectors are defined in Appendix A.

Table 4. Annual Spending and Employment Impacts of Average WCPSS Operating Budget Remaining in Wake County for Spending, by Economic Sector.

Sector	Spending (2015$ millions)	Employment[1]
Agriculture	0.0	0.0
Natural resources	0.0	0.0
Public utilities	49.0	18.6
Construction	4.7	31.3
Manufacturing	3.1	6.3
Trade	263.1	1672.9
Transportation	15.7	131.1
Communications	78.8	131.1
Financial services	183.2	475.0
Real estate	468.5	449.6
Professional services	137.2	699.6
Health care	141.9	715.3
Leisure/hospitality (including restaurants)	134.1	1274.5
Personal services	74.1	537.2
State/local government	15.7	62.6
Federal government	7.9	49.9
Total	1577.0	6255 (indirect + induced)

[1]Omitting the direct employment of WCPSPS.

Source: WCPSS annual budgets, IMPLAN for Wake County, North Carolina; and calculations by the author

Clearly, however, the results in Table 4 show:

THE OPERATING BUDGET SPENDING BY WCPSS HAS WIDE AND DEEP IMPACTS ON OTHER ECONOMIC SECTORS IN THE COUNTY, PARTICULARLY PROFESSIONAL SERVICES, REAL ESTATE, HEALTH CARE, AND FINANCIAL AND PERSONAL SERVICES

Impact of the WCPSS Capital Budget

WCPSS also makes capital expenditures, and these capital expenditures also have broad county impacts. In the five year period for which data are available (2011-2015), yearly capital spending has averaged $307.5 million.[8]

Capital spending is inherently "lumpy". This means that, unlike operational spending, capital spending tends to progress in a pattern of high spending in some years followed by low spending in other years. Therefore, rather than look at capital spending for a typical year (as was done with the operating budget), this section will evaluate the impact of aggregate WCPSS capital spending for projects completed over the last five fiscal years (2011-2015).

[8] Amount is in 2015 purchasing power dollars.

WCPSS spent $1537.2 million for capital projects from 2011 to 2015.[9] Before calibrating the impacts of this spending, two questions must be addressed – the amount of funds for land acquisition, and leakage. Funds used for land acquisition have no economic impact because they simply represent payment for transfer of ownership. There is no resulting net impact on the county economy. Therefore, spending for land purchases must be omitted before economic impact is calculated. In the case of the recent WCPSS capital expenditures, the data presented above ($1537.2 million) are exclusive of funds spent for acquiring land.

As with the operating budget, the issue of leakage deals with initial (direct) payments to out-of-county vendors. Such funds are not available for re-circulating in the county economy. The model of the Wake County economy shows 69% of educational facility construction spending is paid to out-of-county firms.[10] Therefore, a leakage rate of 69% is used for non-land capital spending. For the five-year period of fiscal years 2011-2015, the direct capital spending retained in the county economy is therefore $476.5 million ($1537.2 x 0.31).

Table 5 shows the total regional spending impact of the five-year WCPSS capital budget is $1060.6 million and 4579 jobs. As would be expected, the largest component of both the spending and employment impacts is from the direct construction activities. However, indirect and induced effects increase the spending impact by 123% and increase the employment impact by 102%.

[9] In 2015 purchasing power dollars.

[10] IMPLAN for Wake County, North Carolina.

EVERY $1 OF CAPITAL BUDGET SPENDING BY WCPSS ON NON-LAND PURCHASES AND RETAINED IN THE COUNTY RESULTS IN $2.23 OF TOTAL COUNTY SPENDING. ALSO, EVERY $1 MILLION OF CAPITAL SPENDING BY WCPSS AND RETAINED IN THE COUNTY IS ASSOCIATED WITH 9.6 JOBS IN THE REGION

Table 5. Total Wake County Economic Impact of WCPSS Recent Five-Year (2011-2015) Capital Spending.

Impact	Spending (2015$ millions)[1]	Employment (job years)[2]
Direct effect	476.5	2268
Indirect effect	276.7	1020
Induced effect	307.4	1291
Total effect	1060.6	4579

[1] Omits funds for land acquisition; [2] each unit is 1 job for 1 year

Source: WCPSS annual budgets; IMPLAN for Wake County, North Carolina; and calculations by the author.

Table 6 divides the impacts of the WCPSS capital budget by economic sector. After construction, the sectors most affected are professional services, real estate, trade, financial services, and leisure/hospitality for spending, and professional services, trade, leisure/hospitality, personal services, and health care for employment. So, just as for the operating budget:

THE WCPSS CAPITAL BUDGET HAS WIDE IMPACTS ACROSS MULTIPLE ECONOMIC SECTORS IN WAKE COUNTY

Table 6. Total Wake County Economic Impact of WCPSS Recent Five-Year (2011-2015) Capital Spending, by Economic Sector.

Sector	Spending ($ millions)	Employment
Agriculture	0.0	0.0
Natural resources	0.0	0.0
Public utilities	10.4	4.6
Construction[1]	681.1	3380.0
Manufacturing	4.4	9.2
Trade	53.4	233.3
Transportation	4.4	23.0
Communications	22.3	27.6
Financial services	29.4	59.5
Real estate	67.6	68.7
Professional services	130.3	425.9
Health care	18.0	86.7
Leisure/hospitality (including restaurants)	19.1	150.8
Personal services	16.9	91.3
State/local government	2.2	9.2
Federal government	1.1	9.2
Total	1060.6	4579

[1] includes indirect and induced effects in non-WCPSS construction

Source: WCPSS annual budgets; IMPLAN for Wake County, North Carolina; and calculations by the author

DEVELOPMENT OF HUMAN CAPITAL

Economic relationships can be viewed in an input-output format. Consider the production of vehicles. They are the output made from the inputs of steel, rubber, electronics, glass, machinery, and workers. Buyers value the vehicles, not the inputs. It is the value of vehicles made and sold which is part of the national accounts of aggregate economic output of the nation.

Education can also be usefully viewed in an input-output form. Inputs are the classrooms, books, computers, learning programs, and – of course – teachers and staff. The output is the knowledge and skills acquired by the students. Economists term such knowledge and skills "human capital". It is the output – the "human capital" – that is valued by the students, their parents, and the community. In the modern economy, students with more "human capital" tend to be more successful, earn higher salaries, and are able to attract better-paying jobs to the community.

So, while the economic impacts measured in the previous section are important and useful, their calculation was an analysis of *inputs*. People are most interested in what the use of those inputs achieves. That is, what is the *output* of the inputs? The focus of this section is to measure the economic impact of WCPSS by measuring the *gain in human capital* of WCPSS' students. The next two sections discuss and measure other *outputs* of WCPSS.

The focus on outputs is in line with the current national interest in measuring the results of public schools. Most states and local school systems now consistently test students

throughout the year to measure progress and achievement. Test results can be used to pinpoint areas where students may need further assistance in meeting the goal of graduation and successful entry into the workforce or college.

Even accepting that development of student human capital and successful completion of a K-12 program are the output goals of a public school system, such as WCPSS, a challenge is establishing a measure or measures of the output. Two approaches are used in this report. The first borrows from numerous studies of the output of universities and colleges.[11] Here, the financial value for a student attaining a college degree is the expected increase in lifetime income from a typical job obtained by a college graduate compared to the typical job obtained by a high school graduate. For K-12 school systems like WCPSS, the same approach can be used with one change – the comparison is between the likely income earned by a high school graduate to the probable income earned by a high school dropout.[12]

Recognize that such a measure has some inherent issues and so it will only be an approximation to the real value of WCPSS' output. One important issue is that the measure does not separate the lifetime increment to income between that from the inherent talents of the

[11] See, for example,Michael L. Walden,*Economic Benefits in North Carolina of The University of North Carolina Campuses*, November 2008; Michael L. Walden, *The Economic Impact of North Carolina State University*, August 2010; Robert Beam, Bria Fennessey, Roger Lederer, Grant McDonough, and Shawn Mjelde, *Economic Impact Study of the University of Wisconsin-Superior and the Local Economy,* May 2008*;* and The Perryman Group, *A Tale of Two States and One Million Jobs*, March 2007.

[12] For an example of an application to public schools, see Economic Modeling Specialists, Inc., *The Economic Impact of Communities in Schools*, May 2012.

student and that received from the school's (here WCPSS) training. Researchers have struggled with this issue without finding a suitable solution.

Another issue is the assumption that graduates effectively received all their training through WCPSS, and therefore WCPSS has a "claim" on the lifetime income increment. Certainly this is not the case for all students. Students frequently move in and out of school districts. For students who graduated from WCPSS but received some of their K-12 training at another school district, their lifetime income increment overstates the contribution of WCPSS. However, there will also be students who received some training in WCPSS but moved away and graduated from another district. WCPSS will not receive credit for the share of additional lifetime income it helped such students achieve. A large amount of data processing of student records – beyond the scope of this study – would be necessary to sort these factors.

Therefore, the value of the additional human capital created by WCPSS is calculated by assuming an average work life and applying the expected annual increase in earnings between a high school graduate and a high school dropout to the number of WCPSS graduates. This procedure is applied to each of the five graduating classes from 2011 to 2015. A work life of 47 years (age 18 to 65) is assumed. The most recent data show the increment in annual earnings between a high school dropout and high school graduate is approximately $6888.[13] The lifetime (during 47 years) value of this annual increment in earnings is converted to a single value today (2015) using a technique called *present value*. The concept of present value accounts for the

[13] The earnings increment is for Wake County and for the latest data (2013) updated to 2015 dollars (U.S. Census, *American Community Survey)*. The increment is assumed to be maintained throughout the graduate's work career.

lower value of future dollars due to continuing inflation. An appropriate long-term interest rate is used as the "discount rate" to reduce the levels of future dollars. A long-term interest rate of 3.1% is used in the calculations. This was the annual rate on 30-year constant maturity Treasury bonds in the summer of 2015.[14]

Table 7 gives the results of the calculations.[15] The value ranges between $1428.8 million and $1617.4 million depending on the number of graduates. The value has trended upward over time as the number of WCPSS graduates has increased. But the conclusion is clear.

IN RECENT YEARS, WCPSS HAS ANNUALLY GRADUATED STUDENTS WHO WILL REALIZE AN ESTIMATED TOTAL PRESENT VALUE OF LIFETIME INCREMENT TO THEIR INCOME OF BETWEEN $1.4 BILLION AND $1.6 BILLION

Of course, many WCPSS graduates go on to college. In the last five years, 51% of WCPSS graduates entered a four-year college and another 19% entered a two-year college.[16] Students successfully completing a college degree will further enhance their human capital and add to their lifetime income. For example, the average worker with a four-year college degree earns $26,859 more annually than a worker with a high school diploma, while the average worker with a two-year degree earns $8549 more annually than a worker with a high

[14] Federal Reserve System, at www.federalreserve.gov

[15] See Appendix B for details on the calculations in Table 7.

[16] WCPSS data.

Table 7. Present Value (2015 $) of Estimated Increment to Lifetime Income of WCPSS Graduates, 2011 – 2015.

Year	Number of Graduates	Value ($ millions)
2015	9553	1617.4
2014	9131	1545.9
2013	8844	1497.4
2012	8748	1481.1
2011	8439	1428.8

Source: WCPSS, U.S. Census; calculations by author (Appendix B).

school diploma.[17]

It makes logical sense that students performing better in high school will also perform at a higher level academically in college. This implies that high schools doing a better job training their students can "claim" some of the additional lifetime income earned by their college graduates. One recent study found a strong link between improvement in a student's high school grade point average (GPA) and the student's successful completion of college. [18]

Using a weighted average annual earnings increment of $21,915 for a 4-year college and a 2-year college graduate compared to a high school graduate, a work lifetime of 43 years (age

[17]U.S. Census, *American Community Survey*, for Wake County and in 2015 purchasing power dollars.

[18] Saul Geiser and Maria Santelices. "Validity of High-School Grades in Predicting Student Success Beyond the Freshman Year: High-School Record vs. Standardized Tests as Indicators of Four-Year College Outcomes", Center of Studies in Higher Education, University of California, Berkeley, June, 2007.

Table 8. Present Value (2015$) of Estimated Increment to Lifetime Income of WCPSS College Graduates Due to Improved High School Performance in Each Year.

Year	WCPSS Graduates Initially Attending College	Value ($ millions)
2015	6592	142.9
2014	6300	136.5
2013	6279	103.3
2012	6211	62.0
2011	5992	84.9

Source: U.S. Census; WCPSS; calculations by author (Appendix C).

22 to 65), and the findings of the recent study linking improved high school performance to an increased likelihood of graduation from college, Table 8 gives the present value of additional lifetime earnings attributable to the WCPSS for each graduating class.[19] The values are based on the annual change in the GPA of seniors planning to attend college. The annual values range from $62 million to $142.9 million and average $105.9 million. Therefore:

BASED ON IMPROVED ACADEMIC PERFORMANCE OF WCPSS STUDENTS, AN AVERAGE $105.9 MILLION OF ADDITIONAL LIFETIME INCOME OF RECENT WCPSS GRADUATING CLASSES FORECASTED TO COMPLETE COLLEGE CAN BE ATTRIBUTABLE TO WCPSS

[19]See Appendix C for details on the calculations.

DEVELOPMENT OF SOCIAL CAPITAL

Human capital relates to the individual skills and training received by students to make them more productive workers and therefore able to command higher salaries. As such, human capital is an individual characteristic that applies specifically to individual rewards in the workplace.

In contrast, *social capital* refers to characteristics and actions of individuals which have wider public implications. For example, individuals with higher levels of social capital would be more likely to participate in the electoral process, less likely to engage in criminal activity, less likely to require public financial assistance, and more likely to lead healthy lifestyles so as to make fewer demands on the health care system.

There is a body of academic research indicating that education is linked to the development of social capital.[20] That is, individuals with more education are more likely to vote and to be healthy and less likely to be involved in crime and to receive public assistance. Since these beneficial behaviors and circumstances are likely to reduce costs for the public sector (government), it can be implied that institutions promoting educational attainment – such as WCPSS – have a positive economic impact of developing social capital and thereby reducing public costs.

[20] For a review of the literature, see The College Board, 2005, *Education Pays*. Trends in Higher Education Series; and Levin, Henry, Clive Belfield, Peter Muenning, and Cecelia Rouse, *The Costs and Benefits of an Excellent Education for All of America's Children*, Columbia University, January 2007.

Table 9. Present Value (2015 $) of Estimated Savings in Public Crime, Welfare, and Health Care Costs Associated with Recent WCPSS Graduating Classes.

Year	Number of Graduates	Crime Cost Savings ($ millions)	Public Health Care Cost Savings ($ millions)	Welfare Cost Savings ($ millions)	Total Savings ($ millions)
2015	9553	$445.2	$158.7	$35.2	$639.1
2014	9131	$426.4	$151.7	$33.6	$611.7
2013	8844	$413.0	$146.9	$32.6	$592.5
2012	8748	$408.5	$145.3	$32.2	$586.0
2011	8439	$394.1	$140.2	$31.1	$565.4

Source: Lochner and Moretti; Alliance for Excellent Education; Levin, et. al.; calculations by author (Appendix D).

A comprehensive study of the impacts of educational attainment on crime found that for every additional high school graduate, annual spending on crime is reduced by $1900.[21] Converting this annual amount for a period of 47 years (each 18 year old high school graduate lives to retirement age of 65) and using a discount rate of 3.1%, the annual lifetime savings per high school graduate is $46,702.[22] After multiplying by the number of WCPSS graduates in each of the last five years, Table 9 shows that annual savings have ranged between $394.1 million and $445.2 million.

[21] Lochner,Lance, and Enrico Moretti, "The Effect of Education on Crime: Evidence from Prison Inmates, Arrests, and Self Reports, " UCLA and the University of Western Ontario, October 2003. The authors' monetary results have been updated to 2015 dollars using the Consumer Price Index. The authors' lower range of findings is used.

[22] See Appendix D for details on the calculations. Levin, et. al. argue the benefits for reduced crime expenditures end at age 65.

Similarly, a recent study concluded that every student who graduates from high school is associated with a lifetime reduction of $22,725 (2015 $) in Medicaid and uninsured medical coverage costs.[23] Table 9 indicates the associated savings in public health care costs for recent WCPSS graduating classes range between $140.2 million and $158.7 million.

Finally, research has shown high school graduates reduce welfare (TANF: Temporary Aid to Needy Families) public costs relative to non-graduates, amounting to lifetime savings of $3973 per graduate.[24] These aggregate benefits are also shown in Table 9.

Taken together, the last column of Table 9 shows the estimated lifetime savings in public costs for crime prevention, health care, and welfare associated with recent WCPSS graduating classes. Therefore, the important conclusion is:

EACH RECENT WCPSS CLASS OF GRADUATES IS ASSOCIATED WITH BETWEEN $565.4 MILLION AND $639.1 MILLION OF SAVINGS IN FUTURE CRIME, WELFARE, AND HEALTH CARE PUBLIC EXPENDITURES

[23] Alliance for Excellent Education, *Healthier and Wealthier: Decreasing Health Care Costs by Increasing Educational Attainment".* Issue Brief, November 2006. The result is specifically for North Carolina and has been updated to current (2015) dollars and discount rates.

[24] Levin, et. al., Table 11. Dollar amounts have been updated to 2015 values and current discount rates.

IMPACT ON LOCAL WEALTH

Local schools can have an impact on local wealth – primarily in terms of property wealth – in two ways. First, as local schools generate graduates who remain in the local economy, those graduates will spend more money. This additional spending creates more local economic activity which, in turn, makes local property more valuable. So there is a positive correlation between the higher spending from high school graduates (as compared to high school drop-outs) and local property values. Economists call this relationship "capitalization", meaning the additional spending is "capitalized" into local property values.

The second effect comes from school quality – as indicated by various performance measures. A substantial literature review has found that homebuyers prefer to locate in localities with better quality schools, and they are willing to pay a higher price for the home to be in such a location.[25] This means the value of better performing schools will also be "capitalized" into local property values.

Capturing these effects is challenging. For the first effect, the most direct way is to use comparisons of local property values to local income to gauge the change in property values when future incomes rise as a result of students graduating from high school. An examination

[25] Three recent studies are Chiodo, Abigail, Ruben Hernandez-Murillo, and Michael Owyang, "Nonlinear Effects of School Quality on House Prices", *Federal Reserve Bank of St. Louis Review*, May/June: 185-204, 2010; Ries, John and Tsur Somerville, "School Quality and Residential Property Values: Evidence from Vancouver Rezoning", *The Review of Economics and Statistics*, November 92(4), 2010: 928-944; and Brasington, David and Donald Haurin, "Educational Outcomes and House Values: A Test of the Value-Added Approach", Working Paper 2005-03, Department of Economics, 2005, Louisiana State University.

of North Carolina tax records shows that, prior to the real estate boom of the late 1990s to mid-2000s, the ratio of real (land and structures) property values to income in Wake County was 1.4 (1998).[26] This suggests that every additional dollar of local income is capitalized into local property values at the rate of $1.40. The same tax records indicate that every dollar of real property in the county is taxed at a rate of 0.8 cents.[27]

As indicated earlier, the annual earnings premium for high school graduates over high school dropouts is approximately $6888. If the high school graduate remains working in the county, then this premium will be spent in the area and will be capitalized into county real property values. If the graduate acquires further education but remains in the county upon completion, the capitalized value of the high school earnings premium will remain. This premium – and its impact on real property values – will only be lost if WCPSS graduates leave the county permanently. However, since the county is growing faster than the nation, such losses will be relatively small and will be counterbalanced by high school graduates from other regions moving to Wake County. Therefore Table 10 presents both the real property value and property tax values for the county using the entire earnings premium for each WCPSS graduating class.[28]

The annual impact on real property values ranges between $81.4 million and $92.1 million, and the annual impact on property tax revenues is near $0.7 million. While important,

[26] North Carolina Data Center (www.linc.state.nc.us) and U.S. Department of Commerce (www.bea.gov).

[27] Op. cit., North Carolina Data Center, FY 2013.

[28] See Appendix E for details on the calculations.

the values should be kept in perspective. A real property value of $90 million is 0.08% of total county real property values in 2013. Nonetheless:

THE CONTINUING GRADUATION OF FUTURE WORKERS AND CONSUMERS FROM WCPSS HAS A POSITIVE IMPACT ON BOTH LOCAL REAL PROPERY VALUES AND PROPERTY TAX REVENUES. EACH RECENT GRADUATING CLASS HAS ADDED CLOSE TO $90 MILLION IN COUNTY REAL PROPERTY VALUES AND $0.7 MILLION IN REAL PROPERTY TAX REVENUES IN WAKE COUNTY

Table 10. Wake County Real Property Value and Property Tax Revenue Impacts of the Earnings Premium of WCPSS Graduates

Year	Number of Graduates	Associated Increase in Real Property Values ($ millions)	Associated Increase in Property Tax Revenues ($ millions)
2015	9553	$92.1	$0.74
2014	9131	$88.1	$0.70
2013	8844	$85.3	$0.68
2012	8748	$84.4	$0.67
2011	8439	$81.4	$0.65

Source: North Carolina State Data Center; author's calculations (Appendix E).

Before estimating the second impact of school performance on residential property values, it's important to examine recent trends in measures of school performance for WCPSS. Figures 4, 5 and 6 show changes in three measures – the Scholastic Aptitude Test (SAT) total score for reading and math, the SAT total score for reading, math, and writing, and the senior class grade point average (GPA). Trend lines are in red. All data are from WCPSS.

Each of the measures shows an improving trend over time; thus, using all measures, it can generally be concluded that WCPSS performance has risen. If this improved performance is valued by homeowners – and research suggests it is – then residential property values in Wake County would respond in a positive way. Using the most research calibrating such a response and applying it to an estimate of residential property values in Wake County suggests that:[29]

DUE TO IMPROVING ACADEMIC PERFORMANCE IN WCPSS BETWEEN 2010 AND 2014, WAKE COUNTY RESIDENTIAL PROPERTY VALUES ARE APPROXIMATELY $11.2 BILLION HIGHER THAN WITHOUT THE BETTER ACADEMIC RESULTS, AND WAKE COUNTY PROPERTY TAX REVENUES ARE HIGHER BY $89.6 MILLION

[29] See Appendix F for details on the calculations.

Figure 4. Trends in WCPSS SAT-Reading and Math Scores, 2010-2014.

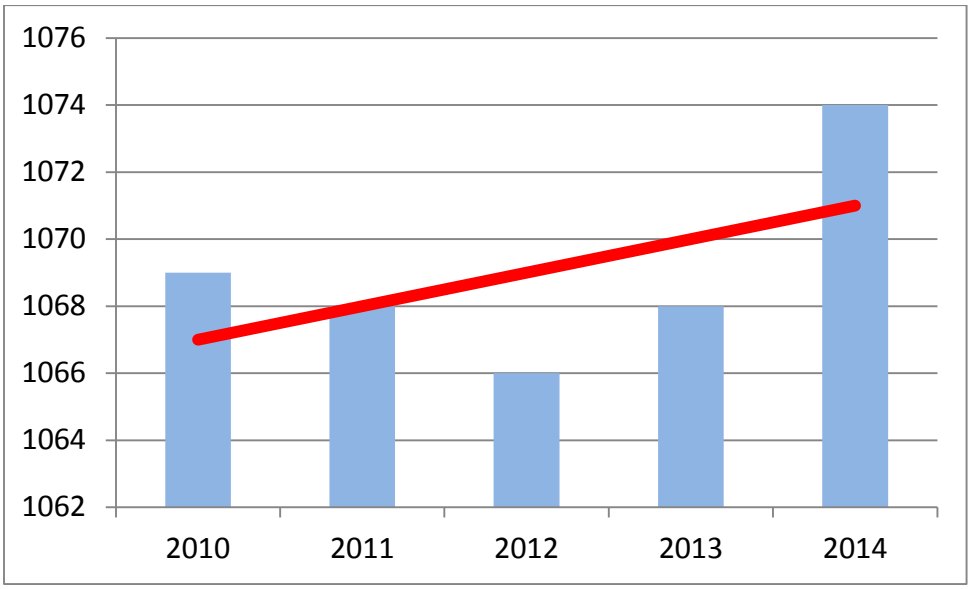


Figure 5. Trends in WCPSS SAT - Reading, Math, Writing Scores, 2010-2014.

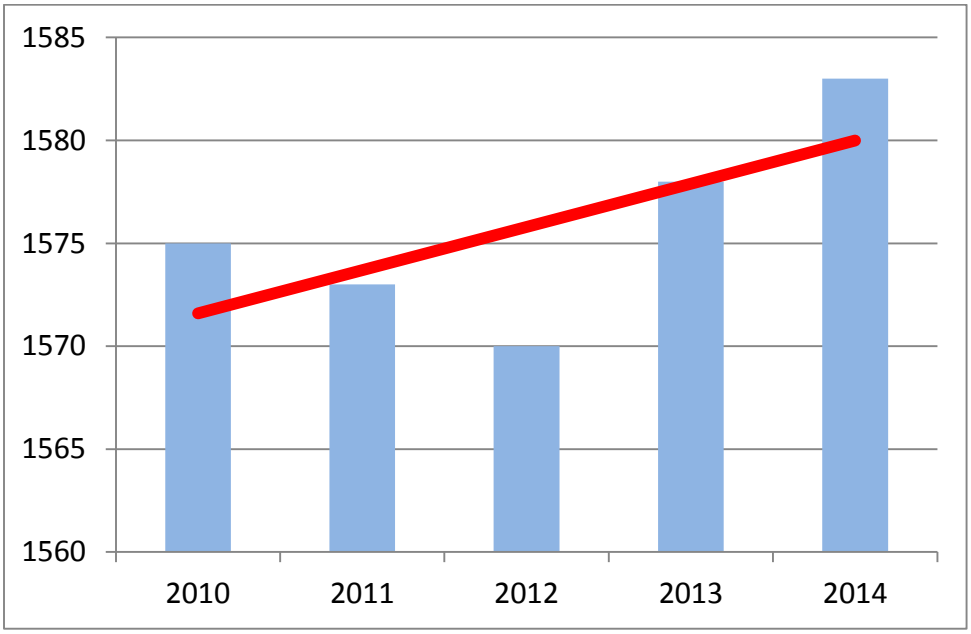
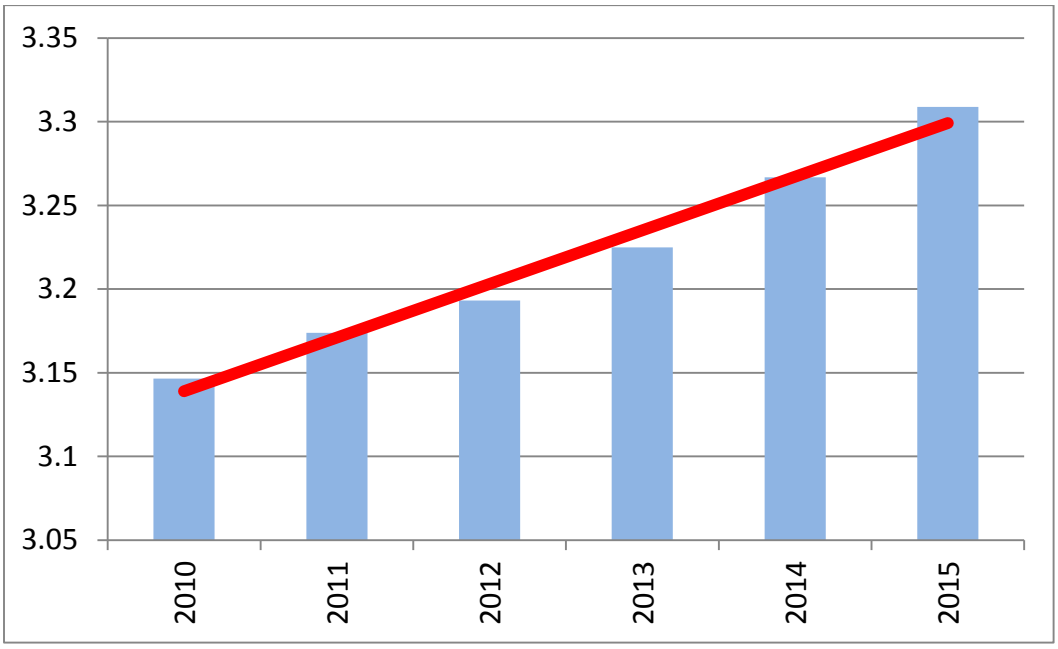


Figure 6. Trends in WCPSS GPA, 2010-2015.



SUMMARY

WCPSS has a large and varied economic impact in Wake County. This study has estimated those impacts in two broad categories: the economic effects of WCPSS spending as an *input* in the K-12 educational system, and the economic effects of the *outputs* of WCPSS. While both are important, it is the output measures which address the ultimate goal of WCPSS: educated students who contribute to an improved standard-of-living and enhanced wealth in the local community.

As a major employer with a significant budget in the community, the economic impact of WCPSS is substantial. Using the recent five-year budget average, it was found that every $1.00 of WCPSS operating budget spending which is retained in the county economy results in total county spending of $1.76. Likewise, every one direct WCPSS job is associated with another 0.34 jobs in the county economy.

Similar effects result from the WCPSS capital budget. Every $1.00 of capital spending by WCPSS and retained in the local economy results in a total of $2.23 of spending in the Wake County economy, and every $1 million of capital spending by WCPSS is associated with an additional 9.6 jobs in the county.

Both the operating and capital budgets of WCPSS were found to impact a large and varied number of economic sectors in the county economy, but particularly the professional services, real estate, health care and financial and personal services.

The report identified three important *outputs* of WCPSS and estimated dollar values for each: the economic value of degrees awarded, the future reduction in public costs associated with individuals graduating from college, and the impact on local wealth as a result of the academic performance of WCPSS.

The economic value of degrees awarded by WCPSS was measured by the lifetime increment in earnings of high school graduates compared to high school dropouts. For each of the past five graduating classes, this increment (in present value 2015 $) is between $1429 million and $1617 million. The academic performance of WCPSS graduating seniors has also been improving, on trend, in recent years. This improvement – in turn – has increased the likelihood that WCPSS students will complete a college degree. The value of this increased probability of completing college was estimated at an average value of $105.9 million for each of the last five classes of WCPSS seniors.

Considerable research has found that individuals graduating from high school are less likely to engage in criminal behavior and are more likely to lead healthy lifestyles and use less public financial assistance compared to high school dropouts. This means high school graduates reduce future public crime costs, public welfare, and public health costs. For each of the recent WCPSS graduating classes, the reduction in these costs is estimated at between $565 million and $639 million (in present value 2015 $).

Lastly, WCPSS can impact local wealth – specifically real property values – in two ways. One is through the additional spending that high school graduates create compared to high school dropouts. This impact was estimated to be $86 million in additional county real property values

and $0.7 million in higher county real property tax revenues for each recent class of WCPSS graduates. The second, and more significant, impact comes from the positive response of residential property values to improved academic performance of WCPSS students. All standard measures of academic performance of WCPSS seniors show improved trends in recent years. It is calculated that as a result of this improvement, Wake County property values are $11.2 billion higher compared to the levels without the improvement in academic performance during 2010 to 2014. The corresponding increase in property tax revenues to Wake County is $89.6 million.

APPENDIX A: DEFINITIONS OF ECONOMIC SECTORS

Agriculture – commercial livestock, crop, forestry, and fishing activities

Natural resources – extraction of natural resource commodities

Public utilities – electric power generation, transmission, and distribution; natural gas distribution; and water and sewage treatment and delivery systems

School construction – construction of non-residential school structures

Other construction – construction, maintenance, and repair of residential and non-residential structures

Manufacturing – all manufacturing operations, including both durable and non-durable manufacturing

Trade – wholesale and retail trade

Transportation – air, rail, water, and truck transportation; couriers and messengers; and warehousing and storage

Communications – newspapers, periodicals, book, and software publishers; audio and video industries; cable programming; internet publishing and broadcasting; telecommunications; and data processing

Financial services – depository and non-depository intermediation institutions; securities, commodities, and insurance activities

Real estate – institutions involved in ownership and rental activities of real and personal property

Professional services – business, scientific, educational and management services and support staff

Health care – offices of physicians; hospitals, nursing, residential care, and child care services; individual and family services

Leisure/hospitality – performing arts; spectator sports; museums and parks; fitness and recreational sports centers; amusement parks; hotels and motels; food services and drinking places

Personal services – machinery and electronic repair and maintenance; personal care services; religious, civic, social, and professional organizations

Public schools – public K-12 educational institutions

State/local government – transit, electric, and other local government enterprises; local public good provision

Federal government – U.S. Postal service; federal government enterprises; military installations; federal public good provision

APPENDIX B: CALCULATION OF THE INCREMENT TO LIFETIME EARNINGS FROM HAVING A HIGH SCHOOL DEGREE

The dollar values in Table 7 were generated in the following way. First, the annual income increment of $6888 was multiplied by the number of graduates in each year.

Second, the present value factor sum corresponding to an interest rate of 3.1% and a 47 year time period was calculated. This value is the sum of the individual present value factors – assuming an interest rate of 3.1% - for each of 47 years. The interest rate indicates how much $1.00 declines in purchasing power in future years. So, for example, one year in the future $1.00 will have a purchasing power of 97.0 cents, and two years in the future $1.00 will have a purchasing power of 94.1 cents, etc.[30] The purchasing power values are calculated for each of 47 years in the future and then summed.

Lastly, the present value factor sum derived in the second step is multiplied by the result of the first step (# graduates x $6888) to derive the results in the third column of Table 7.

[30] The purchasing power one year ahead is found from the calculation (1/1.031), and the purchasing power two years ahead is found from the calculation $(1/(1.031)^2)$. The "power" term corresponds to the number of years ahead.

APPENDIX C: CALCULATING THE IMPACT OF IMPROVED HIGH SCHOOL PERFORMANCE ON THE LIFETIME INCOME OF COLLEGE GRADUATES

Geiser and Santelices' research tested the effects of alternative measures of almost 80,000 high school students' performance on their eventual likelihood of completing college. Four measures of the students' high school performance – their high school grade point average (GPA), SAT verbal score, SAT math score, and SAT writing score – together with socioeconomic characteristics such as parent's education and income, were used to predict each student's probability of graduating from college. Among the high school performance measures, the student's GPA was "consistently the strongest predictor of the four-year college outcomes for all academic disciplines and campuses."[31] Based on a four point scale for the GPA, the study found that for every one point increase in a student's GPA, the student's probability of graduating from college increased by 34%.

This information was used to calculate WCPSS' "claim" on the increase in lifetime income due to a college degree for a given WCPSS graduating class using the following equation:

CHGGPA x #COL x $21,915 x 23.6 x 0.34, where:

[31] Geiser and Santelices, *op. cit*., 1.

CHGGPA = change in the GPA from the previous year, in points (e.g., 2.77 – 2.07 = 0.70), of seniors planning to attend college,

#COL = number of WCPSS graduating seniors planning to attend college,

$21,915 = weighted average annual increase in earnings of a worker with a college degree (bachelor's or associate's degree) and a high school degree,

23.6 = present value factor sum for interest rate of 3.1% and a work life of 43 years,

0.34 = proportion of lifetime income increment due to improved high school performance.

Data for CHGGPA and #COL were provided by WCPSS.[32]

[32] GPA data provided by WCPSS were means for graduates. Unavailable data for 2014 are interpolations for 2013 and 2015.

APPENDIX D: CALCULATING THE IMPACT OF A HIGH SCHOOL GRADUATE ON REDUCED FUTURE PUBLIC CRIME COSTS, WELFARE AND PUBLIC HEALTH EXPENSES

To calculate the reduction in public crime costs associated with each high school graduate, Lochner and Moretti's lower annual estimate, which was calculated in 1993-valued dollars, was first converted to 2015 dollars. This resulted in an annual reduction of $1900. To convert to a lifetime amount, the high school graduate's age (18) was subtracted from the current retirement age (65 years) to derive a future period over which the annual savings would be realized of 47 years. The present value factor sum associated with a 3.1% interest rate and 47 year period was multiplied by the annual amount of $1900 to give a lifetime reduction in crime costs (in 2015 $) associated with each high school graduate of $46,702. Multiplying $46,702 by the number of annual WCPSS graduates gave the total savings reported in the third column of Table 9.

The public health care cost savings per high school graduate calculated by the Alliance for Education Excellence are already in lifetime amounts. The monetary value was in 2005 dollars, so this amount was converted to 2015 dollars to give a lifetime value of $16,613. Multiplying $16,613 by the number of WCPSS graduates gave the total savings reported in the third column of Table 9.

Similarly, the estimates of Levin, et. al. of welfare savings are in lifetime amounts per graduate, which have been updated to 2015 dollar values and applied to WCPSS graduates.

APPENDIX E: CALCULATING THE IMPACT OF HIGH SCHOOL GRADUATES' ANNUAL EARNINGS PREMIUM ON LOCAL REAL PROPERTY VALUES AND PROPERTY TAX REVENUES

The annual earnings premium of a high school graduate over a high school dropout ($6888) is multiplied by the average ratio of real property value to personal income for Wake County (1.4) and further by the number of WCPSS graduates in each year to give the values in the third column of Table 10.

The values in the third column of Table 10 are multiplied by the tax rate of 0.008 (0.8 cents per $1) to derive the associated real property tax revenues in the fourth column of Table 10.

APPENDIX F: CALCULATING THE IMPACT OF IMPROVED WCPSS PERFORMANCE ON WAKE COUNTY PROPERTY VALUES

The value of Wake County residential real estate is estimated at $74.2 billion in 2010. This is based on a total real property value for Wake County of $103.1 billion (North Carolina State Data Center, *LINC*) and a ratio of residential property value to total property value of 0.72 (Board of Governors of the Federal Reserve System, *Flow of Funds Accounts*).

The research by Brasington *et. al*. suggests a one standard deviation improvement in test scores is associated with a 7% increase in residential property values. Between 2010 and 2014, the WCPSS SAT-math & reading average score increased 2.1 standard deviations; the SAT-math & reading & writing was up 2.2 standard deviations; and the GPA increased 2.2 standard deviations. Thus, using an average of a 2.15 standard deviation improvement, the impacts on residential property values and property taxes in Wake County as a result of the improved academic performance of WCPSS students are:

Increase in property value: $74.2 billion x 2.15 x 0.07 = $11.2 billion

Increase in property tax revenues: $11.2 billion x 0.008 = $89.6 million