

THE ECONOMIC IMPACT OF THE VIRGINIA BEACH CITY PUBLIC SCHOOL SYSTEM



Michael L. Walden, Ph.D.

Economic Consultant

June 2011

EXECUTIVE SUMMARY

The Virginia Beach City Public School System (VBCPS) has large and significant economic impacts on the economy of the Virginia Beach-Norfolk-Newport News Metropolitan Area. Every \$1.00 spent and retained in the regional economy from the VBCPS operating budget results in total regional spending of **\$1.53**, and every one direct VBCPS job is associated with another **0.64** jobs in the regional economy. Also, every \$1.00 spent and retained from the VBCPS capital budget results in total regional spending of **\$1.55**, and every \$1 million of VBCPS capital spending is associated with **12.6** jobs in the region.

More important are the three major *outputs* of VBCPS: 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 VBCPS students.

The economic value of degrees awarded by VBCPS is measured as the expected increase in lifetime earnings of high school graduates compared to high school dropouts. For each of the recent five VBCPS graduating classes, this value is calculated as between **\$800 million and \$900 million** (in current 2011 dollars). Also, as a result of recent improved academic performance of VBCPS graduates, their increased likelihood of graduating from college is valued at **\$22 million** for the last five graduating classes.

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 compared to high school dropouts. This means high school graduates reduce future public crime costs and public health costs. For each of the recent VBCPS graduating classes, the reduction in these costs is estimated at between **\$260 million and \$280 million** (in current 2011 dollars).

Lastly, VBCPS 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 **\$60 million** in additional regional real property values and **\$0.5 million** in higher regional real property tax revenues for each recent class of VBCPS graduates.

The second and more significant local wealth impact comes from the positive response of residential property values to improved academic performance of VBCPS students. All standard measures of academic performance of VBCPS seniors show improving trends 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 VBCPS' recent improved academic results has cushioned the adverse impacts of the recession on the local residential real estate market. It is calculated that the improved VBCPS test scores between 2007 and 2010 have resulted in City of Virginia residential property values that are between **\$2.8 billion and \$9.5 billion** higher compared to the levels without the improvement in academic

performance. The corresponding gain in property tax revenues to the City of Virginia Beach is between **\$28 million and \$86 million.**

The economic impact of VBCPS is summarized as follows:

Inputs

- Every \$1 spent and retained in the Virginia Beach-Norfolk-Newport News Metropolitan Area by the VBCPS operating budget results in \$1.53 of regional spending
- Every direct VBCPS job is associated with another 0.64 regional jobs
- Every \$1 spent and retained in the region by the VBCPS capital budget results in \$1.55 of regional spending
- Every \$1 million spent by the VBCPS capital budget results in 12.6 regional jobs

Outputs

- Each recent VBCPS graduating class generated between \$800 million and \$900 million in additional lifetime income (2011 \$)
- As a result of improved academic performance of recent VBCPS graduates, their increased likelihood of completing college is valued at \$22 million for the last five graduating classes
- Each recent VBCPS graduating class is associated with a lifetime reduction in public crime costs and public health care costs of between \$260 million and \$280 million (2011 \$)
- The additional spending of each VBCPS graduating class adds \$60 million to regional property values
- The recent improvement in VBCPS academic performance is estimated to have resulted in City of Virginia Beach residential property values that are between \$2.8 billion and \$9.5 billion higher compared to levels without the improvement in academic performance (see Appendix F for the calculations)

TABLE OF CONTENTS

Acknowledgments	9
About the Author	9
Introduction	10
The Region	13
Spending and Employment Impacts of Virginia Beach City Public Schools	17
Development of Human Capital	29
Development of Social Capital	35
Impact on Local Wealth	37
Summary	44
Appendix A: Definition of Economic Sectors	47
Appendix B: Calculation of the Increment to Lifetime Earnings from Having a High School Degree	49
Appendix C: Calculating the Impact of Improved High School Performance on the Lifetime Income of College Graduates	50

Appendix D: Calculating the Impact of a High School Graduate on Reduced
Public Crime Costs and Public Health Care Expenditures52

Appendix E: Calculating the Impact of High School Graduates’ Annual Earnings
Premium on Local Real Property Values and Property Tax Revenues53

Appendix F: Calculating the Impact of Improved VBCPS Performance on City
of Virginia Beach Residential Property Values54

Figures

Figure 1. Economic Impacts of VBCPS12

Figure 2. The Virginia Beach-Norfolk-Newport News Metropolitan Area14

Figure 3. Flowchart of Economic Impact of VBCPS Spending18

Figure 4. Trends in VBCPS SAT-Reading and Math Scores41

Figure 5. Trends in VBCPS SAT-Reading, Math, Writing Scores.....41

Figure 6. Trends in VBCPS ACT Scores42

Figure 7. Trends in VBCPS GPA42

Tables

Table 1. Economic Structure of the Virginia Beach-Norfolk-Newport News Metropolitan Area and the City of Virginia Beach Compared to the to the Nation, 201016

Table 2. Key Socioeconomic and Demographic Data of the Virginia Beach-Norfolk-Newport News Metropolitan Area and the City of Virginia Beach Compared to the Nation17

Table 3. Annual Spending and Employment Impacts of Average VBCPS Operating Budget Remaining in the Region for Spending22

Table 4. Annual Spending and Employment Impacts of Average VBCPS Operating Budget Remaining in the Region for Spending by Economic Sector23

Table 5. Total Regional Economic Impact of VBCPS Recent Five-Year (2007-2011) Capital Spending27

Table 6. Total Regional Economic Impact of VBCPS Recent Five-Year (2001-2011) Capital Spending by Economic Sector28

Table 7. Present Value (2011 \$) of Estimated Increment to Lifetime Income
of VBCPS Graduates, 2006-201033

Table 8. Present Value (2011 \$) of Estimated Increment to Lifetime Income
of VBCPS College Graduates Due to Improved High School
Performance in Each Year34

Table 9. Present Value (2011 \$) of Estimated Savings in Public Crime and
Health Care Costs Associated with Recent VBCPS Graduating
Classes36

Table 10. Regional Real Property Value and Property Tax Revenue Impacts
of the Earnings Premium of VBCPS Graduates40

ACKNOWLEDGEMENTS

Several members of the staff of Virginia Beach City Public Schools provided their time and expertise in assisting Dr. Walden complete this report, including especially Kathleen O'Hara, Heidi Janicki, Farrell Hanzaker, and Tony Arnold. Each of these individuals responded to Dr. Walden's numerous requests for data and information in a timely and professional manner. Thanks are also due to Superintendent James Merrill for making the initial contact to Dr. Walden and supporting the project to its conclusion.

ABOUT THE AUTHOR

Michael L. Walden is a William Neal Reynolds Distinguished Professor at North Carolina State University, where he has taught since 1978. The author of eight books and over 250 articles and reports, among Walden's specialties is economic impact analysis, particularly for public and educational institutions. His most recent book is *North Carolina in the Connected Age* (The University of North Carolina Press, 2008). The winner of several national and state awards, he was the recipient of the UNC Board of Governors Award for Excellence in Public Service in 2010. Walden frequently comments about the economy in the media, writes a biweekly newspaper column, broadcasts a daily radio program, and makes scores of public presentations each year in various forums.

INTRODUCTION

Virginia Beach City Public Schools (VBCPS) is the third largest public school system in Virginia and among the 50 largest systems in the country. It serves approximately 70,000 students in 85 schools. It is one of the largest employers in the region along with a substantial payroll. Given its size and vital task of educating students for both the workforce and further training in college, the economic impact of VBCPS is certainly 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 by the Virginia Beach-Norfolk-Newport News Metropolitan Area as designated by the U.S. Census.¹ Use of the metropolitan area allows the economic impacts of VBCPS on local suppliers and consumer spending to be captured. Economic impacts are measured both in terms of dollars and employment and, where appropriate and possible, locally generated and received public revenues.

The economic impacts of VBCPS are measured in four categories as illustrated in Figure 1:

Impact 1. The impact on regional spending and employment of VBCPS’ annual budgets, including the spending by VBCPS on salaries, supplies, and other operational support which generates income to employees and vendors. Employees

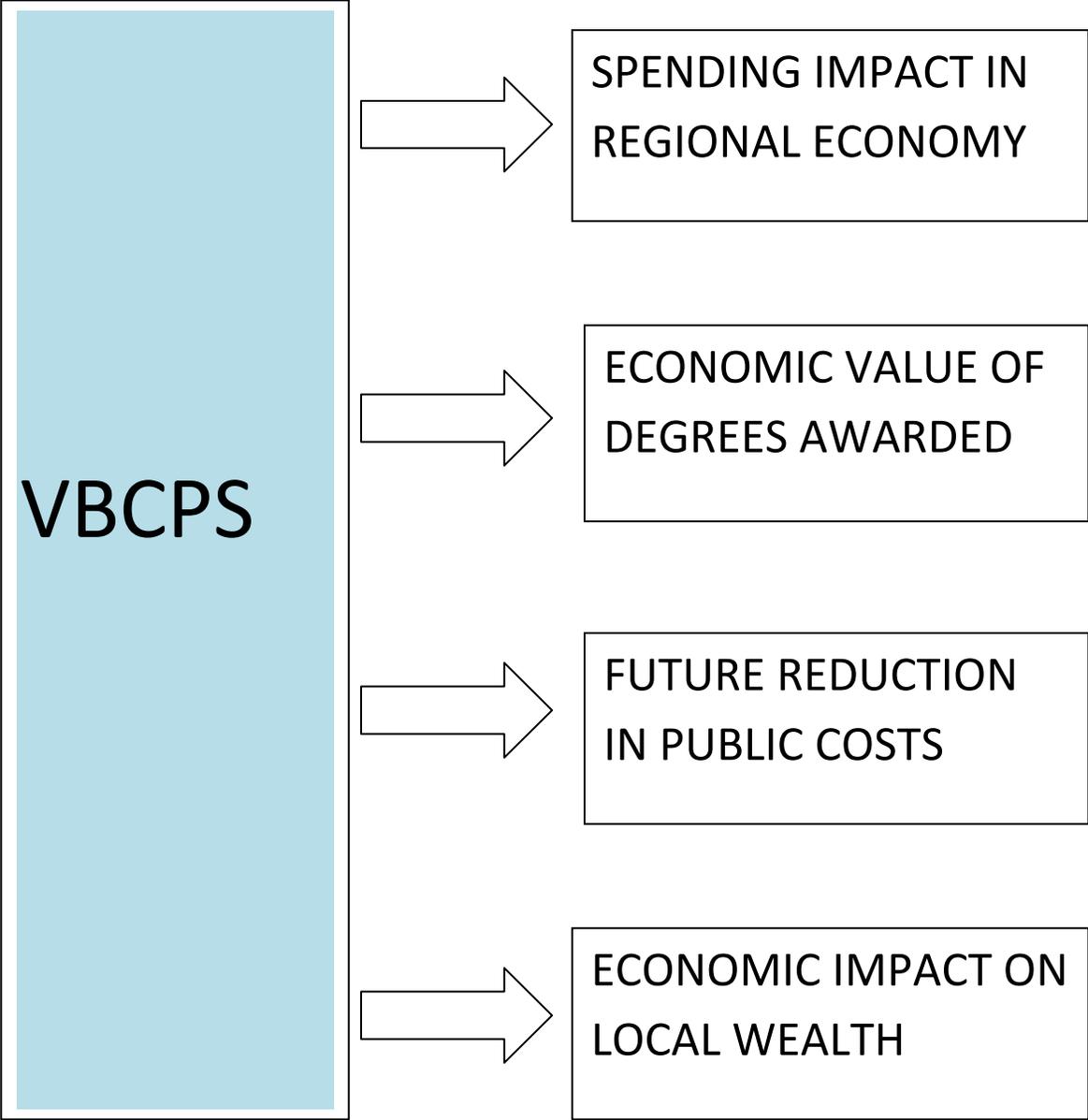
¹ The Virginia Beach-Norfolk-Newport News Metropolitan Statistical Area includes Gloucester, Isle of Wight, James City, Mathews, Surry, and York Counties and Chesapeake, Hampton, Newport News, Norfolk, Poquoson, Portsmouth, Suffolk, Virginia Beach, and Williamsburg Cities in Virginia; and Currituck County in North Carolina.

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 VBCPS’ budget. The components of this total impact of VBCPS’ budget – as well as the total impact itself – are estimated. The analysis is performed separately for the VBCPS 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 VBCPS 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 VBCPS 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 VBCPS 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 public health care costs. Estimates are calibrated for these benefits.

Figure 1. Economic Impacts of VBCPS.



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 regional property values indicated by recent trends in the performance of VBCPS is estimated.

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

For ease of presentation, the report is divided into several sections. The next section provides context for the VBCPS impact assessment by summarizing recent trends in the regional economy of the Virginia Beach-Norfolk-Newport News Metropolitan Area. Then follow four sections, each with one section devoted to results for the aforementioned economic impacts. The final section provides conclusions and a summary of the findings.

THE REGION

The Virginia Beach-Norfolk-Newport News Metropolitan Area (Figure 2) is a major urban region on the Atlantic coast. Its gross domestic product (value of all goods and services produced) is \$80 billion (2009), which is 20% of the Virginia state total. The City of Virginia Beach, the largest constituent area in the region by population, accounts for almost \$20 billion of the regional gross domestic product total.²

² Data are from the U.S. Bureau of Economic Analysis and *IMPLAN for Virginia*.

Figure 2. The Virginia Beach-Norfolk-Newport News Statistical Metropolitan Area.



Although the region certainly suffered during the recent nationwide recession, it weathered the downturn relatively better than the nation. Between 2007 and 2009 regional gross domestic product dropped 0.6%, compared to a decline of 2.8% for the nation. Unemployment peaked at 8.1% (January 2010) in the region compared to 10.4% for the nation (February 2010). The 2010 average unemployment rate in the region was 7.4% but 9.6% in the nation. The labor

market numbers were even better for the City of Virginia Beach. Unemployment peaked at 7% (January 2010) and averaged 6.4% for 2010.³

Tables 1 and 2 give further information for the region. Table 1 compares the economic structure of the region and the City of Virginia Beach to that of the nation. Several differences are evident. The region has a much heavier concentration of employment in the federal government sector than both the City of Virginia Beach and the nation. This reflects the port, naval, and shipping industries primarily associated with Norfolk and Newport News. The additional federal government employment is balanced by relatively less employment in manufacturing and education and health services. In contrast, the City of Virginia Beach has an additional focus on the leisure and hospitality sector and the professional and business services sector, with significantly lower relative employment in manufacturing and education and health services.

Table 2 compares key socioeconomic and demographic information between the region, the City of Virginia Beach, and the nation. Average salaries are slightly lower in both the region and the City of Virginia Beach than in the nation. However, these salaries have not been adjusted for any cost-of-living differences between the three areas.⁴ There is also a lower

³ Unemployment rate numbers are not seasonally adjusted and are from the U.S. Bureau of Economic Analysis.

⁴ There are no official cost-of-living indicators by state, metropolitan area, or city. However, constructed indicators for states from the Missouri Economic Research and Information Center show a lower cost-of-living in Virginia than in the nation. Within Virginia, it is reasonable to expect the cost-of-living to be higher in the northern DC suburbs than in the rest of the state. If accurate, then this would suggest a lower cost-of-living in the Virginia Beach-Norfolk-Newport News and City of Virginia Beach areas. Such a lower cost-of-living would imply higher salary values for the region and City of Virginia Beach in purchasing power terms than indicated in Table 2.

Table 1. Economic Structure of the Virginia Beach-Norfolk-Newport News Metropolitan Area and the City of Virginia Beach Compared to the Nation, 2010.

Percent of Total Employment

Sector	Region	City of Virginia Beach	U.S.
Manufacturing	7.0	3.3	8.9
Trade, Transportation, Utilities	17.8	19.5	19.0
Information	1.7	2.3	2.1
Financial Services	4.9	7.6	5.9
Construction	5.0	5.8	4.8
Professional and Business Services	13.3	16.3	12.8
Education and Health Services	12.7	13.3	15.1
Leisure and Hospitality	11.4	15.5	10.0
Other Services	4.7	3.4	4.1
Federal Government	6.8	0.9	2.3
State and Local Government	14.7	2.9	15.0
Unclassified	-	9.2	-

Construction includes natural resource employment

Source: U.S. Bureau of Labor Statistics

Table 2. Key Socioeconomic and Demographic Data of the Virginia Beach-Norfolk-Newport News Metropolitan Area and the City of Virginia Beach Compared to the Nation.

Factor	Region	City of Virginia Beach	U.S.
Population, 2009	1,674,498	433,575	307,006,550
Average Salary, 2009	\$42,969	\$43,110	\$45,831
% of population aged 65 and over	11.0	10.0	12.6
% of persons aged 25 and over with a high school degree	88.4	92.2	84.6
% of persons aged 25 and over with a bachelor's degree	27.2	31.6	27.5

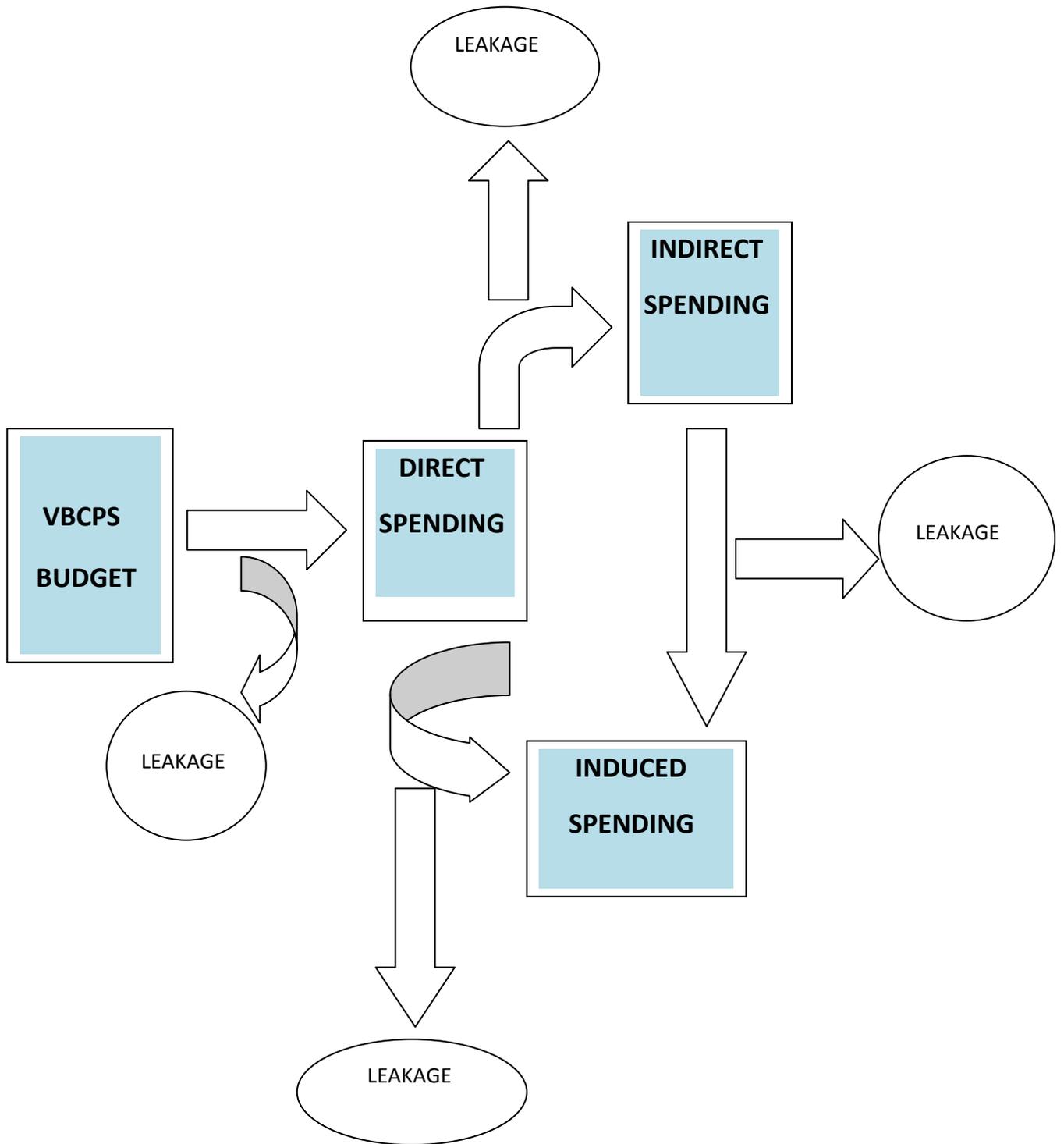
Sources: U.S. Census Bureau; *IMPLAN FOR VIRGINIA*

percentage of the population who are over age 65 in both the region and the City of Virginia Beach. The region has a slightly higher percentage of adults with a high school degree and a slightly lower percentage of adults with a bachelor's degree than the nation, but the City of Virginia Beach is higher on both educational attainment measures than the nation.

SPENDING AND EMPLOYMENT IMPACTS OF VIRGINIA BEACH CITY PUBLIC SCHOOLS

Economists group economic impact of spending by either a private firm or public institution (like the VBCPS) into three categories (Figure 3). The first is the *direct economic*

Figure 3. Flowchart of Economic Impact of VBCPS Spending.



impact (“direct spending” in Figure 3). This is the spending that goes to salaries of VBCPS faculty and staff and businesses selling directly to VBCPS. 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 VBCPS 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, VBCPS 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.

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 the Virginia Beach-Norfolk-Newport News metropolitan area are taken from IMPLAN (“impact planning”), a software developed for local economic impact analysis and unique for each metropolitan area.⁵

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

Impact of the VBCPS Operating Budget

The VBCPS operating budget is large. Over the last five fiscal years (2007/08 – 2011/12) the System has spent an average annual amount of \$680 million. However, as related above, this spending does not capture the full economic impact of VBCPS. VBCPS spending sets off a chain reaction of other spending and re-spending in the regional economy as businesses and households alike take funds received from VBCPS and purchase products and services from vendors in the area.

⁵ IMPLAN is developed by MIG, Inc., Minneapolis, MN.

Eighty-five percent (85%) of the VBCPS operating budget goes to employees in the form of salaries and benefits.⁶ Hence, the major broader regional impact of VBCPS 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 regional economy. Federal and state taxes will come “off the top” and will immediately flow outside the region with no assurance of returning. Mortgage payments made to an out-of-region lender, insurance premiums paid to a provider in another state, and on-line purchases to out-of-region sellers are other examples of funds that won’t be recycled locally. Based on an analysis of regional spending patterns, the total of such “leaked” funds are set at 35% of the VBCPS operating budget.⁷

Table 3 shows the regional impact of the five-year annual VBCPS 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 \$680 million; after subtracting the leakage rate of 35%, becomes a direct effect of \$442 million. The spending creates an indirect effect of \$94.4 million and an induced effect of \$138.9 million, for a total effect of \$675.3 million. Comparing the total spending effect of \$675.3 million to the direct effect of \$442 million, the results indicate that:

EVERY OPERATING \$1.00 SPENT BY VBCPS AND RETAINED IN THE REGION RESULTS IN TOTAL REGIONAL SPENDING OF \$1.53.

⁶ Virginia Beach City Public School System, *School Board Proposed Operating Budget, FY 2011/12*, p. 31.

⁷ Derived by using the IMPLAN data for the Virginia Beach-Norfolk-Newport News Metropolitan Area.

Table 3. Annual Spending and Employment Impacts of Average VBCPS Operating Budget Remaining in the Region for Spending.

Impact	Spending (\$ millions)	Employment
Direct effect	442.0	10,484
Indirect effect	94.4	2516
Induced effect	138.9	4237
Total effect	675.3	17,237

Source: VBCPS annual budgets; IMPLAN for the Virginia Beach-Norfolk-Newport News Metropolitan Area; and calculations by the author

The employment impacts shown in Table 3 are also substantial. The direct effect of 10,484 jobs is the five year annual average employment at VBCPS. To this is added 2516 indirect effect jobs and 4237 induced effect jobs, for a total regional employment impact of 17,237 jobs. Therefore, on average:

EVERY ONE JOB IN VBCPS IS ASSOCIATED WITH A TOTAL OF 1.64 JOBS IN THE REGION. OR, STATED ANOTHER WAY, EVERY ONE JOB IN THE VBCPS CREATES ANOTHER 0.64 JOBS IN THE REGION.

It is also instructive to see the impact of the VBCPS operating budget on individual economic sectors within the region.⁸ This information is provided in Table. 4. On the spending

⁸ The economic sectors are defined in Appendix A.

Table 4. Annual Spending and Employment Impacts of Average VBCPS Operating Budget Remaining in the Region for Spending, by Economic Sector.

Sector	Spending (\$ millions)	Employment¹
Agriculture	0.1	1.5
Natural resources	0.1	0.2
Public utilities	38.0	52.9
Construction	1.6	12.6
Manufacturing	6.6	17.9
Trade	264.6	3522.1
Transportation	8.5	54.1
Communications	8.0	29.6
Financial services	32.6	124.7
Real estate	99.3	286.2
Professional services	77.2	786.0
Health care	53.8	550.6
Leisure/hospitality	61.9	1030.7
Personal services	15.1	217.4
State/local government	3.9	40.8
Federal government	4.0	25.7
Total	675.3	6753 (indirect + induced)

¹Omitting the direct employment of VBCPS.

Source: VBCPS annual budgets, IMPLAN for the Virginia Beach-Norfolk-Newport News Metropolitan Area; and calculations by the author

side, the top five sectors impacted are trade, real estate, professional services, leisure/hospitality, and health care. Since almost all of the VBCPS 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, professional services, health care, and real estate. The rankings of spending impacts and employment impacts by economic sector do not exactly correspond due to differences in the labor intensity of different industries. Clearly, however, the results in Table 4 show:

THE OPERATING BUDGET SPENDING BY VBCPS HAS WIDE AND DEEP IMPACTS ON OTHER ECONOMIC SECTORS IN THE REGION, PARTICULARLY THE TRADE, PROFESSIONAL SERVICES, HEALTH CARE, REAL ESTATE, AND LEISURE/HOSPITALITY SECTORS

The economic model only calculates economic impacts for the metropolitan region. However, as stated above, the major impact from the VBCPS operating budget is from spending by faculty and staff. Since a large percentage (83%) of VBCPS faculty and staff live in the City of Virginia Beach⁹, it would be expected that the majority of both the spending and employment impacts would be in the City of Virginia Beach.

⁹ From Virginia Beach City Public Schools.

Impact of the VBCPS Capital Budget

VBCPS also makes capital expenditures, and these capital expenditures have broad regional impacts. In the past three years (2009-2011), yearly capital spending has averaged \$63.4 million.¹⁰ The spending has predominately been for modernization of existing facilities.

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 VBCPS capital spending for projects completed over the last five years (2007-2011).

VBCPS spent \$271.9 million for capital projects completed from 2007 to 2011.¹¹ Before calibrating the regional 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 regional economy. Therefore, spending for land purchases must be subtracted before economic impact is calculated. In the case of the recent VBCPS capital expenditures, data indicate only a small percentage (2.7%) has been for land acquisition.¹² The \$271.9 million recent five year capital project budget is reduced by 2.7% (to \$264.6 million) before the economic impact calculations are commenced.

¹⁰ Virginia Beach City Public Schools, *Modernization/Replacement Program*.

¹¹ *Ibid.*

¹² Information provided by Mr. Tony Arnold of VBCPS.

As with the operating budget, the issue of leakage deals with initial (direct) payments to out-of-region vendors. Such funds are not available for re-circulating in the local economy. However, data from VBCPS suggest such leakage is not a large issue for the capital budget. In the past decade, regional contractors have been used for the capital projects.¹³ This is not unusual given the size and growth of the Virginia Beach-Norfolk-Newport News Metropolitan Area in recent years. Only leakage of 12% is used to account for out-of-region taxes.¹⁴ The direct capital spending retained in the region is therefore \$232.8 million.

Table 5 shows the total regional spending impact of the five-year VBCPS capital budget is over \$360 million and 2927 jobs.¹⁵ 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 55% and increase the employment impact by 54%.

THE CONCLUSION IS THAT EVERY \$1 OF CAPITAL BUDGET SPENDING BY VBCPS ON NON-LAND PURCHASES AND RETAINED IN THE REGION RESULTS IN \$1.55 OF TOTAL REGIONAL SPENDING. ALSO, EVERY \$1 MILLION OF CAPITAL SPENDING BY VBCPS IS ASSOCIATED WITH 12.6 JOBS IN THE REGION

¹³ Ibid.

¹⁴ Based on data from the U.S. Department of Commerce, *Survey of Consumer Finances*.

¹⁵ 2927 jobs divided by direct spending of \$232.8 million gives 12.6 jobs for every \$1 million of VBCPS spending.

Table 5. Total Regional Economic Impact of VBCPS Recent Five-Year (2007-2011) Capital Spending.

Impact	Spending (\$ millions)¹	Employment
Direct effect	232.8	1901
Indirect effect	54.5	436
Induced effect	73.2	590
Total effect	360.5	2927

¹ Omits funds for land acquisition.

Source: VBCPS annual budgets; IMPLAN for the Virginia Beach-Norfolk-Newport News Metropolitan Area; and calculations by the author

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

THE VBCPS CAPITAL BUDGET HAS WIDE IMPACTS ACROSS MULTIPLE ECONOMIC SECTORS IN THE REGION

Table 6. Total Regional Economic Impact of VBCPS Recent Five-Year (2007-2011) Capital Spending by Economic Sector.

Sector	Spending (\$ millions)	Employment
Agriculture	0.1	1.1
Natural resources	0.0	0.0
Public utilities	2.4	3.4
Construction ¹	233.4	1905.1
Manufacturing	8.4	22.9
Trade	17.2	229.3
Transportation	3.7	23.5
Communications	4.4	16.2
Financial services	12.8	49.1
Real estate	25.8	74.4
Professional services	22.4	228.2
Health care	13.2	135.1
Leisure/hospitality	6.4	106.3
Personal services	7.3	105.5
State/local government	1.8	18.8
Federal government	1.2	8.1
Total	360.5	2927

¹ includes indirect and induced effects in non-VBCPS construction

Source: VBCPS annual budgets; IMPLAN for the Virginia Beach-Norfolk-Newport News Metropolitan Area; 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 VBCPS by measuring the *gain in human capital* of the System’s students. The next two sections discuss and measure other *outputs* of VBCPS.

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 VBCPS, 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.¹⁶ 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 VBCPS, 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.

Recognize that such a measure has some inherent issues and so it will only be an approximation to the real value of VBCPS' output. One important issue is that the measure does not separate the lifetime increment to income between that from the inherent talents of the student and that received from the school's (here VBCPS) training. Researchers have struggled with this issue without finding a suitable solution.

¹⁶ 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.

Another issue is the assumption that graduates effectively received all their training through VBCPS, and therefore VBCPS 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 VBCPS but received some of their K-12 training at another school district, their lifetime income increment overstates the contribution of VBCPS. However, there will also be students who received some training in VBCPS but moved away and graduated from another district. VBCPS 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 have been necessary to sort these factors.

Therefore, the value of the additional human capital created by VBCPS 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 VBCPS graduates. This procedure is applied to each of the five graduating classes from 2006 to 2010. 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 \$9000.¹⁷ The lifetime (during 47 years) value of this annual increment in earnings is converted to a single value today (2011) using a technique called *present value*. The concept of present value accounts for the 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

¹⁷ U.S.Census. This increment – in inflation-adjusted dollars – is assumed to be maintained throughout the graduate’s work career.

4.5% is used in the calculations. This was the annual rate on 30-year constant maturity Treasury bonds in the spring of 2011.¹⁸

Table 7 gives the results of the calculations.¹⁹ The value ranges between \$800 million and \$900 million depending on the number of graduates. The value has trended upward over time as the number of VBCPS graduates has increased. However, the conclusion is clear.

IN RECENT YEARS, VBCPS HAS ANNUALLY GRADUATED STUDENTS WHO WILL REALIZE AN ESTIMATED TOTAL PRESENT VALUE OF LIFETIME INCREMENT TO THEIR INCOME OF OVER \$800 MILLION.

Of course, many VBCPS graduates go on to college. In the last five years, approximately sixty percent (60 %) of VBCPS graduates have entered college.²⁰ 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 over \$22,000 more annually than a worker with a high school diploma, while the average worker with a two-year degree earns over \$10,000 more annually than a worker with a high school

¹⁸ Federal Reserve System, at www.federalreserve.gov

¹⁹ See Appendix B for details on the calculations in Table 7.

²⁰ VBCPS data.

Table 7. Present Value (2011 \$) of Estimated Increment to Lifetime Income of VBCPS Graduates, 2006 – 2010.

Year	Number of Graduates	Value (\$ millions)
2010	5088	889.3
2009	5017	876.9
2008	5031	879.3
2007	4902	856.8
2006	4763	832.5

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

diploma.²¹

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.²²

Using an average annual earnings increment of \$18,000 for a college graduate compared to a high school graduate, a work lifetime of 43 years (age 22 to 65), and the findings of the

²¹ U.S. Census, *Statistical Abstract 2011*, Table 701.

²² 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 (2011 \$) of Estimated Increment to Lifetime Income of VBCPS College Graduates Due to Improved High School Performance in Each Year.

Year	VBCPS Graduates Initially Attending College	Value (\$ millions)
2010	3205	26.0
2009	3161	-4.4
2008	3119	-5.9
2007	3137	6.2
2006	3048	0.1

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

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 VBCPS for each graduating class.²³ The values are based on the annual change in the GPA of seniors planning to attend college. The values are negative for 2008 and 2009 when the GPA fell. But for all other years the values are positive and sum to \$22 million for the five graduating classes examined. Therefore:

BASED ON THE IMPROVED ACADEMIC PERFORMANCE OF VBCPS STUDENTS, OVER \$22 MILLION OF ADDITIONAL LIFETIME INCOME OF RECENT VBCPS GRADUATES WHO ARE FORECASTED TO COMPLETE COLLEGE CAN BE ATTRIBUTABLE TO THE VBCPS.

²³See Appendix C for details on the calculations. The \$18,000 earnings increment is a weighted average for four-year and two-year college graduates based on the number of graduates in each category.

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, 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.²⁴ That is, individuals with more education are more likely to vote and to be healthy and less likely to be involved in crime. Since the last two beneficial behaviors (being healthy and law-abiding) are likely to reduce costs for the public sector (government), it can be implied that institutions promoting educational attainment – such as VBCPS – have a positive economic impact of developing social capital and thereby reducing public costs.

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 \$1809.²⁵

²⁴ For a review of the literature, see The College Board, 2005, *Education Pays*. Trends in Higher Education Series.

²⁵ 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 2011 dollars using the Consumer Price Index. The authors’ lower range of findings is used.

Table 9. Present Value (2011 \$) of Estimated Savings in Public Crime and Health Care Costs Associated with Recent VBCPS Graduating Classes.

Year	Number of Graduates	Crime Cost Savings (\$ millions)	Public Health Care Cost Savings (\$ millions)	Total Savings (\$ millions)
2010	5088	\$190.6	\$88.3	\$278.9
2009	5017	\$187.8	\$87.1	\$274.9
2008	5031	\$188.5	\$87.3	\$275.8
2007	4902	\$183.6	\$85.1	\$268.7
2006	4763	\$178.4	\$82.7	\$261.1

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

Converting this annual amount for a period of 61 years (each 18 year old high school graduate lives to the average life expectancy of 79 years) and using a discount rate of 4.5%, the annual lifetime savings per high school graduate is \$37,464.²⁶ After multiplying by the number of VBCPS graduates in each of the last five years, Table 9 shows that annual savings have ranged between \$178 million and \$190 million.

Likewise, a recent study concluded that every student who graduates from high school is associated with a lifetime reduction of \$17,362 (2011 \$) in Medicaid and uninsured medical

²⁶ See Appendix D for details on the calculations.

coverage costs.²⁷ Table 9 indicates the associated savings in public health care costs for recent VBCPS graduating classes range between \$82 million and \$88 million.

Taken together, the last column of Table 9 shows the estimated lifetime savings in public costs for crime prevention and health care associated with recent VBCPS graduating classes.

Therefore, the important conclusion is:

EACH RECENT VBCPS CLASS OF GRADUATES IS ASSOCIATED WITH BETWEEN \$260 MILLION AND \$280 MILLION OF SAVINGS IN FUTURE PUBLIC CRIME COSTS AND PUBLIC HEALTH CARE EXPENDITURES.

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 generates 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.

²⁷ Alliance for Excellent Education, *Healthier and Wealthier: Decreasing Health Care Costs by Increasing Educational Attainment*. Issue Brief, November 2006. The result is specifically for Virginia.

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.²⁸ 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 of Virginia tax records shows that, prior to the real estate boom of the mid 2000s, the ratio of real (land and structures) property values to income in the Virginia Beach-Norfolk-Newport News Metropolitan Area was 1.3.²⁹ This suggests that every additional dollar of local income is capitalized into local property values at the rate of \$1.30. The same tax records indicate that every dollar of real property in the region is taxed at a rate of 0.9 cents.³⁰

As indicated earlier, the annual earnings premium for high school graduates over high school dropouts is approximately \$9000. If the high school graduate remains working in the

²⁸ 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.

²⁹ Virginia Department of Taxation, Annual Reports, available at www.tax.reports.gov/site.cfm?alias=AnnualReports

³⁰ Ibid, and based on the latest data, for 2009

region, then this premium will be spent in the area and will be capitalized into regional real property values. If the graduate acquires further education but remains in the region 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 VBCPS graduates leave the region permanently. However, since the region 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 the Virginia Beach-Norfolk-Newport News Metropolitan Area. Therefore Table 10 presents both the real property value and property tax values for the region using the entire earnings premium for each VBCPS graduating class.³¹

The annual impact on real property values ranges between \$55 million and \$60 million, and the annual impact on property tax revenues is near \$0.5 million. While important, the values should be kept in perspective. A real property value of \$60 million is 0.03% of total regional real property values in 2009. Nonetheless:

THE CONTINUING GRADUATION OF FUTURE WORKERS AND CONSUMERS FROM VBCPS HAS A POSITIVE IMPACT ON BOTH LOCAL REAL PROPERTY VALUES AND PROPERTY TAX REVENUES. EACH RECENT GRADUATING CLASS HAS ADDED CLOSE TO \$60 MILLION IN REGIONAL REAL PROPERTY VALUES AND \$0.5 MILLION IN REAL PROPERTY TAX REVENUES.

³¹ See Appendix E for details on the calculations.

Table 10. Regional Real Property Value and Property Tax Revenue Impacts of the Earnings Premium of VBCPS Graduates

Year	Number of Graduates	Associated Increase in Real Property Values (\$ millions)	Associated Increase in Property Tax Revenues (\$ millions)
2010	5088	\$59.5	\$0.54
2009	5017	\$58.7	\$0.53
2008	5031	\$58.9	\$0.53
2007	4902	\$57.4	\$0.52
2006	4763	\$55.7	\$0.50

Source: Virginia Department of Taxation; 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 VBCPS. Figures 4, 5, 6, and 7 show changes in four measures – the Scholastic Aptitude Test (SAT) total test score for reading and math, the SAT total test score for reading, math, and writing, the ACT (American College Testing), and the senior class grade point average (GPA). Two versions of the SAT are provided because a writing section was added in 2006. Some observers may be concerned that this addition makes the total SAT not comparable over the entire time period. To address this, both total SAT scores are given, with – of course – the score including the writing component only since 2006. The GPA scores are only available since 2003. All data are from VBCPS.

Figure 4. Trends in VBCPS SAT-Reading and Math Scores.

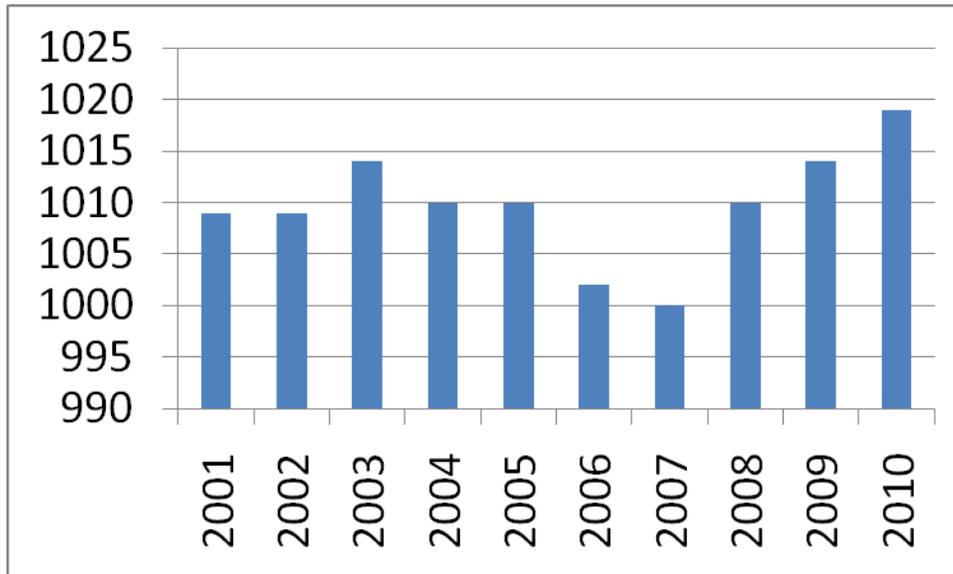


Figure 5. Trends in VBCPS SAT - Reading, Math, Writing Scores.

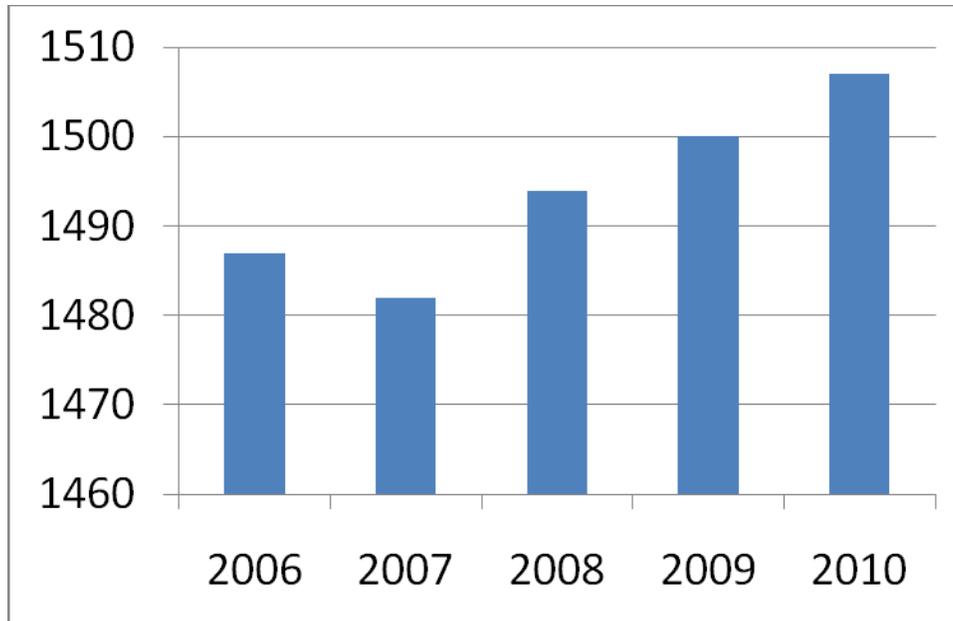


Figure 6. Trends in VBCPS ACT Scores

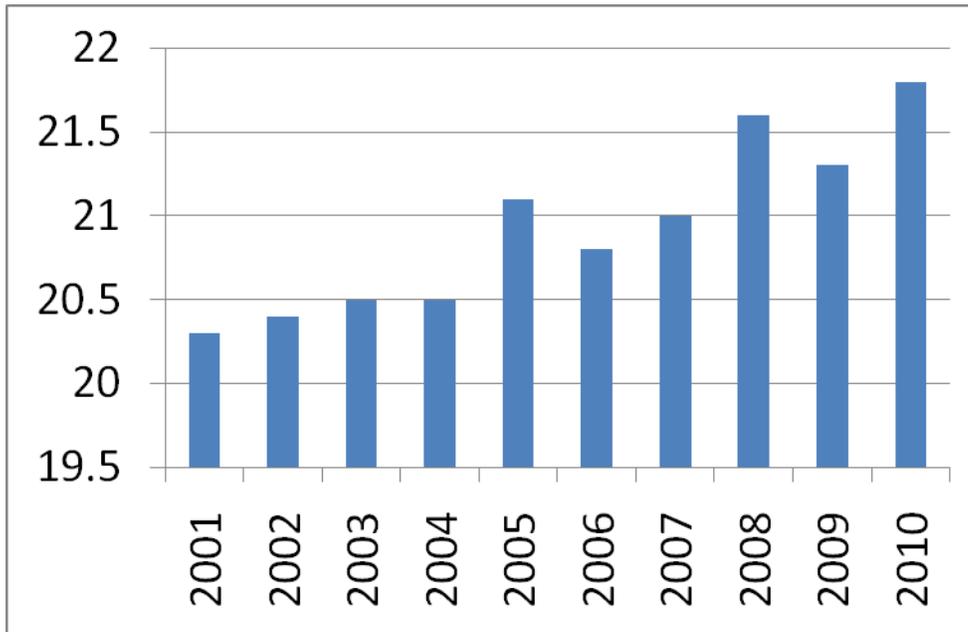
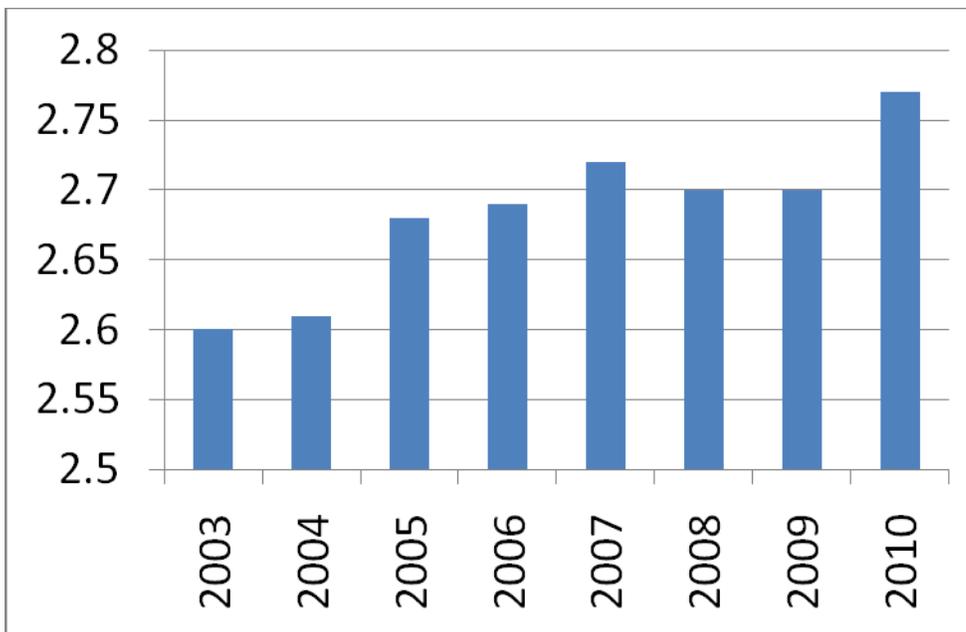


Figure 7. Trends in VBCPS GPA.



The ACT shows an improving trend over the entire decade (2001-2010). The SAT-Reading and Math - indicates an improving trend since 2007, and this is supported by the SAT-Reading-Math-Writing. The GPA shows a rising trend since 2003 but with slight dips in 2008 and 2009. Thus, using all measures, it can generally be concluded that VBCPS performance has increased since 2007.³² If this improved performance is valued by homeowners – and research suggests it is – then residential property values in the City of Virginia Beach would respond in a positive way. Using the most recent research calibrating such a response and applying it to an estimate of residential property values in the City of Virginia Beach suggests that:³³

AS A RESULT OF THE IMPROVEMENT IN VBCPS STUDENT PERFORMANCE BETWEEN 2007 AND 2010, RESIDENTIAL PROPERTY VALUES IN THE CITY OF VIRGINIA BEACH ARE BETWEEN \$2.8 AND \$9.5 BILLION HIGHER COMPARED TO THE LEVELS WITHOUT THE IMPROVEMENT IN ACADEMIC PERFORMANCE. THE CORRESPONDING GAIN IN PROPERTY TAX REVENUES TO THE CITY OF VIRGINIA BEACH IS BETWEEN \$28 MILLION AND \$86 MILLION.

³² The positive trends in SAT and ACT performance for VBCPS are in contrast to declining trends in those same tests for the nation (U.S. Census Bureau, *Statistical Abstract 2011*, Table 264; and ACT, *The Condition of College and College Careers, 2011*). The decline in the SAT scores in 2006 and 2007 may be related to the introduction of the new writing component.

³³ See Appendix F for details on the calculations.

SUMMARY

VBCPS has a large and varied economic impact in the Virginia Beach-Norfolk-Newport News Metropolitan Area as well as in the City of Virginia Beach. This study has estimated those impacts in two broad categories: the economic effects of VBCPS spending as an *input* in the K-12 educational system, and the economic effects of the *outputs* of VBCPS. While both are important, it is the output measures which address the ultimate goal of VBCPS: 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 VBCPS is substantial. Using the recent five-year budget average, it was found that every \$1.00 of VBCPS operating budget spending which is retained in the local economy results in total regional spending of \$1.53. Likewise, every one direct VBCPS job is associated with another 0.64 jobs in the regional economy.

Similar effects result from the VBCPS capital budget. Every \$1.00 of capital spending by VBCPS and retained in the local economy results in a total of \$1.55 of spending in the Virginia Beach-Norfolk-Newport News metropolitan economy, and every \$1 million of capital spending by VBCPS is associated with an additional 12.6 jobs in the region.

Both the operating and capital budgets of VBCPS were found to impact a large and varied number of economic sectors in the regional economy, but particularly the trade, professional services, health care, real estate, and leisure/hospitality sectors.

The report identified three important *outputs* of VBCPS 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 VBCPS.

The economic value of degrees awarded by VBCPS 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 (present value of) is between \$800 and \$900 million. The academic performance of VBCPS graduating seniors has also been improving, on trend, in recent years. This improvement – in turn – has increased the likelihood that VBCPS students will complete a college degree. The value of this increased probability of completing college was estimated at an aggregate value of \$22 million for the last five classes of VBCPS 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 compared to high school dropouts. This means high school graduates reduce future public crime costs and public health costs. For each of the recent VBCPS graduating classes, the reduction in these costs is estimated at between \$260 million and \$280 million (in present value 2011 \$).

Lastly, VBCPS 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 \$60 million in additional regional real property values and \$0.5 million in higher regional real property tax revenues for each recent class of VBCPS

graduates. The second, and more significant, impact comes from the positive response of residential property values to improved academic performance of VBCPS students. All standard measures of academic performance of VBCPS seniors show improving trends in recent years. It is calculated that as a result of this improvement, City of Virginia Beach property values are between \$2.8 billion and \$9.5 billion higher compared to the levels without the improvement in academic performance during 2007 to 2010. The corresponding increase in property tax revenues to the City of Virginia Beach is between \$28 million and \$86 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 \$9000 was multiplied by the number of graduates in each year.

Second, the present value factor sum corresponding to an interest rate of 4.5% and a 47 year time period was calculated. This value is the sum of the individual present value factors – assuming an interest rate of 4.5% - 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 95.7 cents, and two years in the future \$1.00 will have a purchasing power of 91.6 cents, etc.³⁴ These 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 \$9000) to derive the results in the third column of Table 7.

³⁴ The purchasing power one year ahead is found from the calculation $(1/(1.045))$, and the purchasing power two years ahead is found from the calculation $(1/(1.045)^2)$. 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.”³⁵ 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 VBCPS’ “claim” on the increase in lifetime income due to a college degree for a given VBCPS graduating class using the following equation:

$CHGGPA \times \#COL \times \$18,000 \times 18.9 \times 0.34$, where:

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

³⁵ Geiser and Santelices, op. cit., 1.

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

\$18,000 = weighted average annual increase in earnings of a worker with a college

degree (bachelor's or associate's degree) and a high school degree,

18.9 = present value factor sum for interest rate of 4.5% 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 VBCPS.

APPENDIX D: CALCULATING THE IMPACT OF A HIGH SCHOOL GRADUATE ON REDUCED FUTURE PUBLIC CRIME COSTS AND PUBLIC HEALTH CARE EXPENDITURES

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 2011 dollars. This resulted in an annual reduction of \$1809. To convert to a lifetime amount, the high school graduate's age (18) was subtracted from the current average lifespan (79 years) to derive a future period over which the annual savings would be realized of 61 years. The present value factor sum associated with a 4.5% interest rate and 61 year period was multiplied by the annual amount of \$1809 to give a lifetime reduction in crime costs (in 2011 \$) associated with each high school graduate of \$37,464. Multiplying \$37,464 by the number of annual VBCPS 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 2011 dollars to give a lifetime value of \$17,362. Multiplying \$17,362 by the number of VBCPS graduates gave the total savings reported in the third column of Table 9.

**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 (\$9000) is multiplied by the average ratio of real property value to personal income for the Virginia Beach-Norfolk-Newport News Metropolitan Area (1.3) and further by the number of VBCPS 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 0.009 (0.9 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 VBCPS
PERFORMANCE ON CITY OF VIRGINIA BEACH RESIDENTIAL
PROPERTY VALUES**

The value of City of Virginia Beach residential real estate is estimated at \$40 billion in 2007. This is based on a total real property value for the City of Virginia Beach of \$55.3 billion (Virginia Department of Taxation, *Annual Report, Fiscal Year 2007*) 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 2007 and 2010, the VBCPS SAT-math & reading average score increased 3.4 standard deviations; the SAT-math & reading & writing was up 2.5 standard deviations; the ACT rose 1.5 standard deviations; and the GPA increased 1.0 standard deviations. Thus, using the low and high standard deviation trends, the lower and upper bounds for the impact on residential property values and property taxes in the City of Virginia as a result of the improved academic performance of VBCPS students are:

Lower bound on increase in property value: $\$40 \text{ billion} \times 1.0 \times 0.07 = \2.8 billion

Lower bound on increase in property tax revenues: $\$2.8 \text{ billion} \times 0.009 = \25 million

Upper bound on increase in property value: $\$40 \text{ billion} \times 3.4 \times 0.07 = \9.5 billion

Upper bound on increase in property tax revenues: $\$9.5 \text{ billion} \times 0.009 = \86 million