Selected Returns on Investments in Higher Education in Kentucky

Prepared for the Kentucky Council on Postsecondary Education by the Center for Business and Economic Research, Gatton College of Business and Economics, University of Kentucky

Gatton College of Business and Economics
Center for Business and Economic Research

CPE
Higher Education Matters

Center for Business and Economic Research
Department of Economics
Gatton College of Business and Economics
University of Kentucky
225M Gatton Business and Economics Building
University of Kentucky
Lexington, KY 40506-0034
Voice: (859) 257-6226
E-mail: cber@uky.edu
Web: http://cber.uky.edu

Contributors:
Michael T. Childress, michael.childress@uky.edu
Michael W. Clark, michael.clark@uky.edu

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Acknowledgments

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Summary

Education pays in a lot of ways—higher earnings, increased labor force participation, better health, and more civic involvement are just a few of the benefits (Ma and Pender, 2023). Generally, these benefits increase as one attains higher levels of education. Given the variety and extent of the benefits, it is easy to understand why states invest so heavily in higher education. In Kentucky, for example, nearly 10 percent of general fund expenditures are for higher education (Natonal Association of State Budget Officers, 2023). Kentucky's investments have mostly kept pace with nearby states and the U.S. going back to before 1980, and then exceeded them with the passage of the *Kentucky Postsecondary Education Improvement Act of 1997*. This financial commitment, however, began to lose energy with the onset of the Great Recession in 2008. While the Commonwealth's educational gains have not yet matched its competitor states, higher education investments have facilitated the development of a workforce with increasing levels of education, skills, and productive potential.

The research presented here finds that the returns and impacts of these investments, which include, but are not limited to, increased individual earnings, higher government tax revenue, and more consumer spending, are substantially larger than the initial state investment. Using the cohort of Kentucky students who graduated from high school in 2015 as our case study, **we estimate the financial return from tax revenue to be around four-and-a-half times greater than the initial state investment and the local economic impact nearly seventeen times greater**. These returns, moreover, represent a conservative estimate since they do *not* include the *financial* benefits of better health outcomes, enhanced labor productivity, lower utilization of government social services, higher civic and community engagement, or a reduction in crime rates, which provide financial benefits and are associated with increased education.

Background

The skills, knowledge and abilities of our people are the fuel that propels us along the path of prosperity. Consequently, Kentucky's future economic prosperity will be largely determined by the pursuit of and investment in educational excellence. With a highly educated population and skilled workforce, productivity improves, the economy grows, and incomes rise. The lesson is clear—if rising per capita income is the destination, then education and innovation are the tickets.

Research supports what common sense suggests. Stanford economist Eric Hanushek and his colleagues find a strong connection between academic achievement and state-level economic growth (Hanushek, Ruhose, and Woessmann, 2016). They find, for example, that if Kentucky students performed at the same level as those in Minnesota—the state with the highest performing students in the country—then gains to Kentucky's gross domestic product (GDP) over the next 80 years could top $1 trillion or five times the current level. Likewise, according to a 2014 paper by John Fernald at the Federal Reserve Bank of San Francisco and Charles Jones at Stanford, around three-fourths of U.S. economic growth since 1950 was fueled by just two factors—rising educational attainment and research intensity (Fernald and Jones, 2014). Business leaders have

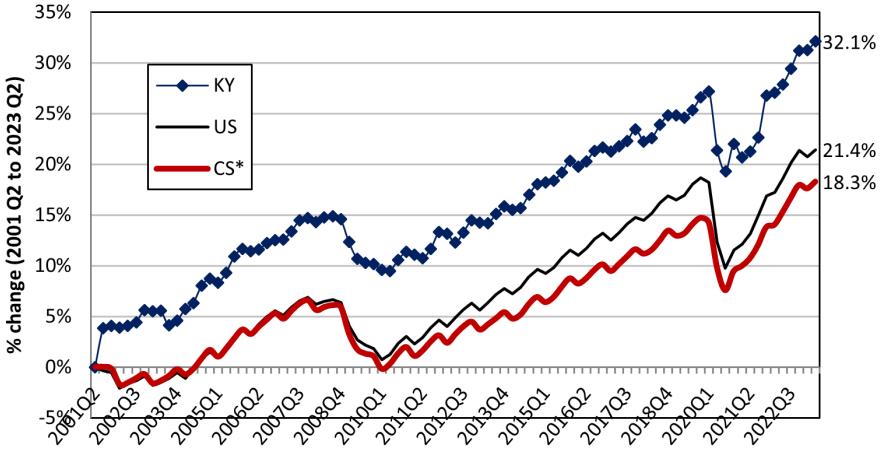
found common ground with academic researchers over the relationship between education and the economy. Surveys of corporate executives show, year after year, that the availability of abundant *skilled* labor is one of the most valuable assets to a community (Area Development, 2024 Q1).

Policy makers across the country recognize the importance of education for advancing economic growth. In Kentucky, two legislative acts in the last three-and-a-half decades laid the foundation for educational and economic change—the *Kentucky Educational Reform Act of 1990* (KERA) and the *Kentucky Postsecondary Education Improvement Act of 1997* (HB1 of 1997). The principal goal of the former was to improve K-12 educational achievement, while the main goal of the latter was to increase postsecondary educational attainment. Both have helped to increase the number of individuals in Kentucky's workforce with higher levels of education. Kentucky still trails the competitor states and the U.S. in the percentage of its prime working-age population with post-secondary education, but the gap is narrowing. The number of individuals in Kentucky's workforce with at least some college increased by 32.1 percent from mid-2001 to mid-2023, a much higher growth rate compared to the competitor states[1] or the U.S. (Figure 1, p.7).[2]

The Kentucky Council on Postsecondary Education released its 2022-2030 state plan for higher education in February 2022. The overall goal, as articulated in *Higher Education Matters: A Statewide Strategic Agenda for Kentucky Postsecondary Education*, is to increase the percentage of Kentuckians with a postsecondary degree or certificate to 60 percent by the year 2030. The U.S. Bureau of Labor Statistics (BLS) estimates that nearly 67 percent of the new occupational positions created nationally from 2023 to 2033, and about 41 percent of the total jobs in 2033, will require at least some postsecondary education (U.S. Bureau of Labor Statistics, 2023).[3] The percentage of jobs requiring some education, training, or credentials beyond high school has increased over time. This is reflected in Figure 2 (p. 7). The percentage of prime working-age adults (25 to 54 years old) in Kentucky with at least two years of post-secondary education increased from 10 percent in 1960 to 40 percent in 2022, and the BLS occupational projections suggest a continuation of this trend. The chart also shows that Kentucky consistently lags the competitor states and the U.S. Kentucky, for instance, reached a level in 2020 that the U.S. and the competitor states reached a decade earlier in 2010.

Figure 1: Employment with Postsecondary Education, Kentucky, Competitor States, and the U.S.

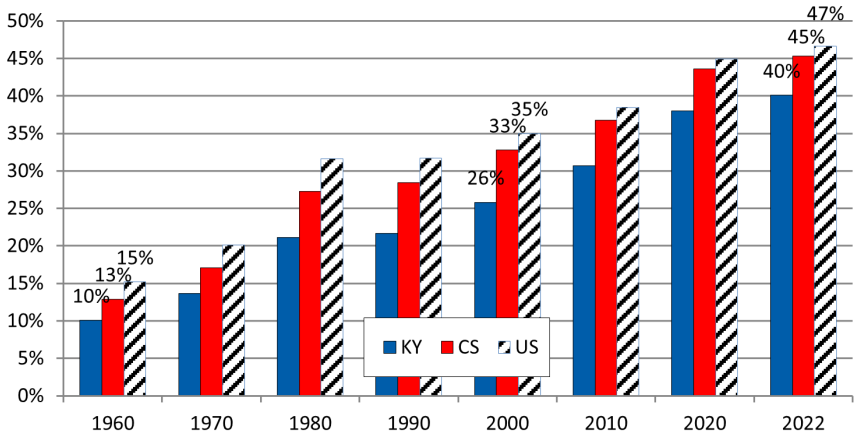
(Some College & Associates Degree, Bachelor's Degree & Higher)



Source: Estimated by the author using U.S. Census, LED Extraction Tool, Quarterly Workforce Indicators (QWI), <https://ledextract.ces.census.gov/qwi/all>, data downloaded 7/11/2024.
Note: CS denotes a modified collection of competitor states that excludes Mississippi, due to several quarters of missing workforce data.*

Figure 2: Two or More Years of Higher Education, Kentucky, Competitor States, and the U.S.

(Prime Working-Age Adults, 25 to 54 Years Old)



Source: Author's analysis of U.S. Census Bureau data from Steven Ruggles, Sarah Flood, Matthew Sobek, Daniel Backman, Annie Chen, Grace Cooper, Stephanie Richards, Renae Rodgers, and Megan Schouweiler. IPUMS USA: Version 15.0 [1960 5% sample; 1970 Form 1 State 1%; 1980, 1990, & 2000 5% samples; 2010, 2020, & 2022 ACS 5-Year]. Minneapolis, MN: IPUMS, 2024. https://doi.org/10.18128/D010.V15.0

Investments

Four words describe the arc of Kentucky's higher education investments over the last four and a half decades: *substantial*, *similar*, *surging*, and *subsiding*. Two of these characterizations, surging and subsiding, reflect key inflection points for public finance of higher education, the *Kentucky Postsecondary Education Improvement Act of 1997* and the Great Recession in 2008. Whether we are examining expenditures or appropriations, looking at absolute levels or rates of change, referencing the population (per capita) or the student (FTE), or using personal income or gross domestic product as the backdrop, these four words capture the essence of the Commonwealth's postsecondary education investments from the late 1970s to the present.

Substantial

Kentucky's higher education expenditures from general fund sources constituted 9.9 percent of total general fund expenditures in fiscal year 2023 (Figure 3, p. 9), a significant portion of total general fund expenditures (Natonal Association of State Budget Officers, 2023).[4] According to the 2023 State Higher Education Finance (SHEF) report produced by the State Higher Education Executive Officers Association (SHEEO), "Higher education is the third largest general fund budget category in Kentucky. State and local government funding for higher education totaled $1.5 billion in fiscal year 2023.[5] In addition, public institutions in Kentucky received $1.2 billion in tuition revenue. These two revenue sources serve 139,104 total full-time enrollment (FTE) students at public institutions" (State Higher Education Executive Officers Association, 2023). Moreover, Kentucky's investments have included a greater percentage of its gross domestic product (Figure 5, p. 10)[6] and personal income (Figure 6, p. 11)[7] compared to the competitor states and the U.S., especially during the period bracketed by the adoption of the *Kentucky Postsecondary Education Improvement Act of 1997* and the onset of the Great Recession in December of 2007.[8]

Similar

Because we operate in a global marketplace competing with other states for entrepreneurial talent and industrial prospects, Kentucky's postsecondary educational investments have kept pace with and resemble other states. Kentucky's higher education expenditures in fiscal year 2023 from general fund sources, 9.9 percent (Figure 3, p. 9), is higher than the U.S. average (9.2%), but less than the competitor state average (12.0%). This similarity extends back to at least 1980, as evidenced by the amount of total support from state and local governments (Figure 4, p. 10). The trajectories of total support[9] in Figure 4, which are indexed to 1997, are quite similar from 1980 to 1997, but begin to track a different course at the 1997 inflection point.

Surging

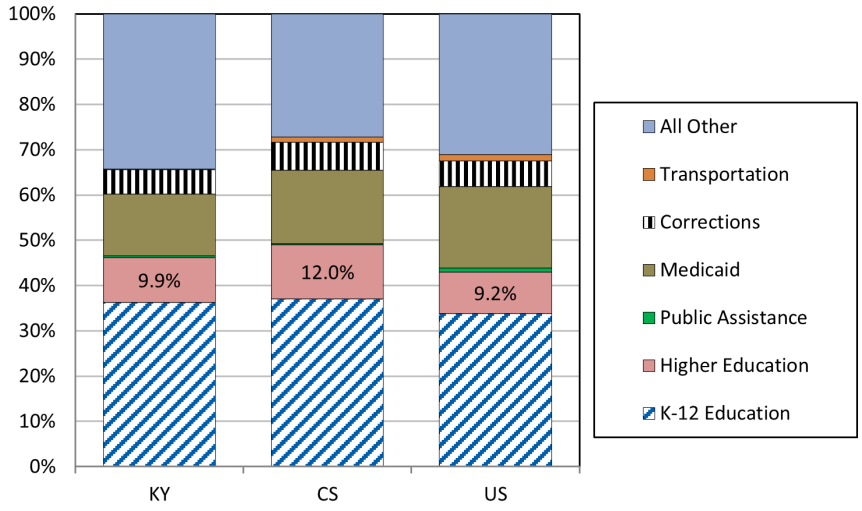
The *Kentucky Postsecondary Education Improvement Act of 1997* was an important piece of legislation that created a turning point for higher education funding (Ellis, 2011), as evidenced in Figure 4 (p. 10). Funding for higher education rose as a percentage of GDP (Figure 5, p. 10), personal income (Figure 6, p. 11), and on a per-student level (Figure 7, p. 11), but faced serious headwinds due to the Great Recession within a decade of the landmark legislation.

Subsiding

Higher education funding support in Kentucky remained flat, and even began to subside in real terms, with the economic shock of the Great Recession in 2008 (Figure 4, p. 10 and Figure 7, p. 11). While other states began to recover within a decade, it took Kentucky another five to six years to marshal an increase in funding support. The metrics that show a surge in funding from 1997 to 2007 also illustrate how it subsided from 2008 to about 2021.

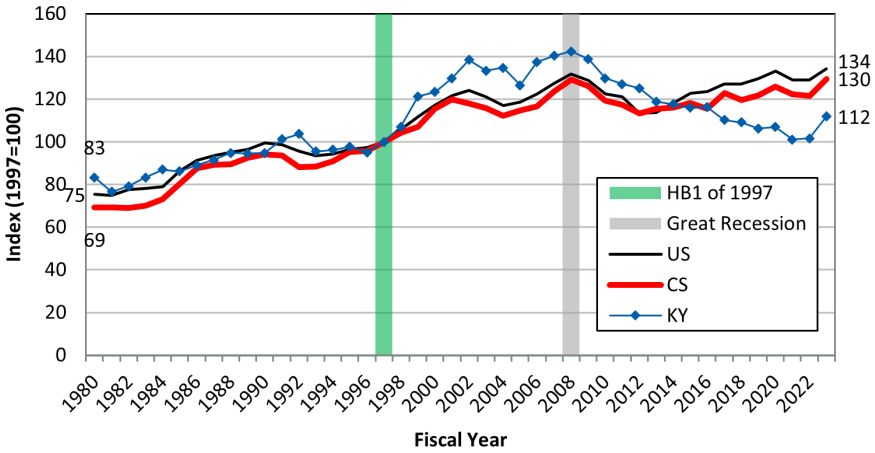
After no growth in the index of higher education total support from 2008 to 2021, Kentucky experienced sharp increases in 2022 and 2023 (Figure 4, p. 10). Similarly, higher education appropriations as a percentage of personal income (Figure 6, p. 11) as well as higher education appropriations per FTE (Figure 7, p. 11) show upward movement.[10] Likewise, Kentucky's general fund appropriations increased in real (inflation-adjusted) dollars in 2022 and 2023. In the next section we examine the relationship between the results of these investments, credentials held by Kentuckians, and the salaries they earn.

Figure 3: State General Fund Expenditures, Kentucky, Competitor States, and the U.S., Fiscal Year 2023
(Percent of Total State General Fund Expenditures)



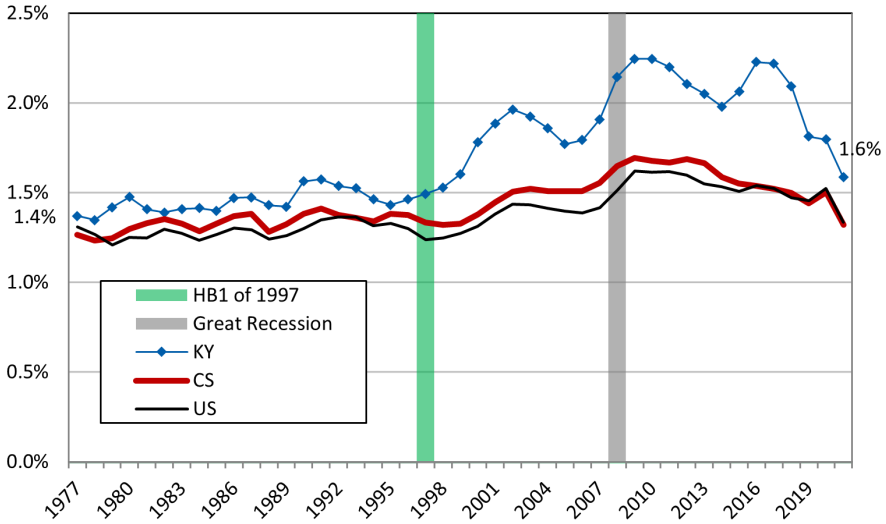
Source: 2023 State Expenditure Report, National Association of State Budget Officers (NASBO).

Figure 4: Higher Education Total Support, Kentucky, Competitor States, and the U.S.
(Federal Stimulus Funds Excluded)



Source: Author's analysis of data from State Higher Education Executive Officers Association. (2024). State Higher Education Finance: FY 2023. Boulder, CO. We convert current dollars to constant 2023 dollars and then index the 2023 constant dollars to 1997. Kentucky's index value of 112 in 2023 indicates that this value is about 12 pecent higher, in real terms, compared to 1997. Likewise, in 1980 it was only 83 percent of the 1997 value.

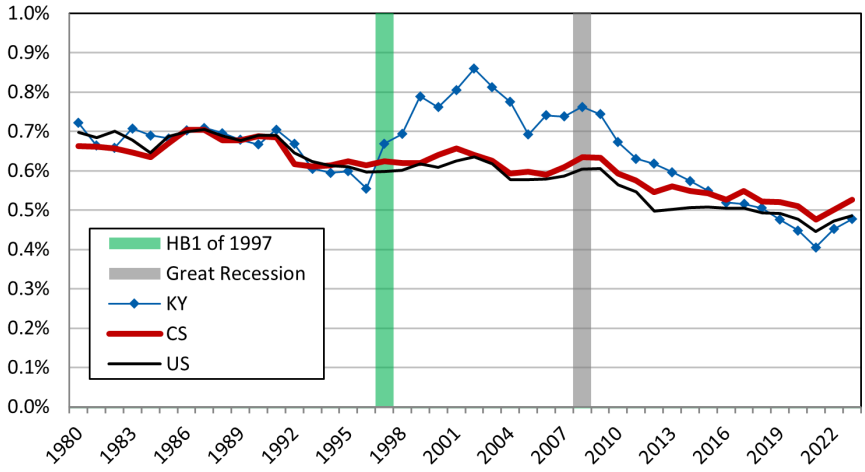
Figure 5: Higher Education Expenditures and GDP, Kentucky, Competitor States, and the U.S., 1977 to 2021
(Prime Working-Age Adults, 25 to 54 Years Old)



Source: Author's calculations based on data from the U.S. Department of Commerce, Bureau of Economic Analysis and U.S. Census Bureau, Annual Survey of State and Local Government Finance.

Figure 6: Higher Education Appropriations & Income, Kentucky, Competitor States, and the U.S., 1980 to 2023

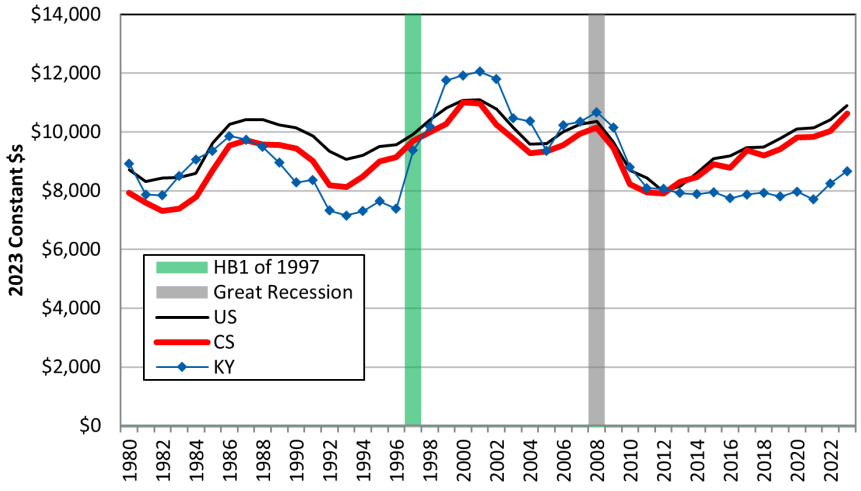
(Appropriations as a Percentage of Total Personal Income)



Source: Author's calculations based on higher education appropriations data that excludes federal stimulus funds (i.e., state and local support available for public higher education operating expenses excluding research, hospitals, and medical education net of federal stimulus funding) from the State Higher Education Executive Officers Association. (2024). State Higher Education Finance: FY 2023. Boulder, CO, and personal income data from the U.S. Department of Commerce, Bureau of Economic Analysis, Table SAINC1.

Figure 7: Higher Ed Appropriations Per Student FTE, Kentucky, Competitor States, and the U.S., 1980 to 2023

(Federal Stimulus Funds Excluded)



Source: State Higher Education Executive Officers Association. (2024). State Higher Education Finance: FY 2023. Boulder, CO. Adjustments made by the author converting current dollars to constant dollars using BLS CPI-U data.

Earnings, Taxes, and Consumer Spending

Higher education is empirically associated and causally linked to higher earnings. For state and local governments, higher earnings usually mean higher tax revenue, and for local economies higher earnings typically translate into higher consumer spending, which, of course, helps businesses to grow. In the sections below we go deeper into these areas and provide estimates for Kentucky.

Earnings

The wage differential between those with high and low levels of education is stark. However, there are many factors that affect one's labor market success, not just education. Getting a degree does not guarantee a higher income, and a lack of a degree does not destine one to a life of low wages. Native intelligence, unobserved ability, hard work, timing, luck, or some other factor can pave the way for economic success regardless of one's educational background. Indeed, while it is possible that something other than education itself accounts for the difference in wages, economists have rigorously studied this issue, and numerous peer-reviewed studies show that education, on average, has a direct and enduring effect on labor market success. In short, the weight of the evidence "unambiguously indicate(s) that most, if not all, of the wage premium is caused by going to college"[11] (Levine and Pardue, 2024) (Ashenfelter and Krueger, 1994) (Card, The causal effect of education on earnings, 1999) (Card, Estimating the Return to Schooling: Progress on Some Persistent Econometric Problems, 2001) (Carneiro, Heckman, and Vytlacil, 2011) (Harmon, Oosterbeek, and Walker, 2003) (Hoekstra, 2009) (Oreopoulos and Petronijevic, 2013) (Rouse, 2007) (Zimmerman, 2014).

We use statistical methods designed to isolate the impact of education on earnings from the many other known factors such as age, sex, and location of residence, which affect earnings too. We estimate that a typical college graduate in Kentucky will have lifetime earnings, from 18 to 64 years old, nearly double that of a high school graduate, a wage premium that is 1.9 times higher (Figure 8, p. 14).[12]

The ratios for associate degree holders (1.4) and graduate degree holders (2.4) are also significant. The estimated lifetime earnings premium for a typical Kentucky high school graduate are just over $600,000, compared to $1.2 million for a bachelor's degree holder (in 2020-2021 dollars).[13] These numbers are consistent with other studies that have examined the relationship between education and earnings on the national level (Ma and Pender, 2023), as well as in Kentucky (Bollinger, Education Pays Everywhere!, 2015).

The trajectories of the cumulative lifetime earnings by credential illustrate that it does not take long for an individual pursuing higher education to catch up with the high school graduate and surpass them, even when accounting for the out-of-pocket costs of postsecondary education as well as the opportunity costs of delayed entry to the labor force (Figure 9, p. 14).

Our key assumptions are shown in Table 1 (p. 15). We assume all students work while in school, but while in school their earnings will be less than high school diploma holders who work and do not pursue postsecondary education. The total investment column shows the estimated "cost" of attending school by credential level. This total amount is deducted from expected wages (while a student) and actual wages in the

form of student loan repayments for ten years after finishing school. For example, we assume a bachelor's degree earner will attend school for four years and will experience just over $47,000 in lost wages during that period. Once they earn their degree, the net cost ($70,100) and student loan interest ($10,560) will be deducted, year-by-year, from their estimated earnings over a ten-year period.

Tax Revenue

One effect of higher personal incomes is more tax revenue for state and local governments. We estimate that an individual with a bachelor's degree will pay almost twice the amount of state and local income, sales, and property taxes as someone with a high school diploma (Figure 10, p. 15). Compared to a high school diploma, an associate degree (46% more), bachelor's degree (86% more), and graduate degree (123% more) are associated with higher tax revenue.

We use the Institute on Taxation and Economic Policy (ITEP) study of state and local taxes to estimate tax revenue. Their study, which is produced using the proprietary ITEP Tax Microsimulation Model, is the only comprehensive, 50-state study of state and local tax distribution (Institute on Taxation and Economic Policy, 2024).[14] We believe the ITEP-based estimates are conservative because our analyses using other methods generate slightly higher tax revenue.[15]

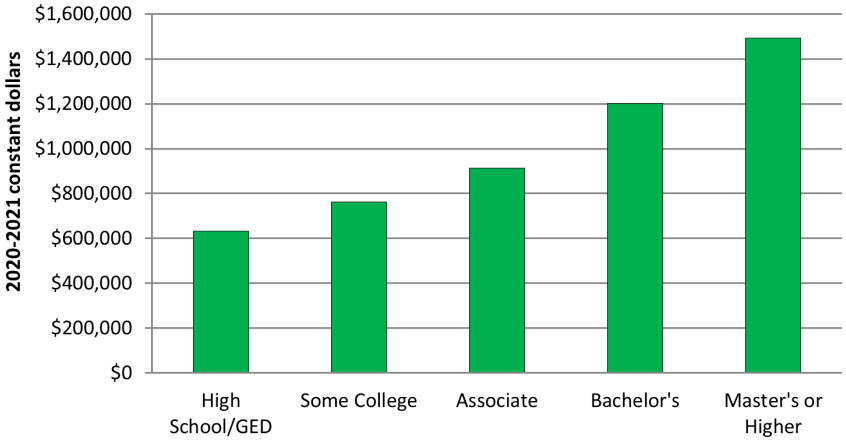
Consumer Spending

When consumers spend money at local businesses, the dollars cascade through the local economy many times. One person's spending is another person's salary, which can also be spent and thereby contribute to another person's salary, and so on. This is known as the "local multiplier effect," and it can significantly boost a community's economic vitality. As described above, higher education leads to higher incomes, and higher incomes are associated with higher levels of consumer spending. The latter can be empirically demonstrated by the U.S. Bureau of Labor Statistics Consumer Expenditure Survey (CE) results.[16]

Determining how much consumer spending is local compared to national or international is more art than science. Nonetheless, a 2015 Brookings analysis provides a reasonable method (Rothwell, 2015). The guiding principle in the Brookings research is "that most goods purchases should not be thought of as local, given that most merchandise is produced outside the local area where it is eventually consumed, but most services are local."[17] This is a conservative approach that limits expenditures to 48 percent of average annual expenditures, and 38 percent of annual income (before taxes). We show the expenditures by local category in Table 2 (p. 16).

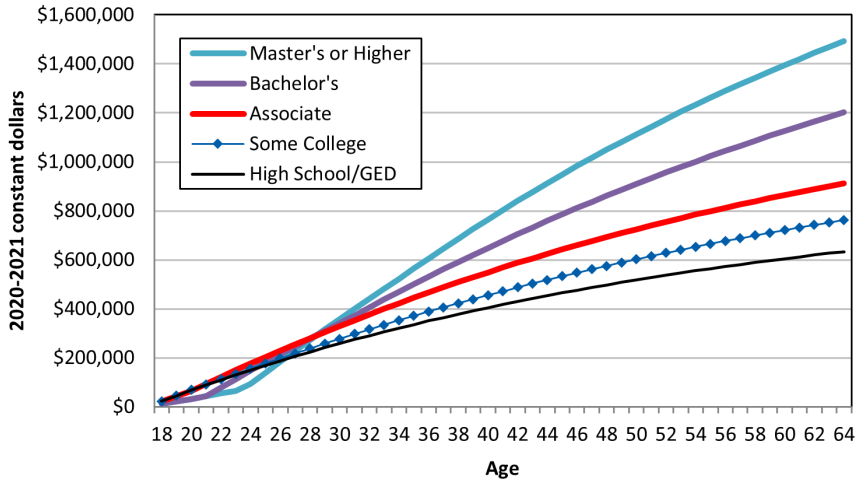
Using the 2023 Consumer Expenditure as a guide, we can estimate average expenditures by education level (Figure 11, p.16).[18] Local consumer spending is estimated to be 40 percent higher for a bachelor's degree holder when compared to someone with a high school diploma, holding other factors constant. Over the course of a working career, someone with a higher income will obviously have much greater spending power, even if they are spending a lower portion of their income. This spending power will contribute to the growth and development of the local economy.

Figure 8: Estimated Cumulative Lifetime Earnings, Kentucky, Age 18 to 64, by Educational Attainment
(Net Earnings After Higher Education Costs)



Source: Model-based estimates calculated by the Center for Business and Economic Research (CBER), Gatton College of Business and Economics, University of Kentucky, using U.S. Census, American Community Survey, 2021 and 2022 1-Year estimates, PUMS, using a 3 percent discount rate.

Figure 9: Estimated Cumulative Lifetime Earnings, Kentucky, Age 18 to 64, by Age and Education
(Net Earnings After Higher Education Costs)



Source: Model-based estimates calculated by the Center for Business and Economic Research (CBER), Gatton College of Business and Economics, University of Kentucky, using U.S. Census, American Community Survey, 2021 and 2022 1-Year estimates, PUMS, using a 3 percent discount rate.

Table 1: Key Factors and Other Assumptions for the 2015 Cohort

Credential Level	Time-to-Degree (Years)[1]	Net (out-of-pocket) Cost[2]	Opportunity Cost (Lost Earnings)[3]	Student Loan Interest[4]	Total Investment
Some College/Certificate	2	$16,000	$0	$2,035	$18,035
Associate	3	$27,100	$3,246	$4,450	$34,796
Bachelor's	4	$70,100	$47,057	$10,560	$127,717
Master's or Higher[5]	6.5	$114,000	$60,659	$24,370	$199,029

[1]Kentucky Postsecondary Education Data System (KPEDS); KYSTATS. Based on high school graduating class of 2015 to AY2022-2023. The time-to-degree is the median number of years for the 2015 cohort.

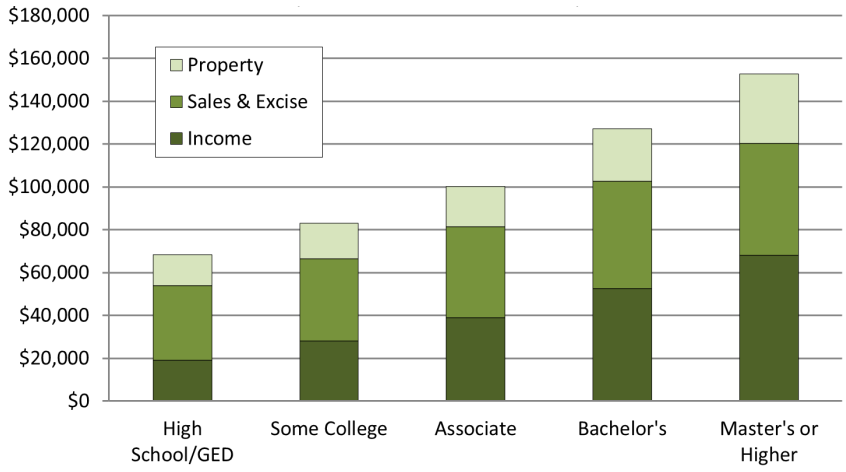
[2]Kentucky Postsecondary Education Data Center. Net (out-of-pocket) cost equals the median cost of attendance minus median grants and scholarships.

[3]Opportunity cost (lost earnings) reflect the change in wages while attending school. We assume all students have earnings while attending school. Numbers are estimated from the Kentucky High School Class of 2010 cohort that was used in *Higher Education's Return on Investment,* Kentucky Council on Postsecondary Education, January 2020. Figure 9. Median Opportunity Cost of Going to College (in Lost Wages), CPE ROI report, p. 16. The percentage differences between high school and other credentials are applied to our estimated salary and earnings numbers, using high school as the base.

[4]The median student loans for some college/certificate, Associate, and Baccalaureate are $5,500, $11,009, and $24,000 respectively. We assume 5% interest rates, with payments beginning upon graduation and spread over ten years.

[5]Master's or Higher estimates are estimated from Bachelor's degree data, except for median time to degree.

Figure 10: Estimated Cumulative Taxes Paid, Kentucky, Age 18 to 64, by Educational Attainment
(Derived from ITEP Estimates)



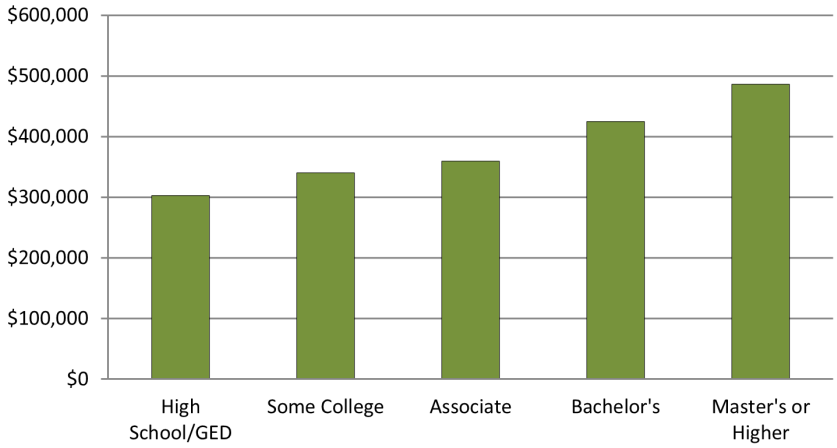
Source: Estimates calculated by the Center for Business and Economic Research (CBER), Gatton College of Business and Economics, University of Kentucky, using U.S. Census, American Community Survey, 2021 and 2022 1-Year estimates, PUMS; Institute on Taxation and Economic Policy (ITEP), Who Pays? 7th Edition

Table 2: Consumer Expenditures by Local Category, All Households, United States, 2023

Expenditure Category	Mean spending, all households	Share of local purchases
Housing (minus property taxes)	$21,728	62%
Utilities, fuel, and public services	$4,549	13%
Food away from home	$3,639	10%
Vehicle maintenance	$1,160	3%
Medical services	$1,184	3%
Personal care products and services	$866	2%
Entertainment fees and admission	$833	2%
Public transportation	$845	2%
Personal household services	$488	1%

Source: U.S. Bureau of Labor Statistics 2023 Consumer Expenditure Survey and What colleges do for local economies: A direct measure based on consumption, Brookings, Jonathan Rothwell, November 17, 2015.

Figure 11: Estimated Cumulative Lifetime Local Spending, Kentucky, Age 18 to 64, by Educational Attainment
(Spending Estimates Calculated as a Percentage of Earnings)



Source: Estimates calculated by the Center for Business and Economic Research (CBER), Gatton College of Business and Economics, University of Kentucky, using U.S. Bureau of Labor Statistics, 2023 Consumer Expenditure Survey data.

Other Benefits of Education

The benefits of higher education extend beyond higher incomes and include many other positive aspects, some of which with sizable financial implications. One study, for example, found that the monetary value of the return to education in terms of better health is worth as much as half of the return to education on earnings (Cutler and Lleras-Muney, 2006). Others have noted how the resulting productivity gains from education can boost gross domestic product, lower crime (Bollinger and Paris, Crime and Punishment and Education, 2015), reduce government spending on corrections (Trostel, 2008), and improve intergenerational economic outcomes, all of which have financial benefits (Blagg and Blom, 2018).

For illustrative purposes we provide six examples below by estimating the net and gross percentages for labor force participation, chronic disease risk behaviors, public assistance, teleworking, volunteerism, and voting. The "gross" numbers, explained in detail below, represent the overall percentages for everyone in that category. We can see, for example, labor force participation (Figure 12, p. 21) for those with a high school diploma is much lower (66%) than those with a graduate degree (89%). Those with graduate degrees are 1.3 times more likely to be in the labor force than those with high school diplomas.

Within each of the education groups, high school diploma, some college (no diploma), associate degree, bachelor's degree, and graduate degree, the individuals might be quite different from each other and only share membership in the group because of that one factor. That is, among those with a bachelor's degree there will be members from every income group, a mix of males and females, many ages, urban and rural residents, and all races and ethnicities. We call these the "gross" percentages. However, because so many factors are correlated—like income, education, race, sex, and location of residence—the gross differences do not reveal how much of a labor force participation difference, for example, is associated with education (because higher education leads to higher income), education (since lower income is correlated with lower education), or location of residence (since individuals in metro areas tend to have higher income and educational attainment).

To better understand the impact of education, it is necessary to isolate and estimate the "net" differences. Multiple regression analysis allows us to assess the independent or net association of education and labor force participation, for example. The net association is an estimate of how individuals differ along a single dimension while holding all other factors constant. For example, comparing two individuals with the same income, race, age, gender, and residence—but from different education groups—allows us to estimate the association between education and labor force participation.

The differences in the "net" percentages across education groups are significant and important. Someone with a bachelor's degree is more likely to participate in the labor force (78% v. 69%), less likely to engage in unhealthy behaviors (56% v. 73%), and twice as likely to volunteer (40% v. 20%), while holding other factors constant, when compared to someone with a high school diploma.

Labor Force Participation

While it is well known that a positive association exists between educational attainment and earnings for those who are in the labor market, an important part of how education impacts the economy is the labor force participation rate. Looking at labor force participation rates in 2023 for Kentucky, the graph below shows the clear relationship between educational attainment and labor force participation (Figure 12, p. 21).[19] These data illustrate a consistent rise in the labor force participation rates as education levels increase from a high school diploma to a bachelor's degree or higher for working-age adults who are 18 to 64 years old. The "gross" estimates (i.e., averages for the educational categories) show an 18 percentage-point increase in the estimated labor force participation rate in Kentucky from high school (66%) to bachelor's degree (84%). The "net" percentages reflect the estimated relationship between educational attainment and labor force participation while holding other factors constant, like sex, age, family income, race, ethnicity, urbanity, and marital status. The same upward trend of increasing labor force participation with higher levels of educational attainment is evident.[20] The variable used here indicates whether the respondent to the Current Population Survey (CPS) was a part of the labor force—working or seeking work—and, if so, whether the person was currently unemployed. In short, one can be employed or unemployed, and be part of the labor force.

Health

It is estimated that 90 percent of the nation's $4.5 trillion in annual health care expenditures is for people with chronic and mental health conditions, such as heart disease, cancer, stroke, diabetes, and arthritis. (U.S. Centers for Disease Control and Prevention, 2024). Much of the chronic disease is caused by four preventable health risk behaviors—lack of exercise, poor nutrition, smoking, and heavy alcohol consumption (U.S. Centers for Disease Control and Prevention, 2024). When compared to the U.S., as well as states that are widely considered to be Kentucky's competitors for economic development prospects, Kentuckians are more likely to smoke, be obese, and not engage in regular physical activity. However, higher levels of education are associated with healthier behaviors and lower rates of chronic diseases. While there might be some concern about reverse causality, the weight of the evidence supports the idea that increasing education improves health outcomes (Cutler and Lleras-Muney, 2006) (Ross and Wu, 1995). We analyzed data from the Behavioral Risk Factor Surveillance System (BRFSS) to explore these relationships. These data represent a comprehensive sample of Kentuckians and provide information on whether a person is at risk for chronic disease, evidenced by the four health risk behaviors. We consider someone to be at risk for chronic disease if they have one or more risk characteristics, such as smoking, obesity, lack of exercise, or heavy drinking. Our models control for other factors, such as race, ethnicity, sex, age, urbanity, marital status, and income, and estimate differences in chronic disease risk behaviors by education levels. For Kentucky, chronic disease risk behaviors decrease as education levels go up. Using net percentages as an example, the estimated chronic disease risk behaviors decline from 73 percent to 56 percent as educational attainment increases from a high school diploma to a college degree (Figure 13, p. 21).[21] Related to the health outcomes are mortality rates. Research shows that educational attainment is associated with increased life expectancy (Hummer and Hernandez, 2013).[22]

Public Assistance

In Kentucky, the percentage of high school graduates 18 to 64 years old receiving SNAP benefits (the Supplemental Nutrition Assistance Program previously known as Food Stamps), Medicaid health benefits, Supplemental Security Income (SSI), or public assistance income is 2.9 times higher than those with a bachelor's degree—38 percent compared to 13 percent (gross percentages). After controlling for age, marital status, sex, urbanity, race, and ethnicity, the relationship between education and receiving public assistance remains strong (net percentages). As illustrated in the bar chart (Figure 14, p. 22), a Kentucky high school graduate is estimated to be 2.6 times more likely to receive public assistance (37%) than someone with a bachelor's degree (14%).[23] Public assistance participation rates decline as education levels increase, translating into cost savings for the state (Ward, Weintraut, and Pisacreta, 2021) (Childress, Ward, and Pisacreta, 2023). Importantly, this relationship—higher levels of educational attainment associated with lower levels of public assistance program participation—holds across a range of public assistance programs including, of course, those described above, but not limited to these four programs. Research done, for example, by the College Board and RAND shows a robust relationship across several public assistance programs, such as the National School Lunch Program, Unemployment Insurance, and various housing programs. The savings for government can be significant. A study published in 2008 estimated that the public assistance savings for state and local governments (i.e., various public assistance programs, Medicaid, unemployment benefits) are $32,500 for an individual over a lifetime who completes college compared to a high school diploma (Trostel, 2008).

Telework

Social distancing policies, such as school closures and self-quarantine measures, were used during the pandemic to thwart the spread of disease. The efficacy of these approaches, however, is largely determined by the extent to which individuals adhere to it. The ability to work remotely can facilitate adherence to social distancing requirements with minimal financial pain for workers. The ability to telework is viewed as a vital factor in improving community resilience during natural disasters (Cutter, Boruff, and Shirley, 2003). The graph below shows how a college degree is related to the ability to telework (Figure 15, p. 22). For example, an individual in Kentucky with a high school diploma or GED is likely to have a lower likelihood of being able to telework (7%) compared to someone with a bachelor's degree (22%).[24] This is the estimated effect of education while holding many other factors constant, including marital status, sex, age, race, ethnicity, urbanity, and family income. These results are consistent with research published in the International Journal of Environmental Research and Public Health (Asfaw, 2022).

Volunteerism

Studies have linked participation in civil society, volunteering for example, to higher levels of community prosperity, higher achievement in schools, and improved individual health. Volunteers can tackle problems such as poverty, illiteracy, and drug abuse that public or private sectors have not adequately addressed, making a community more attractive for economic development. Some research even suggests that members of communities with high levels of civic participation enjoy better health and live longer. In Figure 16 (p. 23),

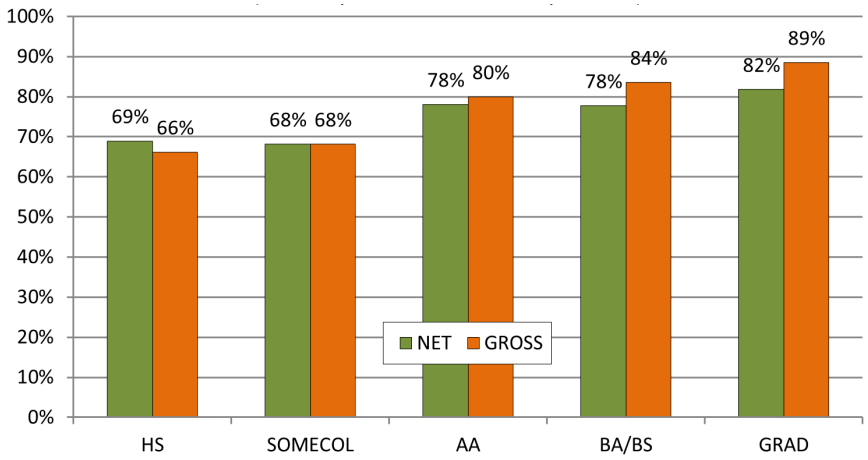
we present volunteer estimates for Kentucky for five broad education groups: individuals with a high school degree only, some college (but no degree), associate degree, bachelor's degree, and graduate degree. The net percentages reflect the association between education and volunteering while holding other factors constant, such as income, gender, race, urbanity, and age. There is a clear and consistent relationship between increasing education levels and higher rates of volunteerism. Individuals with a bachelor's degree volunteer at a significantly higher rate (78%) than those with a high school education (69%).[25] This is important given the social and economic benefits realized from volunteer activities (AmeriCorps, 2021).

Voting

Voting is a basic act of civic engagement and community involvement. Strong, resilient, and vibrant communities are created and nurtured by engaged and connected citizens. Many scholars have advanced the idea that strong community structures are beneficial to economic health (Coleman, 1990) (Putnam, 1993) (Fukuyama, 1995). Strong communities are important for many reasons, but the relationship between social capital—which the OECD defines as the "networks together with shared norms, values and understandings that facilitate co-operation within or among groups"—and economic growth is still being explored and studied. Pulling from the existing economic development literature, The World Bank notes that "development and growth specialists are uncovering the importance of social cohesion for societies to prosper economically and for development to be sustainable," while Rupasingha, et al. (Rupasingha, Goetz, and Freshwater, Social Capital And Economic Growth: A County-Level Analysis, 2000) (Rupasingha, Goetz, and Freshwater, The Production of Social Capital in US Counties, 2006) find that "social capital has a statistically significant, independent positive effect on the rate of per-capita income growth." Voting, which is an act of civic engagement that facilitates the growth of social capital, increases with higher levels of educational attainment, as evidenced in Figure 23. We estimate that in Kentucky the net association between education and voting would suggest that bachelor's degree holders (73%) would be 1.5 times more likely to vote than those with a high school diploma (49%), while holding other factors constant, such as marital status, sex, race, ethnicity, urbanity, age, and family income.[26]

Figure 12: Labor Force Participation by Educational Attainment, 2023

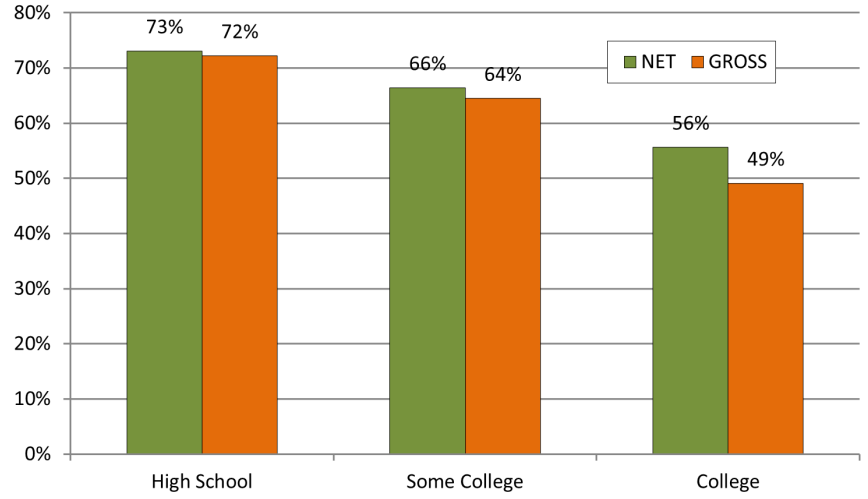
(Kentucky Estimates, 18 to 64 Years Old)



Source: Estimated by CBER using data courtesy of Sarah Flood, Miriam King, Renae Rodgers, Steven Ruggles, J. Robert Warren, Daniel Backman, Annie Chen, Grace Cooper, Stephanie Richards, Megan Schouweiler, and Michael Westberry. IPUMS CPS: Version 11.0 [CPS, Basic Monthly, Jan.-Dec. 2023]. Minneapolis, MN: IPUMS, 2023. https://doi.org/10.18128/D030.V11.0

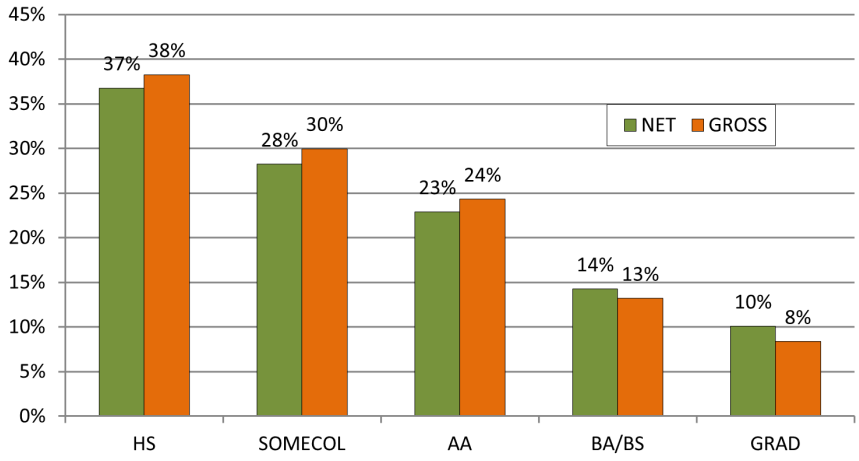
Figure 13: Chronic Disease Risk Behaviors by Educational Attainment, 2018-2022

(Kentucky Estimates, 18 to 64 Years Old)



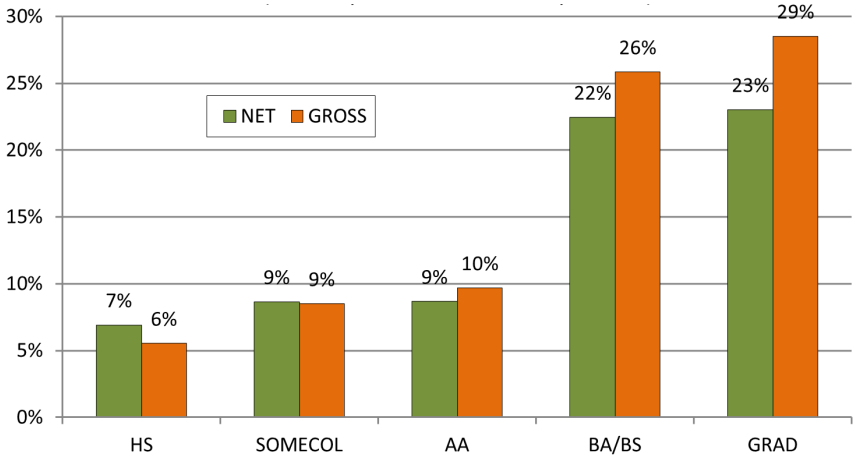
Source: Estimated by CBER using CDC Behavioral Risk Factor Surveillance System data, data pooled for 5 years.

Figure 14: Public Assistance by Educational Attainment, 2021-2022
(Kentucky Estimates, 18 to 64 Years Old)



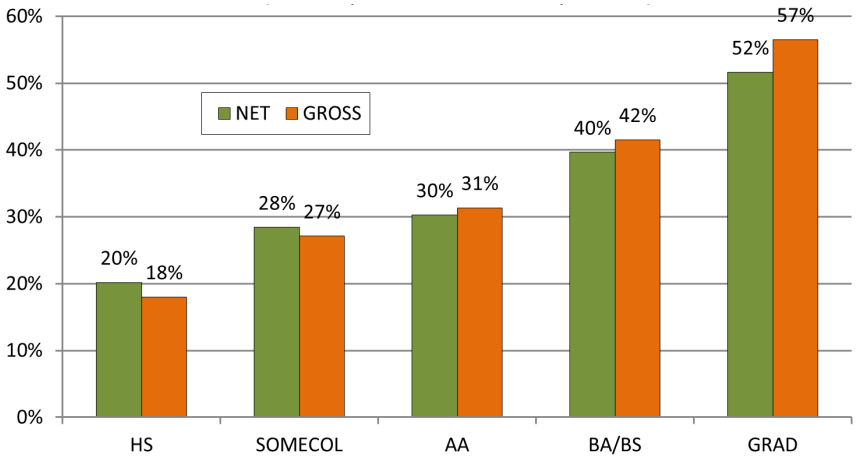
Source: Estimated by CBER using data courtesy of Steven Ruggles, Sarah Flood, Matthew Sobek, Daniel Backman, Annie Chen, Grace Cooper, Stephanie Richards, Renae Rodgers, and Megan Schouweiler. IPUMS USA: Version 15.0 [ACS 2021 & 2022]. Minneapolis, MN: IPUMS, 2024. https://doi.org/10.18128/D010.V15.0

Figure 15: Telework by Educational Attainment, 2022-2024
(Kentucky Estimates, 18 to 64 Years Old)



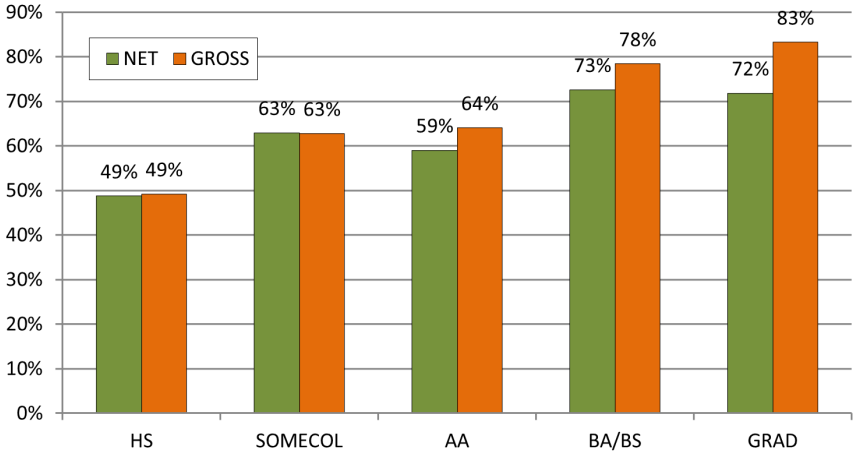
Source: Estimated by CBER using data courtesy of Sarah Flood, Miriam King, Renae Rodgers, Steven Ruggles, J. Robert Warren, Daniel Backman, Annie Chen, Grace Cooper, Stephanie Richards, Megan Schouweiler, and Michael Westberry. IPUMS CPS: Version 11.0 [CPS, Basic Monthly, October 2022 to March 2024]. Minneapolis, MN: IPUMS, 2023. https://doi.org/10.18128/D030.V11.0

Figure 16: Volunteerism by Educational Attainment, 2002-2021
(Kentucky Estimates, 18 to 64 Years Old)



Source: Estimated by CBER using data courtesy of Sarah Flood, Miriam King, Renae Rodgers, Steven Ruggles, J. Robert Warren and Michael Westberry. Integrated Public Use Microdata Series, Current Population Survey: Version 10.0 [Volunteer Supplement Survey, 2002 to 2021]. Minneapolis, MN: IPUMS, 2022. https://doi.org/10.18128/D030.V10.0

Figure 17: Voting by Educational Attainment, 1982-2022
(Kentucky Estimates, 18 to 64 Years Old)



Source: Estimated by CBER using data courtesy of Sarah Flood, Miriam King, Renae Rodgers, Steven Ruggles, J. Robert Warren, Daniel Backman, Annie Chen, Grace Cooper, Stephanie Richards, Megan Schouweiler, and Michael Westberry. IPUMS CPS: Version 11.0 [Voting and Registration Supplement, 1982 to 2022]. Minneapolis, MN: IPUMS, 2023. https://doi.org/10.18128/D030.V11.0

Return on Investment

Clearly, higher levels of education are associated with many positive outcomes, some of which we have analyzed and presented in this report. In this section we explore whether the returns on these investments are positive. The research in this area suggests that governmental investments in higher education pay dividends. A study done by the Federal Reserve Bank of Boston, for example, estimated that the government investment in college students results in a 10.3 percent average annual real internal rate of return (Trostel, 2008).[27]

For our analysis, we leverage data on a subset of the Kentucky public high school graduating class of 2015. We examine those who pursued higher education at Kentucky's *public* institutions as well as the state's educational investments in them from 2015 to the 2022-23 academic year. The results show a positive return on investment. We estimate the financial return from state and local tax revenue to be around four-and-a-half times greater than the initial state investment, and the local economic impact is about seventeen times greater. These returns, moreover, represent a conservative estimate since they do not include the financial benefits of better health outcomes, enhanced labor productivity, lower utilization of government social services, higher civic and community engagement, a reduction in the crime rate, or an economic multiplier effect.

Each high school graduating class is different. The differences can include the percentage who attend college, whether they work while attending school, and how long it takes them to complete a degree or credential. We use the class of 2015 because it is the most recent cohort with eight years of data after high school. We would expect slightly different results from our analysis if we used a different cohort, although we would be surprised by any major differences. But because cohorts differ from year to year, the returns on investment could also vary.

Each high school graduating class is different. There were 44,032 Kentucky public high school graduates in 2015.[28] Of this population, some are high school graduates only (11,398), several have some college experience (18,115), a few earned a postsecondary certificate or diploma (1,513), nearly double that number earned an associate degree (2,701), and a significant number earned a bachelor's degree or higher (10,305). Of the individuals who pursued postsecondary education (32,634), around 75 percent of them attended a public university in Kentucky (24,427).[29] It is the 75 percent who attended an in-state public institution who comprise our cohort case study.

Investments in the cohort

Using data supplied by the Kentucky Council on Postsecondary education (see Appendix B), we estimate that $569 million was invested by the Commonwealth in this cohort from 2015 to the 2022-2023 academic year. This includes general fund appropriations as well as financial aid (i.e., CAP and KEES). These numbers are presented by credentials in Table 3 (p. 25).

Returns from the cohort

The returns in the form of state and local tax revenue (Figure 10, p. 15) are a factor of 4.3 to 4.8 higher, depending on whether a 3 percent or 2.5 percent discount rate is used, respectively.[30] We estimate the cumulative taxes paid by someone with a bachelor's degree, for instance, to be just over $127,000. We multiply this lifetime total by the size of the bachelor's degree holders in the 2015 cohort (7,043) and get $895 million. This is repeated for the other educational categories, and we get a total of $2.445 billion (Table 4, p. 26).[31] For example, assuming a 3 percent discount rate, the state's investment of $569 million would translate into $2.445 billion over the span of the cohort's working lifetime, a ratio of 4.3 greater (Figure 18, p. 26).

Likewise, the returns to the local economy are quite substantial. The increase in consumer spending for local purchases (Figure 11, p. 16) is a factor of 16 to almost 18 times higher than the state investment depending upon the discount rate, and this does not include an economic multiplier, or other ways education can boost the economy, such as increased entrepreneurship or innovation. These numbers are shown in Table 4 (p. 26). We categorize spending into either local or non-local, but only use local spending for our estimated ratio. Across all the higher education categories, from some college/certificate to master's or higher, total local spending is equal to $9.086 billion (Table 4, p. 26; Figure 11, p. 16; and Figure 18, p. 26).[32]

Table 3: High School Class of 2015 Study Cohort
(Millions $s)

Credential Level	Total Net General Fund Investment[1]	Total CAP & KEES Investment	Median Time-to-Degree	Student Cohort Size	Total State Investment
Some College[2]	$168.8	$34.6	2	12,938	$203.4
Certificate/Diploma	$11.7	$2.9	1.5	1,185	$14.6
Associate	$44.7	$13.1	3	2,307	$57.8
Bachelor's	$180.2	$64.6	4	7,043	$244.8
Graduate	$39.0	$9.3	6.5	954	$48.3
Total	**$444.4**	**$124.5**	**-**	**24,427**	**$568.9**

*This cohort is restricted to students within KPEDS attending a public postsecondary institution with a Kentucky high school documented. Students are included from the years 2015 to the 2022-2023 academic year.

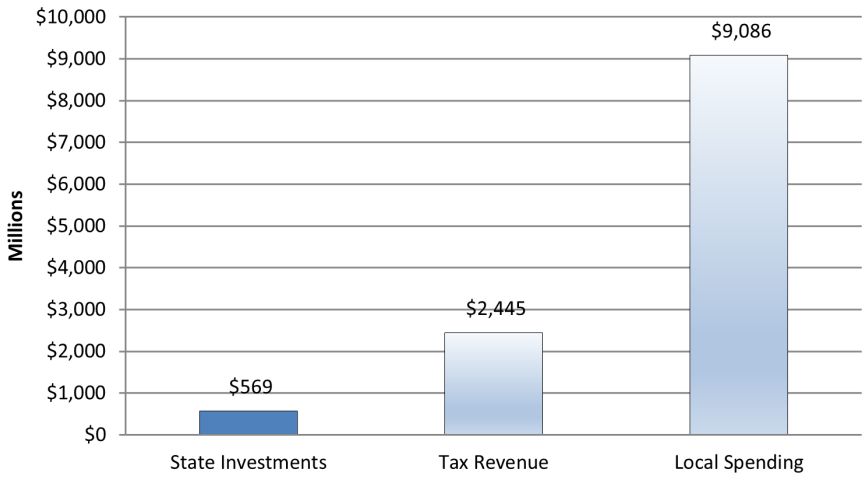
[1]The total net general fund investment is calculated from the tables in Appendix B, which are presented in nominal dollars, but we convert them to 2020-2021 constant dollars. Net General Fund appropriations are defined as total General Fund appropriations minus debt service and any appropriations to support the UofL Hospital Contract.

[2]The two categories of "some college" and "certificate/diploma" are combined into a single group for our ROI analysis, which we refer to as "some college/certificate."

Note: The figures here are calculated using the three tables in Appendix B.

Sources: Appropriations data, Council on Postsecondary Education, Budget and Finance Unit; FTE Student Enrollment Data, Council on Postsecondary Education, Data and Advanced Analytics Unit.

Figure 18: Selected Higher Education Investments and Selected Returns Associated with the Class of 2015



Source: Estimates calculated by the Center for Business and Economic Research (CBER), Gatton College of Business and Economics, University of Kentucky, using a 3 percent discount rate for present value.

Table 4: Estimated Cumulative Working Lifetime Totals
(Ages 18 to 64, Per Person, Unless Otherwise Noted)

Category	High School	Some College, Certificate	Associate Degree	Bachelor's Degree	Master's or Higher
Earned Income[1]	$633,443	$762,333	$911,812	$1,201,517	$1,492,034
Local Spending	$302,459	$339,982	$359,317	$424,799	$485,829
Non-local spending	$285,335	$333,841	$380,948	$473,925	$550,438
Income Tax	$19,003	$28,147	$38,906	$52,625	$68,139
Sales & Excise Tax	$34,839	$38,405	$42,522	$50,047	$52,354
Property Tax	$14,569	$16,503	$18,678	$24,394	$32,252
Total Tax Revenue	$68,412	$83,054	$100,106	$127,067	$152,744
Cohort Size (students)	11,398	14,123	2,307	7,043	954
Total Tax Revenue (millions)[2]	$780	$1,173	$231	$895	$146
Total Local Spending (millions)[3]	$3,447	$4,802	$829	$2,992	$463
State Investments (millions)[4]	$0	$218.0	$57.8	$244.8	$48.2

[1]This is the net total after the cost of higher education, including net out-of-pocket, opportunity costs, and student loan interest.

[2]The total of some college, certificate, associate degree, bachelor's degree, and master's or higher is $2.445 billion. High school numbers are not included.

[3]Total local spending across all higher education categories is $9.086 billion.

[4]The total state investment of $568.8 million include general fund appropriations, CAP, and KEES funds.

Conclusions

This study does not attempt to provide a comprehensive accounting of the returns to the state resulting from postsecondary education investments. We have not included, for example, the government savings from lower public welfare and Medicaid expenditures (Ward, Weintraut, and Pisacreta, 2021) (Bollinger, Moving People Off Public Assistance Programs Through Education, 2015) (Bollinger, Impact of Education on Medicaid Eligibility, 2015), the likely lower public safety and corrections expenditures resulting from a reduction in criminal behavior (Bollinger and Paris, Crime and Punishment and Education, 2015), or the lower health care costs and higher economic growth that would likely result from better health outcomes (Cutler and Lleras-Muney, 2006), longer life expectancy, and higher labor force participation rates. Moreover, we have not monetized any number of additional public or social benefits associated with higher levels of education, such as increased volunteerism, civic participation, or voting. Instead, our conservative estimates suggest a lower-bound floor on the returns the state might expect for its investments in postsecondary education. These returns, even though modest in scope, far exceed the initial state investments.

Endnotes

1. There are twelve states that are viewed as Kentucky's primary competitors for economic development prospects: Alabama, Georgia, Illinois, Indiana, Mississippi, Missouri, North Carolina, Ohio, South Carolina, Tennessee, Virginia, and West Virginia.

2. Some of this growth could have been fueled by in-migration of more educated workers.

3. We include these educational categories in some postsecondary education: some college, no degree; postsecondary nondegree award; associate degree; bachelor's degree; master's degree; and doctoral or professional degree.

4. State general fund appropriations are an important component of higher education funding and constitute about 40 percent of state expenditures for higher education nationally. Federal funds (13.4%), bonds (2.2%), and other state funds (44.5%), such as tuition and fees, are the other major categories. Kentucky relies less on general funds (12.4%), about the same on federal funds (11.8%), and much more on other state funds (75.8%) compared to the U.S., in FY2023 bonds are zero for Kentucky. These percentages are from the 2023 State Expenditure Report, National Association of State Budget Officers (NASBO), pages 30-33, available online at <https://www.nasbo.org/reports-data/state-expenditure-report>.

5. When examining state and local government expenditures for higher education nationally, 85 percent are from state government and 15 percent are from local government (U.S. Census Bureau, 2021 State and Local Government Finance). In 2021 over half of the states, twenty-nine in total, shared funding responsibilities for higher education with their local governments, but Kentucky is not one of them.

6. Higher education expenditures (U.S. Census Bureau, 2021 State and Local Government Finance) include a broad array of expenditures, such as capital construction from all sources and federal transfers. From 1997 to 2007, Kentucky's higher education expenditures as a percentage of gross domestic product were 1.78 percent, compared to 1.46 percent for the competitor states and 1.37 for the U.S.

7. Education appropriations net of federal stimulus (State Higher Education Finance or SHEF) are comprised of state and local support available for public higher education operating expenses excluding research, hospitals, and medical education net of federal stimulus funding. Calculation: Education Appropriations Net of Federal Stimulus = Education Appropriations – Public Federal Stimulus, <https://shef.sheeo.org/data-definitions/>.

8. The recession officially began in December of 2007, but its impact on funding was not felt until 2008.

9. State and local total support (State Higher Education Finance, 2023) is a broad measure of how much money the state provides to support all higher education. This measure does not include any sums for capital outlays and debt service, or sums derived from federal sources (unless otherwise noted), student tuition and fees, or auxiliary enterprises. State and local support consists of state tax appropriations and local tax support plus additional non-tax funds (e.g., lottery revenue) that support or benefit higher education, and funds appropriated to other state entities for specific higher education expenditures or benefits (e.g., employee fringe benefits disbursed by the state treasurer). Federal stimulus funds are excluded from these totals. Calculation: State and Local Support = Tax Appropriations + Non-Tax Support + Non- Appropriated Support + Endowment + Previous Appropriations + Other Support – Return Appropriations – Multiyear Appropriations - Total Federal Stimulus + Local Appropriations, <https://shef.sheeo.org/data-definitions/>.

10. Unfortunately, we do not have State and Local Government Finance data for 2022 and 2023 that would allow us to gauge whether higher education expenditures as a percentage of gross domestic product changed in a similar fashion.

11. The quote, "unambiguously indicate that most, if not all, of the wage premium is caused by going to college," is from Levine and Pardue, 2024.

12. OMB guidance suggests a 2.5 percent discount rate, but we use 3 percent, a more conservative estimate for the results in Figure 8. See the guidance memo at https://www.whitehouse.gov/wp-content/uploads/2023/12/CircularA-94AppendixC.pdf.

13. Earnings are estimated using a multiple regression model utilizing various demographic variables from the U.S. Census Bureau, American Community Survey (2021 and 2022 1-year PUMS datasets pooled). The dependent variable is Total Personal Income (INCEARN), which reports income earned from wages or a person's own business or farm for the previous year; therefore, our income data are from 2020 and 2021. The variables include age, marital status, race, ethnicity, education (dichotomous), interaction terms to capture the difference in income growth over time by education credential, location of residence, and survey year. The model results are presented in Appendix A. We pooled the data to increase the sample size and performed our analysis on the samples separately to test for differences. The only coefficient that was statistically different between years was sex. Men demonstrated statistically significantly higher earnings, ceteris paribus, in 2021 compared to 2020 (for ACS samples 2022 and 2021, respectively).

14. ITEP tax incidence state-level distributional incidence tables are expressed as a share of family income, but our estimates are for personal income. In our sample, family income (FTOTINC) and personal income (INCEARN) are highly correlated (Pearson's r=0.63). To test the association between family and personal income, while holding other factors constant, we use a slightly modified regression model that is based on our personal income model; we use FTOTINC as the dependent variable and include INCEARN as an independent variable along with other variables like education, marital status, location of residence, age, race, sex, ethnicity, and year. The INCEARN coefficient is nearly 1.0 (0.99468) and is highly significant (t=156.2). As a result, we use modified income distributions that more accurately reflect our personal income-based sample to estimate the ITEP tax incidence distributions.

15. TAXSIM, for example, offers an alternative method for estimating state income taxes (Bollinger, How to Raise State Revenue without Raising Taxes, 2015), and generates a total across all educational credentials that is about 11 percent higher than the ITEP method. Similarly, others have used the U.S. Census Consumer Expenditure Survey to generate sales tax estimates (Rothwell, 2015), which is nearly 17 percent higher than the ITEP method. Finally, one can use a simple effective tax rate for estimating property taxes, and when we use this method, we arrive at a total that is almost 30 percent higher than the number estimated using the ITEP approach. The ITEP totals are lower across the three types of taxes, and therefore a more conservative approach.

16. U.S. Bureau of Labor Statistics, Consumer Expenditure Surveys, available online at: <https://www.bls.gov/cex/>.

17. Not all services are included. For example, education, health insurance, life insurance services and a few others are grouped with the purchase of goods.

18. The Consumer Expenditure Survey does not publish state-level estimates, so we use the U.S. (not the regional) results as a proxy for Kentucky.

19. LABFORCE is a dichotomous variable indicating whether the respondent participated in the labor force during the preceding week. See EMPSTAT for a more detailed employment status variable. Those coded as "yes" in LABFORCE were either: were at work; held a job but were temporarily absent from work due to factors like vacation or illness; were seeking work; or were temporarily laid off from a job during the reference period. Because the CPS is designed to measure unemployment in the civilian population, the original dichotomous employment status variable in the survey classifies members of the armed forces as NIU (Not in universe).

20. The labor force participation net percentage differences between high school (69%) and those with an associate degree (78%), bachelor's degree (78%), or graduate degree (82%) are all statistically significant. Likewise, the gross percentages for AA, BA/BS, and GRAD are statistically different from HS.

21. The chronic disease risk behavior net percentage differences between high school (73%) and those with some college (66%) or college (56%) are all statistically significant. The gross percentages for some college and college are statistically different from high school as well.

22. Longer life expectancy can increase government spending, but this is mostly at the federal level (Social Security and Medicare).

23. The public assistance recipient net percentage differences between high school (37%) and those with some college (28%), associate degree (23%), bachelor's degree (14%), or graduate degree (10%) are all statistically significant. The gross percentages for SOMECOL, AA, BA/BS, and GRAD are also statistically different from HS.

24. The teleworking net percentage differences between high school (7%) and those with a bachelor's degree (22%) or graduate degree (23%) are statistically significant. The gross percentages for SOMECOL, AA, BA/BS, and GRAD are statistically different from HS.

25. The volunteerism net percentage differences between high school (20%) and those with some college (28%), associate degree (30%), bachelor's degree (40%), or graduate degree (52%) are all statistically significant. The gross percentages for SOMECOL, AA, BA/BS, and GRAD are also statistically different from HS.

26. The voting net percentage differences between high school (49%) and those with some college (63%), associate degree (59%), bachelor's degree (73%), or graduate degree (72%) are all statistically significant. The gross percentages for SOMECOL, AA, BA/BS, and GRAD are also statistically different from HS.

27. Trostel examines all government investment, which includes federal, state, and local.

28. 2022 Life Outcomes for 2015 Kentucky Public High School Graduates <https://kystats.ky.gov/Latest/LifeOutcomes>.

29. The unaccounted-for students could have attended a private school in Kentucky or an institution, public or private, outside the state. Consequently, they would not have been included in the Kentucky Postsecondary Education Data System (KPEDS).

30. Current OMB guidance recommends a 2.5 percent discount rate, but 3 percent is slightly more conservative.

31. The $2.445 billion = (some college + certificate students = 14,123 * per person taxes of $83,054) + (2,307 associate degree holders * per person taxes of $100,106) + (7,043 bachelor's degree holders * per person taxes of $127,067) + (954 master's degree or higher * $152,744) or (some college/certificate students $1,173 million) + (associate degree holders $231 million) + (bachelor's degree $895 million) + (master's degree or higher $146 million) = $2.445 billion. One can find the student cohort size numbers in Appendix B, as well as Table 4.

32. The $9.086 billion = ((some college + certificate students = 14,123 * per person local spending of $339,982) + (2,307 associate degree holders * per person local spending of $359,317) + (7,043 bachelor's degree holders * per person local spending of $424,799) + (954 master's degree or higher * $485,829) or (some college/certificate students $4,802 million) + (associate degree holders $829 million) + (bachelor's degree $2,992 million) + (master's degree or higher $463 million) = $9.086 billion.

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Appendix A

INCEARN REGRESSION MODEL, 18 to 64
(parameter estimates)

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	-6966224	834345	-8.35	<.0001
AGE	Age	1	-26.84372	44.42	-0.6	0.5456
MARRIED	Dichotomous (Married=1)	1	14189	443.74	31.98	<.0001
GENDER	Dichotomous (Male=1)	1	20072	414.13	48.47	<.0001
WHTNONHISP	Dichotomous (white non-Hispanic=1)	1	3941.79	876.23	4.5	<.0001
BLKNONHISP	Dichotomous (Black non-Hispanic=1)	1	-2398.81	1132.38	-2.12	0.0341
HISPANIC	Dichotomous (Hispanic=1)	1	930.92	1335.54	0.7	0.4858
HS_D	Dichotomous (High School only=1)	1	4548.23	2240.97	2.03	0.0424
SC_D	Dichotomous (Some College=1)	1	1896.48	2339.38	0.81	0.4176
AA_D	Dichotomous (associate degree=1)	1	10796	3078.13	3.51	0.0005
BACH_D	Dichotomous (bachelor's degree=1)	1	10752	2620.84	4.1	<.0001
GRAD_D	Dichotomous (master's or higher=1)	1	29139	3340.00	8.72	<.0001
AGEHS	Interaction term (Age*HS_D)	1	112.62	50.71	2.22	0.0264
AGESC	Interaction term (Age*SC_D)	1	336.77	54.01	6.24	<.0001
AGEAA	Interaction term (Age*AA_D)	1	287.13	69.72	4.12	<.0001
AGEBA	Interaction term (Age*BACH_D)	1	708.06	60.20	11.76	<.0001
AGEGRAD	Interaction term (Age*GRAD_D)	1	733.64	74.20	9.89	<.0001
NOTMETRO	Dichotomous (Not in metropolitan area=1)	1	-6858.97	568.46	-12.07	<.0001
METROCITY	Dichotomous (Metropolitan status: In central/principal city=1)	1	4092.01	833.41	4.91	<.0001
METRONOTCITY	Dichotomous (Metropolitan status: Not in central/principal city=1)	1	8113.82	713.98	11.36	<.0001
METROMIXED	Dichotomous (Metropolitan status: Central/principal city status indeterminable=1)	1	5477.27	555.83	9.85	<.0001
YEAR	Census year	1	3443.84	412.73	8.34	<.0001

INCEARN REGRESSION MODEL, 18 to 64
(parameter estimates)

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	-6966224	834345	-8.35	<.0001
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GENDER	Dichotomous (Male=1)	1	20072	414.13	48.47	<.0001
WHTNONHISP	Dichotomous (white non-Hispanic=1)	1	3941.79	876.23	4.5	<.0001
BLKNONHISP	Dichotomous (Black non-Hispanic=1)	1	-2398.81	1132.38	-2.12	0.0341
HISPANIC	Dichotomous (Hispanic=1)	1	930.92	1335.54	0.7	0.4858
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METROCITY	Dichotomous (Metropolitan status: In central/principal city=1)	1	4092.01	833.41	4.91	<.0001
METRONOTCITY	Dichotomous (Metropolitan status: Not in central/principal city=1)	1	8113.82	713.98	11.36	<.0001
METROMIXED	Dichotomous (Metropolitan status: Central/principal city status indeterminable=1)	1	5477.27	555.83	9.85	<.0001
YEAR	Census year	1	3443.84	412.73	8.34	<.0001

Appendix B

Updated Time to Degree/Credential Completion for High School Class of 2015		
Credential Level	**Median Time-to-Degree**	**Student Cohort Size**
Some College	2	12,938
Ceritifcate/Diploma	1.5	1,185
Associate	3	2,307
Bachelor's	4	7,043
Graduate	6.5	954

*Counts restricted to students within KPEDS attending a public postsecondary institution with a Kentucky high school documented.

Source: Kentucky Postsecondary Education Data System (KPEDS); KYSTATS.

Net General Fund Appropriations in Nominal Dollars, AY 2015-16 to AY 2022-23			
Year	**Net General Fund Appropriation**	**Fall Semester FTE Enrollment**	**Net GF Per FTE**
2015-16	914,865,500.00	152,488.92	6,000.00
2016-17	879,380,900.00	150,381.38	5,848.00
2017-18	878,077,100.00	147,789.60	5,941.00
2018-19	861,645,300.00	145,369.56	5,927.00
2019-20	860,852,700.00	143,933.66	5,981.00
2020-21*	846,417,000.00	141,141.35	5,997.00
2021-22	911,873,800.00	137,350.37	6,639.00
2022-23**	1,014,163,000.00	139,103.81	7,291.00

Notes:

*enacted appropriation

**FY21 figures include a reduction of $20,000,000 to enacted net General Fund appropriations as a result of a $40,000,000 total fund swap using federal Coronavirus

Net General Fund appropriations are defined as total General Fund appropriations minus debt service and any appropriations to support the UofL

FTE = (undergraduate student credit hours/15) + (graduate SCH/12) + (law SCH/12) + (headcount of medical,

Sources: Appropriations data, Council on Postsecondary Education, Budget and Finance Unit; FTE Student Enrollment Data, Council on Postsecondary

Updated CAP and KEES - High School Class of 2015						
Credential Level	**Student Cohort Size**	**Sum of KEES**	**Sum of CAPS**	**Average KEES**	**Average CAP**	**Avg. CAP and KEES**
Some College	12,938	18,121,149	16,452,981	1,400.61	1,271.68	2,672.29
Ceritifcate/Diploma	1,185	1,152,236	1,710,145	972.35	1,443.16	2,415.51
Associate	2,307	7,366,436	5,707,618	3,193.08	2,474.04	5,667.12
Bachelor's	7,043	49,615,414	14,935,403	7,044.64	2,120.60	9,165.24
Graduate	954	7,659,720	1,603,511	8,029.06	1,680.83	9,709.89

*Counts restricted to students within KPEDS attending a public postsecondary institution with a Kentucky high school documented.

Source: Kentucky Postsecondary Education Data System (KPEDS); KYSTATS.

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