

The Financial Value of a Higher Education

By Mark Kantrowitz

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Five years have passed since the U.S. Census Bureau published synthetic estimates of work-life earnings by educational attainment. This paper updates those figures with the most recent data from the U.S. Census Bureau's annual Current Population Surveys, and adds net present value analysis of the financial benefit of a college degree to the individual and to the federal government. The added value of a bachelor's degree over a high school diploma or GED has increased to \$1.2 million in 2005 from \$910,000 in 1997-1999. Compared with the average out-of-pocket costs of a college education, this represents a return on investment in excess of 27%. The added value also corresponds to an additional \$133,000 in cumulative federal income tax revenue. Accordingly, it would be financially worthwhile for the federal government to replace loans with grants in the financial aid packages of low income students if this yielded at least a 32% increase in the number of low income students graduating with bachelor's degrees.

College graduates earn more money than workers with just a high school diploma. In fact, earnings increase with educational attainment, so there is a clear financial benefit to obtaining a higher education. This paper quantifies that financial benefit.

The U.S. Census Bureau published a report in July 2002 that contained *synthetic estimates* of work-life earnings by educational attainment using earnings data from 1997, 1998, and 1999 (Cheeseman Day & Newburger, 2002). Synthetic work-life earnings estimates calculate an average based on a cross-section of annual earnings data by age, as opposed to following a single cohort from the start of the work-life (age 25) to the end (age 64). It estimated that full-time year-round workers with a bachelor's degree would earn nearly \$1 million more than individuals with just a high school diploma or GED. Individuals with a doctoral degree earned \$1.3 million more than bachelor's degree recipients, and professional degree recipients earned \$1 million more than doctoral degree recipients. The 2002 report updated a 1983 report (U.S. Census Bureau, 1983) based on 1979 data and earlier reports that also demonstrated a financial advantage to a college education based on the number of years of school completed (Weitzman, Ono, & Henson, 1968; Henson, Ono, & Thomas, 1970; Henson, Ono, & Thomas, 1974; Salvo & McNeil, 1984).

This article uses a similar methodology for computing synthetic work-life estimates by educational attainment using

2005 mean income data from the 2006 Current Population Survey as published in March 2007 (U.S. Census Bureau, 2007). Mean was used instead of median for comparability with the Census Bureau report's results and because means are better suited for computing return on investment for the population as a whole. The added value of a bachelor's degree over a high school diploma has increased to \$1.2 million, a doctoral degree over a bachelor's degree to \$1.7 million, and a professional degree over a doctoral degree to \$1.2 million, as illustrated in Table 1.

Table 1
Financial Advantage of a College Degree (in Current Dollars)

Financial Advantage	1997-1999	2003-2005	2005
Bachelor's Degree vs. High School Graduate	\$914,289	\$1,181,903	\$1,210,760
Doctoral Degree vs. Bachelor's Degree	\$1,299,137	\$1,742,759	\$1,707,280
Professional Degree vs. Doctoral Degree	\$971,541	\$1,105,585	\$1,163,320

Note. 1997-1999 figures are in constant 1999 dollars; other figures are in constant 2005 dollars. Adjusting the 1997-1999 figures for inflation to obtain constant 2005 dollars would require increasing the figures by 17.2%.

The methodology calculates a current cross-sectional sum of mean annual income figures for full-time year-round workers ages 25 to 64. Since the income data is clustered into 10-year age cohorts (ages 25–34, 35–44, 45–54, and 55–64), it multiplies each cohort's average by 10 before computing the sum. The 2003–2005 column in Table 1 presents an average of three years of data, with the 2003 and 2004 figures adjusted by the Consumer Price Index (CPI-U) to yield constant 2005 dollars, thereby smoothing out some of the year-over-year volatility in the annual figures. This corresponds to the 1997–1999 averages reported in the U.S. Census Bureau's July 2002 report.

Since the methodology substitutes a cross-sectional sum for a retrospective or prospective case-control analysis, it does not include future salary growth or inflationary adjustments corresponding to an individual's actual earnings trajectory through the various age cohorts. Other limitations include:

- There may be significant variation in lifetime income due to choice of college major or profession.
- The assumption of a 40-year work life does not consider the potentially longer work-life for workers who do not pursue a college education.
- The methodology fails to consider the impact of mortality on work-life and the increases in life expectancy associated with a higher education.
- The use of full-time year-round earnings data assumes no interruption of the participation in the work-force.

- The methodology uses mean earnings as opposed to median earnings.

Figure 1 illustrates how mean work-life earnings increase with educational level. The financial advantage of a bachelor's degree recipient over a high school graduate grew in part because work-life earnings for college graduates grew at a faster rate than the work-life earnings for individuals without a college degree.

Figure 1
Synthetic Work-Life Earnings Estimates
for Full-Time Year-Round Workers by Educational Attainment, 2005

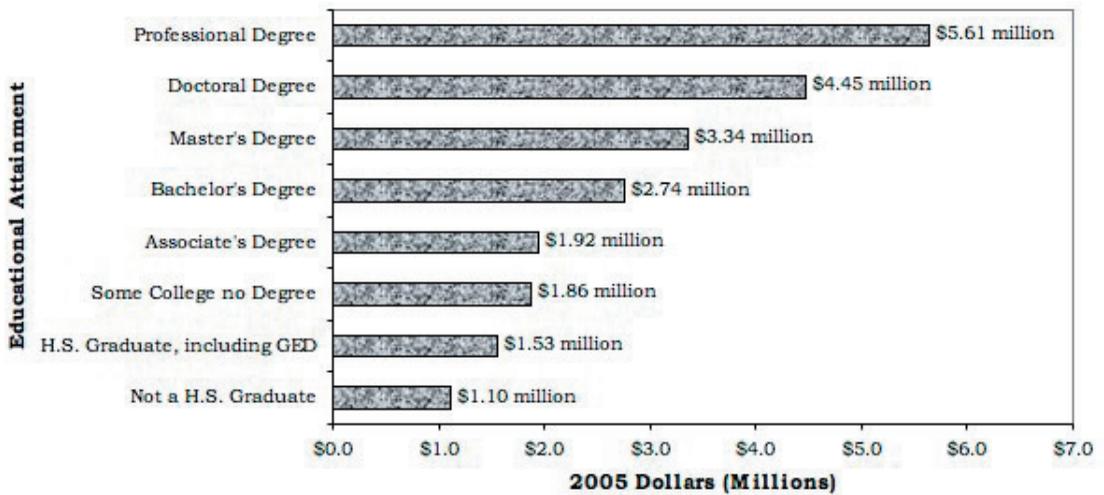
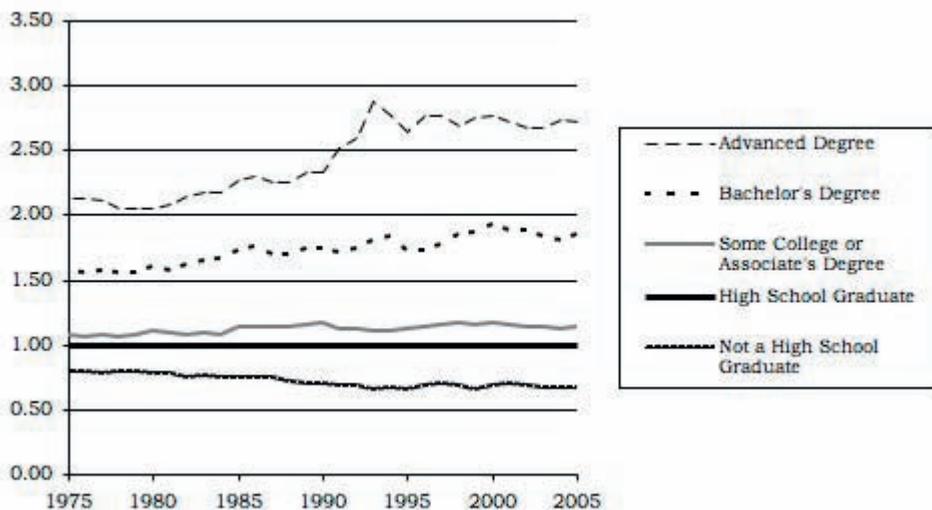


Figure 2
Ratio of Average Earnings of Full-Time Year-Round Workers to
Average Earnings of High School Graduates
by Educational Attainment, 1975–2005



**Estimate of
Work-Life Federal
Income Tax
Revenue**

Figure 2 demonstrates the historical growth in the difference in average annual earnings for workers age 18 and above. In 2005, bachelor’s degree recipients earned 1.86 times the average earnings for high school graduates and advanced degree recipients earned 2.71 times the average earnings for high school graduates. This compares with 1.86 and 2.76 in 1999, respectively.

Using IRS statistics of income data, it is possible to calculate the average federal income tax as a percentage of AGI, as illustrated in Table 2.

**Table 2
Average Tax as Percentage of AGI**

AGI Range	Tax as a Percentage of AGI
\$10,000 to \$15,000	3.53%
\$15,000 to \$20,000	4.86%
\$20,000 to \$25,000	5.93%
\$25,000 to \$30,000	6.65%
\$30,000 to \$40,000	7.21%
\$40,000 to \$50,000	8.00%
\$50,000 to \$75,000	8.71%
\$75,000 to \$100,000	9.90%
\$100,000 to \$200,000	13.62%

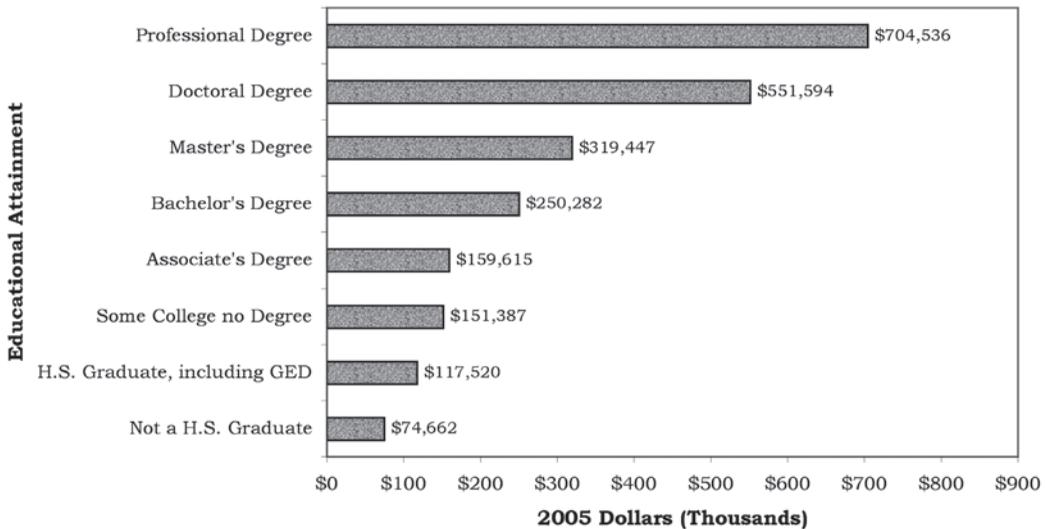
Combining these flat tax rates with the synthetic work-life earnings estimates yields estimates of work-life federal income tax revenue by educational attainment. Figure 3 shows that the federal government earns \$132,762 more in work-life income tax revenue for a bachelor’s degree recipient as compared with a high school graduate. Doctoral degree recipients yield \$301,312 more in income tax revenue than bachelor’s degree recipients, and professional degree recipients yield \$152,942 more than doctoral degree recipients.

**Net Present Value
Analysis**

Net Present Value (NPV) analysis calculates the current equivalent value of a future stream of values. It represents the amount a disinterested investor would be willing to pay in exchange for the asset that produced those values. While it may sound impressive to talk about a million dollars in additional lifetime earnings, one must recognize that future dollars are worth less than current dollars. Net present value often uses a risk-free rate of return as the discount rate, such as the interest rate on U.S. Treasury bills. This yields the amount which would need to be invested now to yield the future stream of values.

This paper uses a discount rate of 4.812%, based on the 30-year Treasury Bond auction of February 8, 2007. Shorter

Figure 3
Synthetic Work-Life Federal Income Tax Estimates
for Full-Time Year-Round Workers by Educational Attainment, 2005



term Treasury bills and notes are within 30 basis points of this discount rate, making it a reasonable choice. U.S. Treasuries are among the lowest risk available financial instruments. Ideally one should use a discount rate that corresponds to the time horizon of each ten year cohort. However, since shorter term treasuries yield a similar discount rate, the potential error from using a single discount rate is minimal.

The cumulative discount for each 10-year age range is calculated using the harmonic mean, which may overstate the net present value by as much as 3% because of the uniform weighting of years within each 10-year age range. The harmonic mean is the reciprocal of the arithmetic mean of the reciprocals. It is appropriate to use a harmonic mean in net present value calculations because net present value involves the reciprocal of the cumulative discount rate. The harmonic mean of two numbers x and y is $\frac{2xy}{x+y}$. It is less than the arithmetic mean $\frac{x+y}{2}$ and greater than the geometric mean \sqrt{xy} . Since the net present value divides each value by the cumulative discount, the average net present value for a decade of values corresponds roughly to the average of the reciprocals of each year's cumulative discounts, yielding the harmonic mean.

Table 3 shows the net present value of the added value of various types of college degrees for both work-life income and federal income tax revenue. Thus a bachelor's degree is a sound investment for a high school graduate if the present cost of attaining the degree is less than about \$520,000. Likewise, it is

Table 3
NPV of Differential Work-Life Income and
Federal Income Tax Estimates
by Educational Attainment, 2005

Added Value	Work-Life Earnings	Federal Income Tax
Bachelor's Degree vs. High School Graduate	\$519,261	\$56,681
Master's Degree vs. Bachelor's Degree	\$194,429	\$24,735
Doctoral Degree vs. Bachelor's Degree	\$627,466	\$117,425
Professional Degree vs. Doctoral Degree	\$456,284	\$57,498

worthwhile for the federal government to invest in federal student aid if the per-student cost is less than about \$57,000.

Comparison With Out-of-Pocket Costs and Federal Student Aid

To evaluate the quality of an investment in higher education requires comparing the net present value of the investment with the cost to the individual and to the federal government (see Table 4). Cost figures were obtained from the data analysis system of the 2003-04 National Postsecondary Aid Study (NPSAS) conducted by the National Center for Education Statistics at the U.S. Department of Education. The figures are limited to four-year institutions and sum the means for freshman through senior years in college, without inflationary adjustments.

Out-of-pocket cost is defined as the student budget (cost of attendance) minus all gift aid, including grants, scholarships, veteran's education benefits and education tax benefits. It represents an estimate of the average student's costs to obtain a college degree.

The federal aid and cost figures are limited to students with an adjusted gross income (AGI) of \$50,000 or less, as an approximation of the federal costs associated with federal student aid for needy students. Note that total federal aid includes federal education loans, which cost the federal government less than 20 cents per dollar lent. Accordingly, the estimated total federal cost figure conservatively assumes a 20% subsidy rate for education loans. The total federal loans figure includes PLUS loans, which is not included in the total federal aid figure.

Table 4
Out-of-Pocket Costs and Federal Student Aid

	Out-of-Pocket Costs	Needy Students (AGI ≤ \$50,000)			Estimated Total Federal Costs
		Total Federal Aid	Total Federal Grants	Total Federal Loans	
Undergraduate	\$48,038	\$20,627	\$7,789	\$13,299	\$10,449

Clearly, with a payoff that has a present value of more than ten times the family's investment, an undergraduate education is a worthwhile investment. That's the equivalent of more than a 27% return on investment. Even at 4-year private nonprofit colleges, where the out of pocket costs are \$65,121, it still represents a return on investment in excess of 20%.

Calculating the return on investment involves solving the following nonlinear equation for R ,

$$R \times \left(1 + \frac{1}{(1+R)^n - 1}\right) = \frac{NPV}{OOPC} \times \frac{[(1+C) \times (1+D) - 1] \times (1+D)^n}{[(1+C) \times (1+D)]^n - 1}$$

where R is the return on investment, NPV is the net present value of the future income stream (\$519,261), $OOPC$ is the out-of-pocket costs (\$48,038), D is the discount rate (4.812%), n is the number of years of income (40), and C is an assumed cost of living increase (3%). For values of R above 20% and $n = 40$, it is reasonable to approximate the left hand side of this equation as R .

Federal student aid also represents a wise investment for the federal government, as the income tax revenue has a present value of more than five times the estimated cost of federal student aid. That's the equivalent of nearly a 14% return on investment.

Moreover, replacing federal loans with grants would pay for itself if it yielded at least a 32% increase in the number of low income students graduating with bachelor's degrees, assuming a 5% increase in low income student matriculation rates. This percentage threshold is based on the following formula,

$$P \geq \frac{TR - C_1}{TR - (1+E) \times C_2} - 1$$

where TR is the federal income tax revenue, C_1 is the current federal cost of financial aid, C_2 is the new federal cost of financial aid, E is the percentage increase in enrollment, and P is the percentage increase in graduation rates. This calculation assumes that the lifetime earnings by educational attainment for students from low income backgrounds mirrors the lifetime earnings for the population as a whole. It does not consider incremental improvements in lifetime earning for students who fall short of obtaining a bachelor's degree. But it also assumes a baseline of some aid as opposed to zero aid.

Adjusting work-life estimates for a 3% annual growth in earnings would yield values in Table 3 that are 69% to 84% higher. The return on investment figures for an undergraduate education would increase to 46% for individuals (34% at private nonprofit colleges) and 23% for the federal government assuming tax brackets increase with CPI. The minimum increase in low income graduation rates required to justify replacing federal loans with grants in need-based student aid packages would drop to 15%.

Conclusion

The added value of a college education has increased significantly since 1999, with a bachelor's degree now worth more than \$2.7 million

in mean work-life earnings in current dollars, a master's degree worth more than \$3.3 million, a doctoral degree more than \$4.4 million, and a professional degree more than \$5.6 million. A bachelor's degree clearly represents a worthwhile investment for the student, with a return on investment greater than 27%. The payback period can be as little as four years. Higher education also represents a financially sound investment for the federal government, with a return on investment from increased tax revenues of 14% and a payback period of less than six years.

Student aid policy experts have advocated for replacing loans with grants in the financial aid packages of low income students, arguing that this will lead to a significant increase in matriculation and graduation rates. This article demonstrates that such a change will pay for itself if it results in a 32% increase in the number of low income students graduating with bachelor's degrees. Depending on certain reasonable assumptions, the breakeven point may be as low as a 15% increase in graduation rates. (These estimates do not consider increases in lifetime income due to partial progress toward a degree and assume a baseline for comparison of some aid as opposed to zero aid.) The elite colleges who have eliminated loans from the financial aid packages of low income students have obtained greater increases in graduation rates (FinAid.org, 2007).

There are several possible areas for future research. The estimates presented in this paper do not account for variations in work-life income according to individual characteristics, such as field of study (major), gender, race and original socio-economic status, and institutional characteristics, such as institutional control (public, private non-profit and private for-profit), Carnegie code, and cost of attendance. Some of these variables, such as gender and race, are already available from the Current Population Survey; most are not.

There are a variety of other individual characteristics, such as life expectancy, infant mortality, health, health insurance coverage, crime rates, welfare and public assistance costs, unemployment rates, use of technology, charitable giving, community service and civic participation, that improve with increasing educational attainment (Clinedinst, 2004; Phipps, Santos, & Merisotis, 2005; Institute for Higher Education Policy, 1998; Singh & Siahpush, 2006; Bureau of Labor Statistics, 2007). These non-financial correlates of educational attainment also have an associated financial cost that can be measured in the tens of billions of dollars per year (Campaign for Educational Equity, 2005).

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