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Published version. *Journal of Dental Education*, Vol. 78, No. 11 (November 2014): 1497-1507.
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# The Economic Costs and Benefits of Dental Education: An Empirical Analysis

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*Abstract:* The rising costs associated with obtaining a dental education have caused some to question the financial benefit of pursuing a dental degree. There is a concern that recent graduates may have difficulty finding professional opportunities that provide the income necessary to service their accumulated educational debt. The aim of this study was to evaluate the trends in educational costs to aid in making an accurate appraisal of the financial benefit of a dental education. Adjusted into constant dollar terms, data from a variety of sources were collected for economic variables such as tuition, fees, student indebtedness, and dentists' earnings. These variables were then analyzed to determine the true costs and benefits of obtaining a dental education. The results showed that, over the course of the last decade, educational costs increased faster than the real net income of practicing dentists, which led to a decline in the return on investment in dental education. However, regardless of an applicant's choice of public or private dental school, there continues to be a positive economic return on students' commitment of both financial resources and time to receive a dental education.

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*Keywords:* dental education, dental students, student debt, student loans, economics

*Submitted for publication 9/26/13; accepted 2/26/14*

It is accepted by most applicants to U.S. dental schools that their education will be an expensive proposition. Typically, only cost is referenced when expense is being discussed, and though cost is an extremely important factor in the decision making process, the real focus should be on the long-term value of the education itself. This long-term value is best expressed by investigating the return on students' financial investment in their education over the course of their dental careers. These future economic prospects from the practice of dentistry are fundamental to the decision to apply to dental school.[1,2]

Escalating postsecondary educational costs in the United States have caused student loan debt—$1.2 trillion as of May 2013—to become the largest form of consumer debt outside of mortgages.[3] Justifiably, these rising costs and the student loan debt associated with them are a major concern for both students and their families. One direct result of this concern is that those individuals who desire to pursue a postgraduate degree have become more discerning consumers when evaluating their educational and career choices. As such, there is a demand for more detailed information beyond pure educational cost or estimates of indebtedness for those who are considering the option of dentistry as a career.

The seminal works of three important economists[4-6] formally linked educational investment to human capital formation and economic development. Their theory is predicated on the notion that an investment may not provide present satisfaction but rather a future return, both monetary and otherwise. In other words, the cost of a dental education should not be considered an expense but an investment, with the necessary expenditures of both time and money and the resulting return on that investment a near perfect illustration of the theory at work. The basic principle of return on investment (ROI) is that one has to spend cash that he or she has now in hopes of realizing a return at some future date.[7] Considering that a dental education is an investment of significant capital, any prudent investor should evaluate this potential return prior to an investment of assets.

Economists frequently reference two classic articles that analyze the present values of lifetime earnings for various occupations and the rates of re-

turn to investment in schooling.[8,9] Though there have been many ROI analyses performed for undergraduate degrees, there is very little recent information related to the ROI for many postgraduate degrees, including dentistry. A review of the literature identified two relatively recent articles that addressed the ROI for postdoctoral dental education[10,11] and only a handful of older articles that directly addressed the rate of return (ROR) for a predoctoral dental education. The hypothesis that the decision to enter dental school is directly related to the relative ROR of becoming a dentist was first examined in a study published in 1975, which concluded that ROR had an influence on the occupational choice of the applicant.[1] A similar study published in 1982 also compared the ROR to the size of the dental school applicant pool and drew the same conclusion.[2] A study published in 1984 compared the ROR for dentistry directly to engineering,[12] while a thorough study published in the *New England Journal of Medicine* in 1994 compared the return on educational investment in primary care medicine with procedure-based specialty medicine, business, law, and dentistry.[13] Taking into account the fact that these publications are between twenty and almost forty years of age, combined with the fact that the cost of dental education has risen almost 50 percent since 2000 with resulting student indebtedness rising almost 66 percent over the last decade,[14] it became readily apparent that new research related to the ROI for a dental education was warranted.

Our analysis used data from the first decade of the twenty-first century (1999-2011), making it much more dynamic in scope and up-to-date than its predecessors. Using nine individual cohorts beginning with the class of 2003 and ending with the class of 2011, the aim of our study was to assess the evolution of the ROI for a dental education over the course of the last decade. Our detailed analysis also enabled us to take public and private dental schools, both individually and collectively, into consideration. Motivated by the concern that graduates of dental school face such a significant level of student-related loan debt as they begin their professional careers, we sought to investigate whether or not their educational investment could be considered a sound financial decision. Our goal was to assist those who might be considering dentistry as a career path by providing an empirical analysis of the financial costs and benefits of receiving the education necessary to become a dentist.

# Methods

Return on investment (ROI) is a popular economic calculation for the profitability of an investment,[15] be it in a financial asset or in human capital. In its simplest form, the return to investing in an asset or activity is defined as the ratio of capital gain (i.e., sale price minus purchase price in the case of an asset or earnings minus costs in the case of an activity) divided by purchase price or expense. In the case of dental education, monetary gains are measured in terms of the present value (PV) of lifetime income after graduation, while expenses consist of direct and indirect costs of attending dental school. It is necessary for investors to compare costs and benefits of their investments that occur at various points in time and bring them to the same basis for comparison purposes. PV represents *today's value* of a sum of money that is receivable sometime in the future. In terms of expenses, direct costs include tuition, books, supplies, instruments, etc., while indirect costs include forgone income while attending dental school.

We can formalize the ROI in dental education as follows. Consider a college graduate holding an appropriate baccalaureate degree who is contemplating attending dental school. Denote by $C_t$ inflation-adjusted (real) total cost of attending dental school, where t is the index of years in dental school (t=0, 1, 2, 3). Let $Y_t$ (t=4, 5, …,43) represent the stream of real income from the year following graduation from dental school to retirement at age sixty-five; denote by $Z_t$ the real income stream of an individual who graduates from college with an undergraduate degree; and let $r_t$ stand for the real discount rate in period t. We can then express the net present value (NPV)[1,16] of lifetime income stream of a prospective dental student as follows:

$$NPV = -\left(C_0 + \frac{C_1}{(1+r_1)} + \frac{C_2}{(1+r_2)^2} + \frac{C_3}{(1+r_3)^3}\right) + \left(\frac{Y_4 - Z_4}{(1+r_4)^4} + \frac{Y_5 - Z_5}{(1+r_5)^5} + \cdots + \frac{Y_{43} - Z_{43}}{(1+r_{43})^{43}}\right)$$

The sum in the first set of parentheses represents the present value of total direct and indirect costs of attending a four-year dental school, while the sum in the second set of parentheses captures the present value of lifetime income of an individual who graduates from dental school at age twenty-six and practices until retirement at age sixty-five, or a total of forty-three years net of the income the individual would have earned had he or she not pursued dental education. The ROI in dental education can be calculated by dividing the above expression by the sum in the first set of parentheses and is a measure of the

percent change in the net returns to dentistry relative to the costs of a dental education.

We applied this methodology to nine dental school cohorts, starting with those who began their dental education in fall 1999 and graduated in spring 2003. We ended with those who started in fall 2007 and completed their education in spring 2011. We employed three samples of these cohorts. One sample pertained to all U.S. dental schools, both public and private, which was then split into two separate subsamples: one containing only public schools and the other only private schools. Our main cohort sample began with the 1999-2000 academic year and consisted of thirty-six public schools and nineteen private schools. The University of Nevada, Las Vegas School of Dental Medicine was included beginning in 2005, and the A.T. Still University Arizona School of Dentistry & Oral Health was included beginning in 2006. With one exception, all dental schools in the sample were four-year dental programs, the exception being the University of the Pacific Arthur A. Dugoni School of Dentistry, which has a three-year dental program.

For each of the four academic years associated with each of the nine cohorts, we acquired direct cost data from the American Dental Association (ADA).[17] These data include tuition, books, fees, health insurance premium, and dental instruments, all converted to constant 2011 prices using the Consumer Price Index (CPI) from the Bureau of Labor Statistics (BLS).[18] We then subtracted from the sum of these items the average scholarship received by the student. Since scholarship data are not available as a stand-alone series, we calculated scholarship by summing the average aid per year[19] from an individual cohort (the sum of loans, scholarships, and grants) and subtracting it from the average debt accrued during dental school. However, we did exclude undergraduate debt.

The indirect cost of attending dental school is the income that could have been earned had the individual not attended dental school and instead had worked at a job commensurate with his or her undergraduate degree. Our measure of sacrificed income is the median income of those individuals twenty-five years of age and over who hold a bachelor's degree. These data are from the U.S. Census Bureau,[20] which reports median income for all majors by gender. From these data, we calculated the weighted average income of male and female college graduates using the number of individuals in each category as weights. We then converted this series into real terms using CPI inflation. For the real interest rate, which is the nominal interest rate adjusted for inflation, we used the data available from the World Bank's World Development Indicators (WDI) for the years 2003-12[21] and the forecasts of the real rate from the Congressional Budget Office for the years 2013-50.[22]

Turning to the income earned by dentists, we used average nominal income of individuals practicing general dentistry taken from the BLS.[23] These data are derived from dentists who are employed and take a salary (wage) and includes those dentists who are incorporated and are in essence an employee of their corporation. The current BLS definition of general dentistry is those who "examine, diagnose, and treat diseases, injuries, and malformations of teeth and gums. May treat diseases of nerve, pulp, and other dental tissues affecting oral hygiene and retention of teeth. May fit dental appliances or provide preventive care."[23] This definition excludes prosthodontists, orthodontists, oral and maxillofacial surgeons, and all other specialists. These annual data are available for the period from 1997 to 2011 and include gross pay, excluding premiums, of wage earning dentists (Figure 1).

We projected practicing dentists' income into the future using cumulative rate of change over the period from 1997 to 2012 divided by the number of periods. An alternative approach would be to calculate year-over-year growth rates and then average them over the entire period, with another possibility being an estimation of growth rates using regression analysis. Using the latter two methods, we obtained results that were not markedly different from the chosen method of projection. We then converted the entire series to real values using CPI inflation. To account for the increase in income attributable solely to postgraduate dental education beyond that earned by holders of D.D.S./D.M.D. degrees, we subtracted the income of the latter from that of the former. We projected the income for holders of bachelor's degrees in a manner similar to that we used to extrapolate dentists' future income (Table 1).

# Results

We began with an examination of the basic data on economic costs and benefits of dental education in the United States for the nine cohorts in the sample. These nine cohorts included those who began their dental education during the 1999-2000 academic year

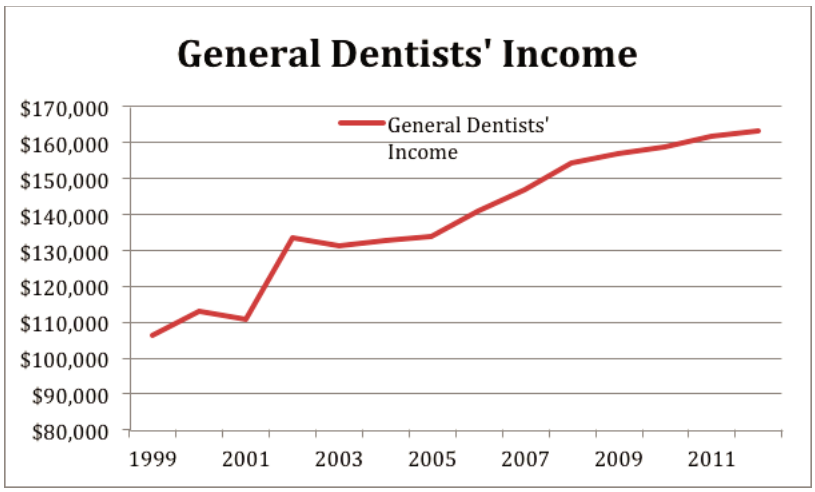


**Figure 1. General dentists' average income, 1999-2011**

*Data source:* Bureau of Labor Statistics.

**Table 1. Real and forecast annual income and interest rates: general dentists and bachelor's degree holders, 1999-2049**

| Year | General Dentists' Real Income | Bachelor's Degree Holders' Real Income | World Bank Real Interest Rate | CBO Real Interest Rate Forecast |
|---|---|---|---|---|
| 1999 | $103,885 | $38,094 | 6.43 | N/A |
| 2004 | $129,491 | $40,605 | 1.49 | N/A |
| 2009 | $157,412 | $45,429 | 2.35 | N/A |
| 2014 | $172,684 | $48,228 | N/A | 2.70 |
| 2019 | $208,981 | $52,149 | N/A | 3.10 |
| 2024 | $252,907 | $56,389 | N/A | 3.00 |
| 2029 | $306,066 | $60,975 | N/A | 3.00 |
| 2034 | $370,399 | $65,933 | N/A | 3.00 |
| 2039 | $448,255 | $71,294 | N/A | 3.00 |
| 2044 | $542,475 | $77,091 | N/A | 3.00 |
| 2049 | $656,500 | $83,359 | N/A | 3.00 |

*Data sources:* Bureau of Labor Statistics, The World Bank, Congressional Budget Office (CBO).

and graduated in May 2003, followed by those who began in the 2000-01 academic year, and so forth, for each consecutive year ending with those who graduated in May 2011.

Figure 2 shows the average real direct cost of attending a private dental school, a public dental school, and the average of the two. As is evident from this figure, private school education direct costs declined for the first three cohorts, began rising with the fourth cohort (2005-06), and rose steadily through the ninth cohort (2010-11). The growth rate of direct cost for the nine cohorts of private dental schools over the sample period was 66.8 percent, or 7.4 percent per year on average.

Public school direct cost followed the same pattern as that of private school direct cost with the exceptions that public school costs began rising sooner than private school costs and that they slightly declined for the last cohort. Over this period, the direct cost of attending public dental schools grew by 150 percent, which was a 16.7 percent per year average. This was more than twice the increase in the direct cost of attending private dental schools. Figure 3 shows the difference between the direct cost of attending a private school and that of attending a public school. The spread between these two types of educational institutions declined between 2004 and 2007, due in part to the higher level of scholarships

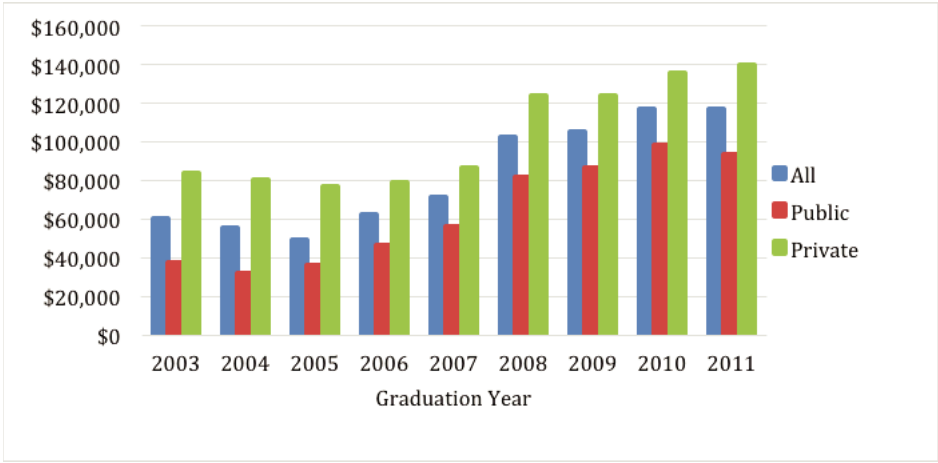


**Figure 2. Real direct cost of dental education, classes 2003-11**

*Note:* Real direct cost = (tuition + fees + books + instruments + health insurance) – scholarships. Graduation year=average of the total real direct costs over the four years of a dental education (e.g., 2003=fall 1999 through spring 2003).

*Data source:* American Dental Association, Surveys on Dental Education.

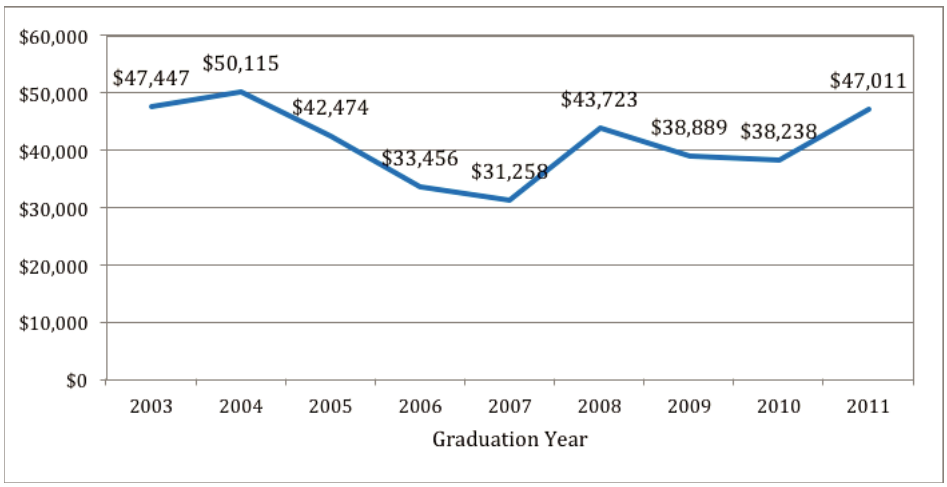


**Figure 3. Difference between private and public dental schools in real direct costs, classes 2003-11**

*Data source:* American Dental Association, Surveys on Dental Education.

offered by public schools relative to those awarded by private schools. However, following a reduction in both federal and state support that was exacerbated by the Great Recession of 2007-09, the direct cost differential between public and private schools began to rise as the level of scholarships decreased.[24]

Figure 2 also shows that the direct cost of obtaining dental education has had an upward trend in the last decade. When analyzing the total cost of earning a dental degree, the forgone income while attending dental school must be calculated. Using the median real income of individuals twenty-five years and over who attained an undergraduate degree, for each cohort in our sample we totaled the incomes for the four years the cohort was attending dental school. The result shows that the indirect cost increased for

all nine cohorts, but it leveled off following the 2007-09 Great Recession (Figure 4). Due to the fact that the recovery from this period of economic recession has not been robust, we have yet to see a return to historical trends.

Having determined the direct and indirect costs of attending dental school, we then applied the same methodology described in the previous section to the data to estimate the return on investment (ROI) in dental education. We began with the results from the full sample of all U.S. dental schools, both public and private. Table 2 shows the present value of the total cost of dental education in both public and private schools; put another way, it shows the direct and indirect total costs of attending dental school for the nine cohorts in our sample. As this table reveals, when adjusted for inflation, the cost of obtaining a dental degree has increased over the course of the nine years of the study. Based upon the calculation of the value (PV) of the total cost of dental education in public and private schools using data on direct and indirect costs, the data show an average annual increase over this same period of approximately 4.45 percent. According to nominal data collected from the BLS and converted into real dollars for our analysis, during this same period the real income of a dentist increased at an average annual rate of 3.8 percent. Taken together, these results suggest that the ROI in dental education has declined in the last decade, which in large part is due to the dramatic increase in

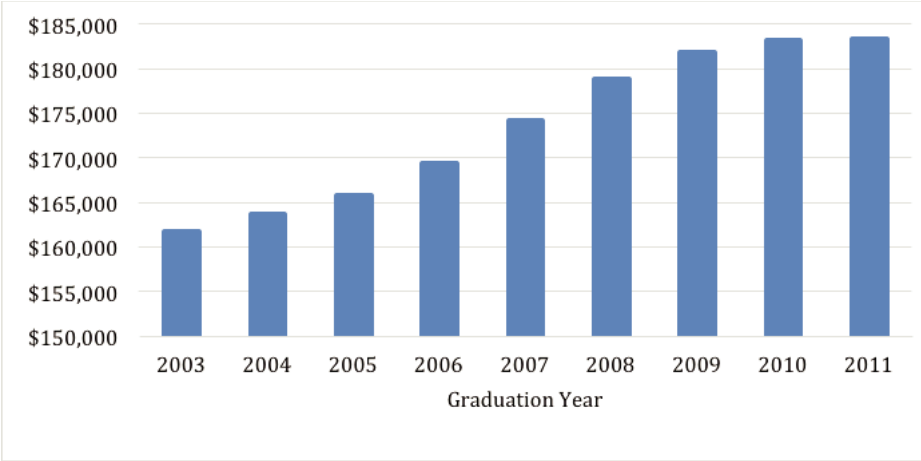


**Figure 4. Indirect (opportunity) cost: four-year sum of real income of individuals holding an undergraduate degree, 2003-11**

*Data source:* Bureau of Labor Statistics.

**Table 2. Present value of total cost of dental education in public and private schools and combined, by four-year cohort for graduating classes 2003-2011**

| Years | Public | Private | All | Annual Increase/Decrease |
|---|---|---|---|---|
| 1999-2003 | $184,853.30 | $228,357.64 | $206,316.64 | N/A |
| 2000-04 | $184,539.15 | $231,570.43 | $207,613.42 | +0.63% |
| 2001-05 | $190,621.11 | $230,464.42 | $204,168.42 | -1.66% |
| 2002-06 | $202,210.17 | $233,349.44 | $217,772.10 | +6.66% |
| 2003-07 | $212,138.69 | $240,526.84 | $226,332.76 | +3.93% |
| 2004-08 | $237,486.16 | $276,915.17 | $257,200.67 | +13.6% |
| 2005-09 | $246,942.88 | $282,759.63 | $264,851.25 | +2.97% |
| 2006-10 | $265,636.84 | $301,716.54 | $283,676.69 | +7.11% |
| 2007-11 | $267,649.09 | $312,922.49 | $290,285.79 | +2.33% |
| Average annual increase | | | | +4.45% |

*Data source:* American Dental Association, Surveys on Dental Education.

public dental school costs. This fact is borne out by our estimate of the ROI (Table 3).

Next, we separately compared the ROI of dental education at private and public schools. Our findings indicate that the ROI for public schools is higher than that for private schools (Table 3, Figure 5). This is expected given that the indirect costs of and lifetime incomes from both types of dental schools are the same, but the direct cost of attending private schools is higher than that of public schools. We also observed two other facts shown in Figure 5: the difference between the two ROIs began to narrow beginning in 2006, and the ROI for public dental schools began to rise at the far end of the sample period while the return for private school dental education declined in the later years of the sample. The variance between public and private school ROI, shown by percentage in Table 3, was seen to expand at the end of the sample period. In fact, over the course of the entire period of our investigation, the average difference between public dental school ROI and private dental school ROI was 4.78 percentage points in favor of public schools.

# Discussion

During the course of our investigation, we discovered that there is very little in the literature that adequately addresses the return on investment of a dental education and that most of what has been written is either out of date or relates to other dental specialties, professions, or fields of study. For such a critical career decision that requires a substantial commitment of financial resources and time, this void in the literature has left many applicants, students, faculty members, and practicing dentists asking the question "Is it worth it?"

Similarities exist between our methodology and that used in previous works.[1,2,10-13] Like previous

**Table 3. Return on investment for public and private dental schools and combined, 2003-11**

| Year | Public | Private | Both | Difference |
|---|---|---|---|---|
| 2003 | 30.79% | 24.44% | 27.32% | 6.35% |
| 2004 | 33.93% | 26.52% | 29.87% | 7.41% |
| 2005 | 33.99% | 27.67% | 31.56% | 6.32% |
| 2006 | 33.01% | 28.26% | 30.47% | 4.75% |
| 2007 | 32.39% | 28.26% | 30.20% | 4.13% |
| 2008 | 30.26% | 25.58% | 27.74% | 4.67% |
| 2009 | 31.15% | 26.88% | 28.87% | 4.27% |
| 2010 | 30.91% | 26.91% | 28.78% | 4.00% |
| 2011 | 32.51% | 27.44% | 29.78% | 5.07% |

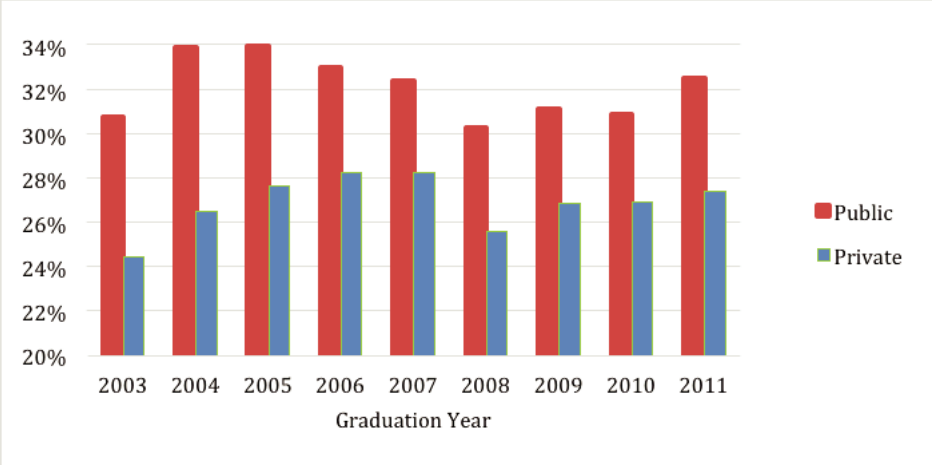


**Figure 5. Comparative return on investment for public and private dental schools, classes 2003-11**

researchers, we acquired direct cost information from the ADA's Annual Survey of Dental Education. These direct costs are inclusive of tuition, fees, instrument costs, books, and health fees. We also chose a similar approach for calculating financial assistance as Dunlevy and Niessen in 1984[12] since we took the total amount of financial award given for an individual school and divided it by the number of students who received aid for that school to calculate the average financial award. We then found the total award given to a cohort and subtracted the net average indebtedness at graduation (average total debt minus average entering debt) to calculate the average scholarship an individual received because "financial award" includes both scholarship and loans.

There were several major differences in our empirical analysis when compared to these earlier studies.[1,2,10-13] First, our sample period was longer in scope in that we followed nine consecutive individual cohorts over the course of their dental education. Secondly, we opted not to include the cost of living in our analysis. The decision not to include the costs of room and board (living expenses) was based on the fact that these are costs all individuals incur whether they are pursuing a dental education or working in another field. Two other fundamental differences relate to how we accounted for the lost income a student accumulates while attending dental school and how we approached interest rates and the rate of inflation for both costs and income. We accounted for forgone income from attending dental school by calculating the income a bachelor's degree holder would have earned in his or her first four years after graduation. The BLS data, which is reported as people twenty-five years of age and over who hold a bachelor's degree, is separated as male and female. We weighted the data to arrive at a total figure that would reflect the entire male and female workforce. Finally, costs and income were put into net present value using the real interest rates and the inflation rate. We used real interest rate data from the World Bank and forecast real interest rates from the Congressional Budget Office when observed data from the World Bank were not available.

The results of this study demonstrate that both the direct and indirect costs of obtaining a dental education have had an upward trend in the last decade, with a significant difference in the growth of direct costs between public and private schools during the time period analyzed. On average, the direct costs at public institutions increased 9.3 percent more annually than those at the private schools. For a potential applicant and his or her family who are primarily influenced by direct costs, this finding might increase the decision to apply to private schools as the spread between public and private direct costs narrow, even though the ROI for public schools remains higher than private schools by nearly five percentage points on average.

Total costs rose over the twelve years of our study, and when adjusted for inflation, the cost of getting a dental degree grew by an annual rate of 4.45 percent. During the same twelve-year time period, as measured by growth in the average annual earnings of dentists, a practicing dentist's calculated real income grew by 3.8 percent annually. Just as the 2007-09 Great Recession influenced the indirect costs of students attending dental school, it had a similar effect on dentist's real income. A different outcome in ROI may have been observed had we been in a more robust economy. Not unsurprisingly, the trend data show that as educational costs increase, the ROI declines. On average, a 1 percent increase in costs reduced ROI by 0.25 percent.

This study has several limitations. The first is that we excluded undergraduate debt in our calculations. On average, the undergraduates who made up the Class of 2013 left college with $35,200 in student loan-related debt.[25] The most recent data from the American Dental Education Association (ADEA), which was for the graduating dental class of 2011, showed that these graduates had a similar albeit slightly higher average of $35,670 in undergraduate student loan-related debt.[26] Given that most often no payments will be made to begin retiring this debt until after dental school, the principle and compounded interest would impact our ROI calculations negatively. Since undergraduate debt has already been incurred regardless of one's occupational choice, it may play only a small role in influencing one's decision to pursue a dental education. However, for potential applicants who have limited means or who act as the primary income producer, having substantial undergraduate debt may increase their need to earn an income quickly regardless of the long-term return on their investment. This pressure to produce income immediately will not fall evenly on all potential students but will have a more profound effect on those with limited means and/or those with children. In this sense, undergraduate debt may alter the composition of an entering class to dental school but not materially change the overall ROI to dental education.

The second limitation was the fact that we could not find average income data for undergradu-

ate degree holders. Ideally, an analysis should use the average income of undergraduate degree holders with the same degree(s) as most dentists in order to be consistent with the measure of dentists' income, but we were required to use data from the U.S. Census Bureau for sacrificed income. The use of median income of those twenty-five years *"and over"* to calculate the forgone income of a dental student may result in an overstatement of the indirect cost of a dental education while underestimating the ROI. Moreover, the data from the U.S Census Bureau are for all undergraduate degree holders and not just those who specialize in a science. Similarly, in place of the real rate from the WDI for the years 2003-12, we used the ten-year Department of the Treasury constant maturity rate, which we expressed in real terms using the CPI inflation rate. The results still indicated a declining ROI but the rate of decline was somewhat less than that obtained when using the WDI real interest rate.

We had two sources to choose from that provide data regarding dentists' income: data from the BLS and data from the ADA Survey of Dental Practices. After reviewing both datasets, we opted to use the BLS data as opposed to the ADA data for two reasons. First, with the ADA data being derived solely from surveys, we believed that the respondents might suffer from a degree of self-selection bias. Secondly, this series appears to be incomplete due to the fact that in some years there were not enough respondents to populate every age bracket. Accounting for 55 percent of the active private practitioners in the United States,[23,27] the BLS dataset by contrast was more complete across all age brackets and lessened the potential for any self-selection bias. However, this decision held its own limitation in analyzing income data for dentists. Consisting of data from only those dentists who are employed and take a salary, the sole use of BLS data could underestimate the lifetime earnings potential of practicing dentists since the data are not inclusive of every practicing dentist. To the extent that the income of owners of dental practices is higher than that of dentists who are employed, one would expect the ROI to be higher for the former group of dentists. Nevertheless, the BLS data do include those dentists whose offices are incorporated since they are considered to be employees of their own corporation.

When making more meaningful comparisons of the ROI of a dental education between public and private schools, it would be beneficial to have income data that are separated by the type of institution attended. Unfortunately, dentists' income data are not divided in this manner and, to our knowledge, do not exist. Therefore, based on the notion that the type of school attended has little impact on lifetime earnings, we used data from dentists in general to reach our conclusions when comparing public versus private dental schools.

With current and future changes in our health care system and the rising direct and indirect costs of a dental education, it might also be worthwhile to compare the ROI to dental education with other undergraduate, graduate, and postgraduate programs that compete for the same pool of applicants. This could include medicine, business, law, and engineering, but other fields of study such as dental hygiene, physician assistants, nursing, and nurse anesthetists should also be analyzed and compared. These alternative areas of study, which require less time in school and therefore less financial resources, are becoming much more popular and attractive to many of the same applicants who might wish to enter dental school.

Given the changing landscape of the dental profession, there are many variables that could have an unpredictable impact on the ROI of a dental education. An uptick or continued decline in the real income of dentists that has occurred since 2000 could alter the ROI of a dental education. Likewise, direct or indirect costs that continue to escalate, taper off, or fall would have an impact on the calculated ROI. The growth in the number of new dental schools, the expansion of existing schools, and the associated number of new graduates could potentially exert a downward pressure to the ROI of a dental education. Although each of these variables has a direct influence on the ROI, the use of recent data for this empirical analysis was designed to identify the current trend of the ROI. As is the case with all works that involve long-term projections, the results are sensitive to the values of the drivers of the endogenous variables, and this analysis is no different. Forecasting the future is a demanding prospect that requires assumptions along with a certain degree of conjecture.

In this study, we applied the standard approach to measuring the return on investment in schooling to that of dental education. We studied nine cohorts made up of those who entered dental school in fall 1999 (Class of 2003) through those who graduated in spring 2011 (Class of 2011). Our estimates indicated that the return on investment in dental education increased from 27.32 percent to 31.56 percent for the first three cohorts (2003-05) but then trended

downward for the next six cohorts (2006-11). Following the high of 2005, there was a sharp decline from 2005 to 2008, then a rebound from 2008 to 2011, albeit not to the high of 2005. From 2005 to 2011, there was a decline of almost two percentage points to 29.78 percent. Over the entire period, the average ROI was 29.4 percent, which compared favorably with the return on some alternative investments. For example, using the S&P 500 index over the period from 1999 to 2012, the average return for investing in the stock market, including dividends, was 14.3 percent,[28] which was slightly less than one-half the return on investing in dental education. It may be argued that the period for which the S&P 500 return is calculated includes the financial meltdown of 2007-08 and the Great Recession of 2007-09. It turned out that our conclusion that the ROI for dental education was much larger than that of investing in the stock market still holds when we considered that, over the period from 1970 to 2012, the average rate of return for investments in the stock market, including dividends, was 18.1 percent. This was more than eleven percentage points lower than the ROI for dental education. However, this alone may not be enough to entice individuals to choose a dental education over other fields of study.

# Conclusion

The findings of this study are of particular importance since our results have shown that, over the course of the last decade, dental educational costs are increasing faster than the real net income of practicing dentists. This disparity has resulted in a decline in the return on investment in dental education and is worrisome should educational costs continue to rise and dentists' incomes remain stagnant or decrease. In spite of this decline in return on investment and regardless of an applicant's choice of a public or private dental school, our findings show that there is a positive economic return on students' commitment of both financial resources and time spent receiving their dental education.

## Acknowledgments

The authors would like to thank the American Dental Association (ADA) and specifically Dr. Marko Vujicic, Managing Vice President, Health Policy Research Center, and Dr. Anthony J. Ziebert, Senior Vice President, Education/Professional Affairs, who supported a collaboration between the ADA and Marquette University. We also thank Mr. Matthew Mikkelson, Manager of Educational and Institutional Surveys, and Mr. Bradley Munson, Health Policy Research Center, for their efforts in helping us gain permission to use the ADA's data.

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