National Trends in Economic Data for Dental Services and Dental Education

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This article will present and analyze national aggregate data regarding dental expenditures, the number of dentists, inflow and outflow of dentists, and their net incomes. The theory chapters about the markets for dental services and dental education explained why these factors are important. These data are central to an examination of the supply and demand conditions that have existed nationally and are likely to shape the future market conditions for dental services. Since demand for dental education derives from the demand for dental services, these national trends are also important to understanding the market circumstances that may confront dental education.

National Dental Expenditures

When supply and demand in all of the markets in the United States interact, the outcome is expenditure for dental services in the various markets. These market expenditures can be aggregated across all markets to measure the total national expenditures for these dental services. These expenditures are sometimes called “expressed demand.” National dental expenditures are the best measure of the overall size of the oral health services market and its trend over time.

The U.S. Bureau of Economic Analysis (BEA) has, for many years, kept track of expenditures from all segments of the U.S. economy as well as subregions of the country. The BEA’s charge is to assess the performance of the national economy. Much of the data it uses to track the economy are collected by the U.S. Census Bureau. It is the best data available to study the overall economy. These data inform us about the total amount spent for dental services, and the data permit dental expenditures to be tracked over time to assess if dental expenditures are expanding, contracting, or staying level. Has the dental services market avoided the pronounced downturn the overall economy experienced recently? Is the dental services market a growth industry? What has been the growth in private versus public expenditures for dental care? This section will provide data to answer those questions.

Figure 1 shows quarterly nominal dental expenditures in selected quarters from 1995 through 2011. Notice the steady growth from the first quarter of 1995 until the second quarter of 2008. Since that latter time, these expenditures have been level. Expenditures are the product of the total amount (quantity) of dental services provided and the contemporary prices (fees) charged for those procedures. Dental fees are not constant. They change over time due to general inflation and other factors. They are also not the same in different areas of the country. A porcelain-fused-to-gold crown will cost more on the upper east side of New York City than it will in rural Kentucky. Without determining changes in fees, we cannot establish if greater expenditures for dental services indicate 1) more or less dentistry is being provided over time or 2) the same amount of dentistry is being provided but at higher fees.

When comparisons of the overall economy at various times or trends in subsectors of the economy are compared to the overall economy over time, a common price index is used to adjust for general price inflation. The price deflator that the BEA usually uses is the Implicit Price Deflator for the Gross Domestic Product (IPD-GDP). This is an index (one number) that is a measure of the level of prices of all new, domestically produced, final goods and services in the overall economy. In most systems of national accounts, including the United States, the GDP deflator measures the ratio of nominal (or current-price) GDP to the real measure of GDP. The formula used to calculate the deflator is:

\[ \text{GDP deflator} = \frac{\text{Nominal GDP}}{\text{Real GDP}} \times 100 \]

How does the economic performance of the dental sector compare to the overall economy and physician services? Figure 3 shows those comparisons. All three series are real measures of expenditures. The red line is expenditures for physician services, the blue line is the GDP, and the purple line is expenditures for dental services. All three lines are indexed to 1.0 at the start of the time period (i.e., 1995:Q1). The numbers beside the lines indicate the percent growth exhibited from the start of the period. The results are sobering for the dental sector.

While real expenditures for physician services grew at a slower rate than the overall economy during the last years of the 1990s, they accelerated past the growth of the GDP during the 2000s. They slowed with the start of the recession in 2007, but the impact of the recession has been modest. At their peak, they had increased 72 percent over their size in 1995; the recession has produced a decline of only 4 percent since that peak. The GDP expanded sharply from Q1 of 1995 until the recession of the early 2000s. After a brief slowdown, the real GDP resumed a robust rate

Figure 1. Quarterly nominal dental expenditures in selected quarters, 1995:Q1 through 2011:Q4
Figure 2. Quarterly real dental expenditures from 1995:Q1 through 2011:Q4

Figure 3. Real expenditures: GDP, physician services, dental services, quarterly from 1995:Q1 through 2011:Q4
of growth until the economic crisis of 2008. After a
decline of about 10 percent, real GDP resumed its
growth and in Q4 of 2010 had expanded 47 percent
over its level in Q1 of 1995. As we all know, the crisis
of 2008 hit the overall economy hard. There was a
sharp contraction that lasted for about two years, but
in 2009, the economy began modest growth.

The picture of the dental sector is less sanguine.
At no time during the period did dental expenditures
rise above the accumulative growth of the GDP or
physician expenditures. During the last half of the
1990s, the dental expenditure growth rate was com-
parable to both physician services and the GDP, but
growth of the dental sector leveled off as we entered
the new millennium. At the end of 2010, total real
dental expenditures were below their level in 2002.
Moreover, a slow declining trend is apparent that
antedates the start of the recession. At the end of
this time period (Q4 of 2011), the dental sector was
still contracting, although the overall economy and
physician expenditures had commenced slow growth.
This performance is cause for concern. Since the mid-
1990s, the dental sector is no longer a growth sector
of the U.S. economy (a growth sector is a sector that
grows faster than the overall economy). This reverses
a trend of several decades during the post-World War
II period when the dental sector outgrew the overall
economy. From 1960 to 1990, the growth of dental
expenditures was greater than the growth in real GDP.

Although dental expenditures are a small
percentage of GDP, Figure 4 vividly illustrates the
decline of dental expenditures as a percentage of the
GDP since 1980. It may not be a coincidence that the
National Institute of Dental Research (NIDR; now
the National Institute of Dental and Craniofacial
Research) published its first caries prevalence study
of U.S. children demonstrating a notable decline in
childhood caries in 1979. Subsequent studies have
revealed that the improvements in caries experience
extend into adult cohorts up to and including those
persons in their fifties.3,5

Part of the growth in real dental expenditures
is the result of population growth. The U.S. popu-
lation has been growing steadily, averaging about
1 percent annually over this time period. Figure 5
factors out population growth to uncover the trend
in per capita dental expenditures and shows that per
capita real dental expenditures grew robustly from
1960 until the early 1980s. Since then, the per capita
expenditures have grown modestly, leveled off, and
then declined the last few years. In fact, average per
capita expenditures in 2010 are about the same level
they were in 1986.

While these trends in aggregate expenditures

![Figure 4. Dental expenditures as a percentage of the GDP, 1960–2010](image-url)
are concerning, we must keep in mind that they represent past performance, not future performance. We all have 20:20 hindsight, but the future is always uncertain. New scientific breakthroughs may open up novel and innovative opportunities for oral health services. Greater collaboration with physicians and other health professionals may provide new opportunities for oral health professionals. The majority of the elderly will keep their teeth, and they will have the financial resources to access dental care. Society may finally commit to helping the disadvantaged access the oral health care they so desperately need. All of these outcomes are possible, but they are by no means sure to happen.

Aggregate analysis of dental expenditures is extremely important in discerning how much care is being provided and how that amount is changing over time or in comparison to other sectors of the economy. However, it does not reveal to whom the care is provided and which subgroups are falling behind the rest of the nation. To address that important issue, the analyses must introduce either regional or socioeconomic/demographic information into the analysis. Other articles in this issue examine those issues in detail.

As was indicated previously, real dental expenditures are an estimate of the total amount of dental services rendered, holding prices constant. But dentistry is a relatively competitive market in which the actions of demand and supply influence the fees that dentists charge. It is important to also consider prices or fees since 1) changes in fees will result in consumers (patients) and dentists taking action and 2) changes in fees may signal changes in the amount of dental services rendered. Fees, at the practice level, help to determine the revenues of the firm and resulting net income of the dentist. Fees also contribute to the total expenditures made by patients. But in a business like dentistry, there is not a single fee for care. There are many procedures rendered by dentists, each carrying its own fee. The American Dental Association (ADA) periodically conducts a survey of dental fees that includes about 200 procedures. The ADA also conducts a periodic survey of the dental services rendered by private practicing dentists that includes about 235 procedures. The ADA’s CDT Code contains more than 590 dental procedures.

So how do economists go about examining whether or not dental fees are increasing or decreasing? We could try to select some representative fees such as those shown in Figure 6. We could then monitor the fees for the selected procedures and calculate changes, averages, and growth rates. But even with this procedure, the task is daunting because there are so many fees. There is a better approach.

We can go to the U.S. Department of Labor’s Bureau of Labor Statistics and follow the calculation of a Consumer Price Index (CPI) it calculates based on a market basket of dental fees thought to be representative of all dental fees charged by dentists. The Dental CPI is calculated on a monthly basis and is also reported on an annual basis. The Dental CPI can then be examined to discern changes in the dental prices as defined with one number reported.
by the Bureau of Labor Statistics. This “nominal” price index changes over time because more and different services are provided and also because of general price inflation. We can follow the Dental CPI over time to see what has happened to “the” price of dental care as defined by the index. However, we can also examine this price index relative to other prices to see if the price of dentistry is increasing, staying the same, or declining relative to the prices of other goods and services. This latter comparison is shown in Figure 7, in which the relative price of dentistry is calculated as the Dental CPI divided by the Overall CPI.

The Overall CPI is also calculated by the Bureau of Labor Statistics to represent the prices of all goods and services exchanged in the United States. The relative price line in Figure 7 shows how dental prices have changed over time relative to prices of all goods and services. From 1950 to 1980 (thirty years), the price of dental care stayed constant relative to the prices of all goods and services. That is, the changes in the price of dental care seemed to be in line with general price inflation. But after 1980, the price of dental care has increased faster than all prices as shown by the positively sloping line from 1980 to 2011 (thirty-one years). During this latter period, the relative price of dentistry increased at an annual rate of 2.2 percent. Interestingly, during this period of increasing dental care prices:

• real aggregate demand increased, by 1.57 percent per year;
• utilization by the population increase, by 1.87 percent per year;
• number of dentists increased, by 1.43 percent per year;
• real gross earnings of dentists increased, by 0.89 percent per year; and
• applicants to dental school increased, by 2.5 percent per year.

This indicates that times of rising prices do not mean that consumers stop buying dental services. Plus, there are a few substitutes (i.e., some may be postponed) for dental services. Economists also suggest that the demand for dental services is inelastic. This means that, while increases in fees tend to discourage consumption of dental care, a 10 percent increase in fees results in less than a 10 percent decline in the consumption of services.
The best sources of data for the number of acting and private practicing dentists come from the ADA, which develops the data, updates it, and maintains the data currently and historically. The two sources of data are the Dental Workforce Model (DWM) and the distribution of dentists in the United States survey. The most recent count of the number of dentists in these reports is for the year 2009. As noted in the overview of the most recent DWM report, the DWM “performs long-term projections of the U.S. dentist workforce using statistical transition models for retirements, occupation change, location choice, specialty education, and death. Additional allocation models distribute new dental school graduates into dental occupations, locations, and specialty programs. The DWM was developed for the ADA’s Health Policy Resources Center with significant extensions to the original work.”

The DWM projects the number of dentists out to 2050. Because of the uncertainty regarding new schools and total future enrollment, we will use only the historical data from 1993 through 2009 for this discussion. Those who want to read the entire report may obtain it from the ADA. The report explicitly cautions readers regarding the assumptions of its future projections, emphasizing that the projections “apply only to dentists within the United States, not U.S. territories. Also, the projections assume that there will be no major structural change in the economy, technology, politics, or the delivery mechanisms and organization of the dental care industry. In particular, no major component of the dental care sector is expected to be nationalized over the horizon of the projections. However, while some technological change can be expected, if it is of a similar impact to the changes over the past 20-30 years, it will not substantially affect the projections.”

We reproduce a portion of a table from that report in Table 1. From 1993 to 2009, the number of professionally active dentists increased by 20.2 percent. The percent increase in active private practitioners was almost identical. Starting at 6,761 in 1993, by 2009 the number of applicants to dental schools increased to 12,202. This represents more than an 80 percent upsurge in sixteen years. Clearly, college students perceived dentistry to be an attractive career choice during this period. The growth rate of applicants was not uniform over the period. A steady rise in applicants occurred from 1993 to 1997, followed by a decline from that point until 2001. Starting in 2002, the number of applicants to dental schools increased to 12,202. This represents more than an 80 percent upsurge in sixteen years. Clearly, college students perceived dentistry to be an attractive career choice during this period. The growth rate of applicants was not uniform over the period. A steady rise in applicants occurred from 1993 to 1997, followed by a decline from that point until 2001. Starting in 2002, the number of applicants again increased to a high of 13,742 in 2007. The last three years of the period saw a decline from the peak in 2007. Since the expansion of applicants far exceeded the number of enrollees, the applicant to matriculant ratio improved over the period. The ratio increased during periods of applicant growth
be an accurate indicator of the adequacy of supply in relation to demand. The ratio simply indicates the number of dentists per capita and has been used as the basis for forecasting the need for more dentists by others. Use of the population-to-dentist ratio is often asymmetrical.

During the period shown in Figure 8 when the ratio was relatively flat, two important factors were also occurring. Real demand per capita expenditures were not increasing, while the productivity of the dental office was demonstrating an increase of about 1 percent annually. So, over the entire period when the ratio was flat, supply was actually increasing in comparison to per capita expressed demand. Because of the setback the profession experienced during the 1980s, there was some catching up to do. Now, with the 1980s long behind us and the number of dental and receded during periods of applicant decline. The period since 2007 has demonstrated a decline in the ratio of almost 17 percent. This rate of decline cannot continue its descent at that speed without reducing the applicant to enrollee ratio markedly.

Figure 8 contains an estimate of the national population-to-dentist ratio. The trend curve clearly indicates that the number of private practice dentists was growing at about the same rate as the population until 2007. Since then, the population has outgrown the number of dentists. This ratio has been used as a yardstick for the adequacy of dentists for many years. There was a time when it provided a significant signal of how the supply of dentists was developing in relation to demand. We should now put this timeworn standard in perspective. It simply holds too many important supply and demand variables constant to be an accurate indicator of the adequacy of supply in relation to demand. The ratio simply indicates the number of dentists per capita and has been used as the basis for forecasting the need for more dentists by others. Use of the population-to-dentist ratio is often asymmetrical.

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<table>
<thead>
<tr>
<th>Year</th>
<th>U.S. Population in Thousands</th>
<th>Professionally Active Dentists</th>
<th>Active Private Practitioners</th>
<th>Applicants to Dental School</th>
<th>First-Year Enrollment</th>
<th>Graduates</th>
<th>Graduation Rate</th>
<th>Applicants per Admission</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>272,647</td>
<td>155,087</td>
<td>142,603</td>
<td>6,761</td>
<td>4,100</td>
<td>3,778</td>
<td>92.1%</td>
<td>1.649</td>
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<td>1994</td>
<td>275,854</td>
<td>157,228</td>
<td>144,581</td>
<td>7,713</td>
<td>4,121</td>
<td>3,875</td>
<td>94.0%</td>
<td>1.872</td>
</tr>
<tr>
<td>1995</td>
<td>279,040</td>
<td>158,641</td>
<td>146,089</td>
<td>7,996</td>
<td>4,237</td>
<td>3,908</td>
<td>92.2%</td>
<td>1.887</td>
</tr>
<tr>
<td>1996</td>
<td>282,172</td>
<td>160,388</td>
<td>147,247</td>
<td>8,598</td>
<td>4,255</td>
<td>3,810</td>
<td>89.5%</td>
<td>2.021</td>
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<td>1997</td>
<td>285,082</td>
<td>160,781</td>
<td>147,778</td>
<td>9,829</td>
<td>4,347</td>
<td>3,930</td>
<td>90.4%</td>
<td>2.261</td>
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<td>1998</td>
<td>287,804</td>
<td>163,291</td>
<td>151,309</td>
<td>9,447</td>
<td>4,268</td>
<td>4,041</td>
<td>94.7%</td>
<td>2.213</td>
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<td>1999</td>
<td>290,326</td>
<td>164,664</td>
<td>152,151</td>
<td>9,010</td>
<td>4,314</td>
<td>4,095</td>
<td>94.9%</td>
<td>2.089</td>
</tr>
<tr>
<td>2000</td>
<td>293,046</td>
<td>166,383</td>
<td>152,798</td>
<td>7,770</td>
<td>4,327</td>
<td>4,171</td>
<td>96.4%</td>
<td>1.796</td>
</tr>
<tr>
<td>2001</td>
<td>295,753</td>
<td>168,556</td>
<td>155,716</td>
<td>7,412</td>
<td>4,407</td>
<td>4,367</td>
<td>99.1%</td>
<td>1.682</td>
</tr>
<tr>
<td>2002</td>
<td>298,593</td>
<td>169,894</td>
<td>156,921</td>
<td>7,538</td>
<td>4,448</td>
<td>4,349</td>
<td>97.8%</td>
<td>1.695</td>
</tr>
<tr>
<td>2003</td>
<td>301,580</td>
<td>173,574</td>
<td>160,184</td>
<td>8,176</td>
<td>4,618</td>
<td>4,443</td>
<td>96.2%</td>
<td>1.770</td>
</tr>
<tr>
<td>2004</td>
<td>304,375</td>
<td>175,709</td>
<td>162,184</td>
<td>9,433</td>
<td>4,612</td>
<td>4,350</td>
<td>94.3%</td>
<td>2.045</td>
</tr>
<tr>
<td>2005</td>
<td>307,007</td>
<td>176,634</td>
<td>162,180</td>
<td>10,731</td>
<td>4,688</td>
<td>4,478</td>
<td>95.5%</td>
<td>2.289</td>
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<tr>
<td>2006</td>
<td>272,647</td>
<td>179,594</td>
<td>164,864</td>
<td>12,463</td>
<td>4,733</td>
<td>4,515</td>
<td>95.4%</td>
<td>2.633</td>
</tr>
<tr>
<td>2007</td>
<td>275,854</td>
<td>181,725</td>
<td>166,837</td>
<td>13,742</td>
<td>4,770</td>
<td>4,714</td>
<td>98.8%</td>
<td>2.881</td>
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<tr>
<td>2008</td>
<td>279,040</td>
<td>181,774</td>
<td>167,769</td>
<td>12,178</td>
<td>4,918</td>
<td>4,796</td>
<td>97.5%</td>
<td>2.476</td>
</tr>
<tr>
<td>2009</td>
<td>282,172</td>
<td>186,415</td>
<td>171,110</td>
<td>12,202</td>
<td>5,089</td>
<td>4,873</td>
<td>95.8%</td>
<td>2.398</td>
</tr>
</tbody>
</table>

unreasonable that this salutary outcome could also save resources in the dental sector while improving oral health. It is an outcome we should hope for and celebrate.

Net Income of Dentists

A primary function is assigned to economic profits in our economic model of the dental services market. In dentistry, profits or net income of dentists provide an indication of the earnings of dentists currently and over time. Net income serves the purpose of indicating current earnings in private practice and the attractiveness of dentistry as a career choice. In dentistry, we expect that as market forces move to create economic profits, practices in the industry will expand services and more individuals will choose dentistry as a career. As the industry expands (relative to demand), fees will be driven to the level at which economic profits cease to exist and the industry stops expanding. Since each dental practice is subject to the discipline of market forces, each practice is induced to produce as efficiently as possible so as not to incur economic losses that force the most inefficient to leave the market.
Both the production of services by specific dental practices and the capacity of the dental services industry are subject to changes in market demand. If demand for dental care increases relative to the supply capacity of the industry, dental fees will tend to rise, and economic profits are created that induce expansion of the industry leading to an increase in the amount of dental services rendered. Alternatively, if demand for care declines or the industry overexpands, dental fees will tend to decline, expansion of the dental industry is discouraged, and some dental practices may even leave the industry (or retirement plans are accelerated).

Net income of dentists, measured as gross receipts of a dental practice minus all practice operating expenses, is an annual measure of the profitability of practicing dentistry. Net income is also a partial indicator of the attractiveness of dentistry as a career and therefore assists with inducing individuals to become dentists. This is an important mechanism when economic conditions in the dental market move in such a manner as to create economic profits and signal the opportunity for more dentists to enter the market.

Figure 9 shows the net income of all private practicing dentists and private practicing general dentists in the United States, while Figure 10 contains year-over-year percent changes in net income since 1975. The “real” net income series in these graphs is the result of adjusting “nominal” net earnings for changes in general prices of goods and services over the same time period (i.e., the net earnings are stated in terms of constant 2009 dollar amounts). Net earnings are shown for all dentists combined and for general dentists. Most private practicing dentists (80 percent) in the United States are general dentists. Among all dentists, net earnings have increased from $151,000 in 1975 (2009 dollar equivalent) to $213,000 in 2009. The average annual rate of growth for all dentists was 1.86 percent. Over the past thirty-four years since 1975, there have been eleven years (33 percent of the time) of decline in dentist net earnings. The average annual percent decline amounted to -3 percent in the years when a decline occurred. For the twenty-three years of positive changes in net income, the average percent increase was 3.1 percent per year.

Among general dentists, net income has increased from $146,000 in 1981 (2009 dollars) to $193,000 in 2009. General dentist net income has increased at an annual rate of 1.67 percent, slightly lower than for all dentists combined. Over the past thirty-four years, net earnings of general dentists have declined fifteen years (44 percent of the time). The average percent decline amounted to -2.5 percent when a decline occurred. For the nineteen years of positive changes in net income, the average percent increase was 3.4 percent.

While the annual rate of growth over the last thirty-four years was about 1.86 percent per year, the following have occurred with regard to average annual growth in net income (Table 2). Growth in net incomes of dentists depends on the period of time. Since the latter part of the 1990s, growth has been very low or even negative since the year 2000. The longest term growth (1975–2009) was also low, while growth from the trough of the 1980–81 recessions to 1999 was relatively high at 2.83 percent for all dentists and 2.75 percent for general dentists. Probably the single most important condition for both the dental education and dental services market is a resumption of an economically healthy growth in the net income of dentists.

In another article in this issue, we discuss the decision required to choose dentistry as being based on an investment decision model. There we looked at this decision that is made at a very early age, requires more years of education, requires forgoing income from an alternative career, and requires waiting four years before entering practice and earning future income. We also identify the rate of return (ROR) methodology as a means of estimating the profitability of a career in dentistry and as a means of comparing dentistry to alternative careers. A significant factor in choosing a career in dentistry is the future earnings that can be expected from practicing the profession. The historical and current levels of net income, together with their historical growth rates, are the key variables that candidates will consider in their investment decision. Increases in dentist net income relative to income earned from alternative occupations increases the ROR to a dental education.

Table 2. Percent change in real net income of dentists for various time periods, 1975–2009

<table>
<thead>
<tr>
<th>Period</th>
<th>All Dentists</th>
<th>General Dentists</th>
</tr>
</thead>
<tbody>
<tr>
<td>1975–97</td>
<td>1.17%</td>
<td>0.09%</td>
</tr>
<tr>
<td>1998–2009</td>
<td>0.41%</td>
<td>0.18%</td>
</tr>
<tr>
<td>1981–99</td>
<td>2.83%</td>
<td>2.75%</td>
</tr>
<tr>
<td>2000–09</td>
<td>-0.23%</td>
<td>-0.29%</td>
</tr>
</tbody>
</table>
and encourages more individuals to choose dentistry. This feeds directly into the dental education market as more applicants to dental school, enrolled students, and future dental school graduates. Alternatively, decline in the net income of dentists leads to a decline in the ROR to a dental education and discourages individuals from choosing dentistry as a career. This decision will be reflected as fewer applicants to dental school, enrolled students, and future graduates. The flattening out of and decline in net income of dentists since 2000 signals negative pressures on individuals to choose dentistry as a career. Alternatively, the choices made by individuals regarding their careers are relative. If the incomes of many occupations are declining, choices about dentistry may not change much. Nevertheless,
the single most important factor for dental practice and education is a robust growth in net income of practicing dentists.

The three most important economic factors to consider in choosing dentistry are net income of dentists, net earnings from an alternative occupation to dentistry, and the costs of obtaining a dental education. As discussed above, increases in dentist net income increase the ROR. In addition, increases in the cost of a dental education decrease the ROR, while increases in the net earnings from an alternative career also decrease the ROR to a dental education. Table 2 shows some growth rates for a recent five-year period for these key ROR variables.

The most recent five-year growth of the variables shown in the table suggests that there is significant downward pressure on the ROR to dental education: declining net income, declining alternative income lower than the decline in dentistry, and increasing costs of obtaining a dental education. The results are also concerning in that the net income of dentists comes from a market that is a relatively competitive market. That is, changes in the supply and demand for dental services are effective in determining the net income of dentists. The costs of dental education reflect the decisions from dental schools that are also cast within a larger university setting.

There are a number of conditions, primarily related to the demand for dental education, that suggest that the dental education sector will not reflect decisions made by a competitive marketplace.

**REFERENCES**