

Attending a two-year college saves money in a four-year education

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Introduction

Over the past several years, college costs have increased. These increases have encouraged many students to attend two-year colleges before attending a four-year college to obtain a four year degree. Since two-year college tuition and fees are generally lower than public four-year college tuition and fees, this results in significant savings for students.

In this project, we'll find a linear model for the cost of attending a two-year college to get a four year degree using the average cost of tuition and fees in the United States over the period from 2006 through 2009. This model will be used to forecast the savings over the years 2013 through 2016.

The savings will be forecast using several assumptions.

- The costs will be calculated over a four year period where the first two years are at a two-year college and the last two years are spent at a public four-year college.
- Only tuition and fees are included in the model. Room, board, books, and any financial aid is not a part of the model.
- The rate at which costs increased over the period 2006 through 2010 will be the same as the rate at which costs increased from 2013 through 2016.

Using these assumptions, the savings is calculated to be almost \$11,000.

Year	Two-Year Colleges	Four-Year Colleges
2006-2007	\$2018	\$5666
2007-2008	\$2061	\$5943
2008-2009	\$2136	\$6312
2009-2010	\$2285	\$6695

Table 1 – Average tuition and fees at different types of institutions in the United States

Methods

To find the linear function that models the data, two points will be picked. These points will be used to find a linear function of the form

$$y = mt + b$$

where y is the cost of tuition and fees and t is the number of years after 2000. The time used for the variable will correspond to the year at the beginning of the school year. The constant m is the slope of the function. The constant b is the vertical intercept of the function. The function describing tuition and fees at two-year colleges is called $T(t)$ and the function describing tuition and fees at four-year colleges is $F(t)$.

The slope of each function is found by calculating

$$m = \frac{y_2 - y_1}{t_2 - t_1}$$

where (t_1, y_1) and (t_2, y_2) are two points on the linear function. Once the value for m is known, it is substituted into the function with one of the points to find b .

The linear functions can be used to forecast the tuition and fees at two-year and public four-year colleges. For instance, to find the cost of tuition and fees from 2013-2014 through 2014-2015, we would calculate

$$T(13) + T(14)$$

The cost of tuition and fees at public four-year colleges from 2015-2016 through 2016-2017 is

$$F(15) + F(16)$$

Adding these amounts,

$$T(13) + T(14) + F(15) + F(16)$$

gives the cost of attending a two-year college for two years followed by two years at a public four-year college.

In a similar manner, we may calculate the cost of attending a public four-year college by finding

$$F(13) + F(14) + F(15) + F(16)$$

The difference between these amounts is the savings from attending a two-year college to obtain a four-year degree.

Results

The function values are calculate by finding the linear function for each type of institution type. The points are picked by determining which pair of points best follows the overall trend in the data.

For instance, the slope between the ordered pairs (7, 2061) and (9, 2285) is

$$m = \frac{2285 - 2061}{9 - 7} = 112$$

Using this slope, the function for costs at two-year colleges is

$$T(t) = 112t + b$$

To find the value for b , put (7, 2061) into the function and solve for b :

$$\begin{aligned} T(7) &= 112(7) + b = 2061 \\ 784 + b &= 2061 \\ b &= 1277 \end{aligned}$$

The cost of tuition and fees at two-year colleges may be calculated from

$$T(t) = 112t + 1277$$

The linear function for calculating the tuition and fees that passes through (6, 5666) and (9,6695) is

$$F(t) = 343t + 3608$$

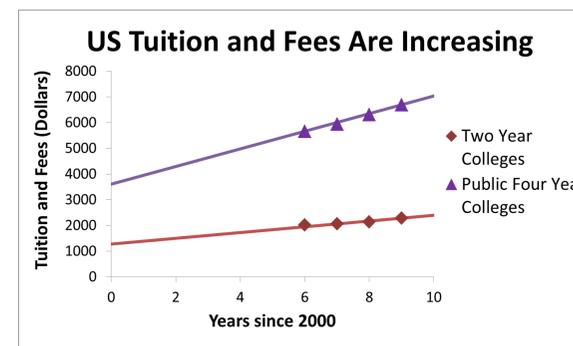


Figure 1 – A scatter plot of the data for two- and four-year public colleges and the corresponding linear functions.

Discussion

The cost of attending a two-year college in the United States for two years and then a public four-year college for two more years is

$$\begin{aligned} Cost &= T(13) + T(14) + F(15) + F(16) \\ &= 2733 + 2845 + 8753 + 9096 \\ &= 23,427 \end{aligned}$$

The cost of attending a public four-year college for four years is

$$\begin{aligned} Cost &= F(13) + F(14) + F(15) + F(16) \\ &= 8067 + 8410 + 8753 + 9096 \\ &= 34,326 \end{aligned}$$

The difference between these costs is

$$Difference = 34,326 - 23,427 = 10,899$$

This tells us that attending a two-year college for the first two years of a four year education saves \$10,899.

This number represents an average across the entire United States. As such, the actual amount saved may be greater or smaller depending on the individual colleges and universities. However, this same strategy could be applied to individual institutions if the cost of tuition and fees is know over several years.

The pair of points chosen for the function also influences the costs. If a pair of points is chosen that results in a larger slope, the costs increase faster. A line based on these points will forecast higher costs in the future. If the points are chosen so that the resulting slope is smaller, the linear function will forecast lower costs in the future. The points chosen in Figure 1 result in linear functions that appear to follow the overall trend of the data best.