Team #5197
What is the Cost of Education?

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Summary

The dilemma of whether or not to attend college has long confronted high school seniors. The difficulty of this cost-benefit analysis has been exacerbated in recent years due to the economic recession confronting the American economy and increased global competition in high-tech industries. Given these contemporary factors, the once-ironclad assumption that college should be pursued by every capable high school student is now being challenged.

We were charged with developing a mathematical model to determine the total cost for a variety of students to attend college in a series of given financial scenarios. By using a modified version of the FAFSA's Expected Family Contribution (EFC), we were able to derive a mathematical equation that modeled EFC as a function of parental income, the educational level a student is considering, number of dependents, and number of parents. This model was then used to calculate the EFC values for the given students in their respective financial scenarios.

We then proceeded to employ the same model we constructed in Part I to predict the short-term and long-term costs and benefits of joining the workforce with different levels of education. The relative advantages and disadvantages of STEM degrees were contrasted with non-STEM degrees, Associate's Degrees, and high school diplomas. Gender and ethnicity were added to the categories utilized in Part I to determine the net short- and long- term outcomes at the various educational levels.

Finally, we added the quantitative and qualitative factors of quality of life to our extant model in order to provide high school students with a guide to maximizing their future quality of life. By including the quantitative values of life satisfaction and Part II-determined long-term income along with the qualitative components of happiness elucidated by Jung and Maslow, we were able to create a hierarchy of ranks for the various courses of action available to high school students, in order to optimize their quality of life.

Introduction

Background:

A college education is something to be valued, an opportunity better taken than avoided. This statement has long been held as a fundamental truth of American personal success.[1] However, the once-unquestionable tenet of higher education has now been called into question by the escalating cost and declining return on the investment of college education.

The problem of rising college tuition costs is one of the greatest future dilemmas facing America today. Recent tuition rate increases have steadily eclipsed inflation; from 1970 to 2013 yearly college tuition adjusted for inflation has nearly tripled, from $4600 to $15,000.[2]

With the recent economic recession's effects on wages and employment, the benefit of college is declining even as the costs are spiking.[3] Student loans in 2013 totaled over $1 trillion, 11% of which were severely delinquent or in default.[2] Meanwhile, the unemployment rate of recent college graduates is 8.5%, with another 16.8% employed in occupations not requiring a college degree.[4] Given these daunting statistics, it is only natural for prospective college students and their parents to wonder whether a college education is still worth the cost.

However, advocates of college education point out that higher education still yields far greater income than any alternative. In purely monetary terms, a Bachelor's Degree earns its holder $650,000 more than a high school diploma over the span of a working lifetime.[5] Furthermore, a college education is shown to be strongly correlated with a slew of non-financial benefits. Higher job satisfaction, a greater sense of accomplishment, and happier overall lives are all linked to a college education.[6] Even given the increased cost, supporters argue, the benefits of a college education still far outweigh its costs.[5]

Of course, college educations is not a monolithic and standardized system. Within the umbrella of higher education, different degrees provide access to different career pathways. Broadly speaking, college degrees may be divided into STEM and non-STEM categories.[7] Between them, the former provides a more specific education and generally higher income, while the latter grants more flexible preparation at the cost of less monetary return; roughly 28% of college students between 2003 and 2009 opted to take STEM degrees.[8] From a financial-security perspective, a STEM degree, whose average entry-level salary is approximately $66,000, exceeds its non-STEM counterpart by $14,000.[9]

Nonetheless, the investment of college education is by its very nature a long-term and sizable investment. For those unfortunate who do not possess sufficient time or money to make such an investment, alternatives exist which can bridge the gap between a college degree and a high school diploma.[10] Technical or vocational schools, with yearly costs approximately $2700, grant two-year Associate's Degrees with an approximate payoff of $45,000.[8] They typically provide a specific qualification for a single profession, rather than the more liberal and encompassing approach of four-year degrees. This narrow focus is offset by their status as a cheaper, more relevant, and faster education process than the traditional four-year option.[11] Recently, President Obama has recognized the vital niche they occupy in higher education, as has initiated a policy proposal to subsidize their tuition.[12]

When viewed as a whole, higher education presents a plethora of contrasting opportunities and restrictions, costs and benefits. For prospective students faced with the balance of university education, vocational schooling, or post-diploma employment, myriad decisions and their relative payoffs must be weighed.[13] Despite being one of the most important decisions to make in life, the issue ultimately boils down to the underlying dilemma: What is higher education really worth?

Restatement of the Problem:

1. Derive a mathematical model to calculate the extrinsic financial costs of attending college.

2. Utilize said model to determine the costs for sample families with varying children, parents, and income (at least six families).
3. Take President Obama's community-college-tuition proposal into account and determine its effects on the model.
4. Derive a model to predict the relative costs and benefits, in the short- and long-term, of entering the workforce with an undergraduate STEM degree, as opposed to alternatives (liberal arts degree, diploma, Associate's Degree, etc). Elements of the previous model may be incorporated,
5. Consider the intrinsic (i.e. non-financial) as well as the extrinsic (monetary) benefits of the varying choices in higher education, and their influence on quality of life. Develop a model, in the form of a hierarchy of ranks, that accounts for the quantitative and qualitative factors of educational choices facing high school students.

Global Assumptions:

1. We assume the people who will use our model will be motivated to work and are thus always employed.
2. The economic situation (i.e. labor market, unemployment, inflation etc.) will not change in the near future.
3. All children are dependent, i.e. they are financially supported by parents, since for a child to be recognized as independent under the age of 24, they must either be married, have dependents, be an orphan, or be a veteran or active member of the Armed Forces.[14]
4. The only contribution parents make is their payment of college tuition. We will ignore individual transactions such as "care packages" and non-tangible contributions such as emotional support for simplicity and because these contributions vary from family to family.

Other Assumptions:

- Normal Retirement Age will remain 67 due to previous assumption that the job market will not change (social security full benefits).[15] The student will retire at this age.
- The entire population of working age is part of the labor force. We make this assumption both because the number of discouraged workers relative to the total labor force is negligible (<1%), and because our model is geared toward those who are motivated to work.
- Minimum family size is one parent and one child, while maximum family size is two parents three children, as given by the problem.
- We will assume homeless people are at the poverty line, since whether or not they are below the line does not affect the amount of aid they will receive (i.e. 100% covered).

Part I: Cost of Education

Assumptions:

1. The student applies for federal financial aid.
2. Everybody that attends college obtains a degree at the expected time.

Cost of Attendance:

We will develop a model to determine the total expenses paid to obtain an undergraduate degree, based upon cost of attendance and the opportunity cost of attending college rather than working.

The cost of attendance CoA constitutes all direct costs of attending college including tuition, room/board, transportation, book/supplies, and other expenses. This cost will be calculated from average full-time costs from the College Board's Annual Survey of Colleges.[8] This data is shown in the table below.

Institution	Average Yearly CoA	Average Total CoA
2-Year Community/Technical School (Commuter)	$16325	$32650
4-Year In-State Public School (On-Campus)	$23410	$93640
4-Year Out-of-State Public and Private Schools (On-Campus)	$41751	$167004

Free Associates Degree Initiative:

President Obama's initiative to provide free Associate's Degrees tuition to qualifying students would decrease cost of attendance by an average of $7600 over two years. We subtract this grant from the cost of attendance prior to performing other functions.[12]

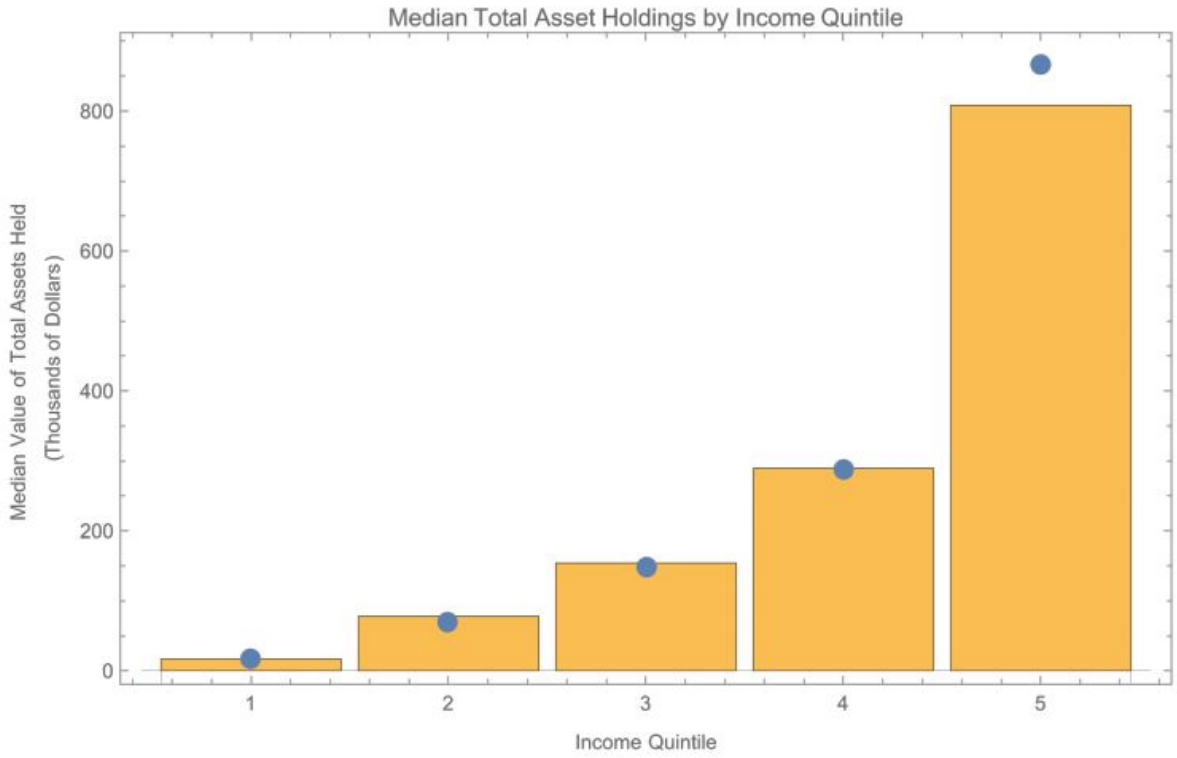
Expected Financial Contribution:

Using a federal financial aid calculator from finaid.org, the expected financial contribution EFC of the family after federal aid can be found based on the age of parents, the total number of parents in the family n_P, number of college-age children in a family n_C, total family income FI, and total family assets FA.[16]

The average age of parents with college-aged children is 44.3 years old. We will assume this parent age for all students.[17]

Based on income quintile vs. assets owned data, a power law relationship between family income and assets earned was created.

$$FA = 0.433FI^{1.388}, r^2 = .997$$



Below some critical value of family income, the expected financial contribution is zero and the family is not expected to pay anything. Above some critical value of family income, the expected financial contribution is equal to the cost of attendance, as one would not be expected to pay more than the cost of attendance. There is a linear relationship between EFC and FI between these critical values of FI. The following EFC linear relationships were calculated based on 7 income data points ranging from \$15000 to \$200000 in total family income for the region between them.

n_P	n_C	Relationship	r^2
1	1	$EFC = -22379 + 0.624FI$	.990
2	1	$EFC = -23628 + 0.623FI$	.997
1	2	$EFC = -11351 + 0.313FI$	.998
2	2	$EFC = -12091 + 0.312FI$	.998
1	3	$EFC = -7758 + 0.210FI$	.997
1	3	$EFC = -8217 + 0.207FI$	.996

Data from the federal aid calculator indicates that the total EFC covering all college-bound children within a family is constant. The total EFC of a family for all children is then distributed across each of the children, so EFC per child has an inverse relationship with n_C.

High r^2 values for linear regressions indicate a linear relationship between income and EFC. Multiplying the EFC per child regression by the number of children yields a constant 0.624 constant relationship between EFC per child and aid.

The number of parents in a family affects the cost of living for a family. Thus, equal-income families with two parents rather than one parent have slightly less EFCs.

This information can be generalized into the following equation:

$$EFC(n_P, n_C, FI) = \frac{-1.063^{n_P-1} * 23469 + 0.624\,FI}{n_C}.$$

The term $-1.063^{n_P-1} * 23469$ is a descriptor of living expenses of the household. $23469 is the poverty line under which living expenses cannot be covered.

Other Scholarships, Grants, and Loans:

As a worst case scenario, we will assume that the student does not get any non-federal scholarships or grant aid. Thus, as assumed, the entire expected financial contribution of the family is not paid upfront and loans are taken out to pay for that.

Financial Aid:

The government need-based financial aid NFC covers all of the cost of attendance that the family is not expected to pay:

$$NFA = CoA - EFC$$

Overall 60% of federal aid is in loans and 40% is in grants. We assume this ratio carries into the ratios of loans to grants for individuals.[18]
Then the total amount of loan money that needs to be taken out L is

$$L = EFC + 0.6NFA = 0.6CoA + 0.4EFC.$$

Opportunity Cost:

The opportunity cost of spending time in college constitutes the money that could be earned if a student chooses to enter the workforce straight out of high school rather than attend an undergraduate institution or to only take a two year degree rather than a four year degree.
Average income is calculated with the following categorizations: ethnicity, gender, and education level. The four categories of ethnicity used are White, Black, Asian, and Hispanic.
Quadratic fits of the values of median income of categorization for 10 year age bins from the data from PINC-03 are taken.[19]

This provides interpolated estimations of the median individual of a given age, ethnicity, gender, and education level and is intended as a model of differentials between promotions and wage increases in different groups.

The opportunity cost of spending time in college O is thus determined by integrating the piecewise income function $I(ethnicity, gender, education, A)$ for ages A from 18 to 22 for educational level of high school graduate, 20 to 22 for the educational level of a 2-year technical school for a given ethnicity, gender, and education:

$$O = \int_{grad\ age}^{22} I(ethnicity, gender, education, A)dA .$$

Paying off Loans:

Let $L(A)$ be the outstanding loan remaining at age A.
We previously showed that

$$L(18) = 0.6CoA + 0.4EFC$$

where we assume that the loan for the entirety of the college education is taken out upon age 18, when students enter college.
Then

$$L(A+1) = L(A)^{1+r} - P(I)$$

where we r is the federal interest rate and $P(I)$ is the portion of income that is spent to repay the loan per year. From here on, we will drop the ethnicity, gender, and education variables for simplicity, but keep in mind that all incomes are calculated with these variables in mind.
Currently, the federal interest rate is 4.66%.[20] Because we have assumed that economic conditions remain constant, this interest rate will remain constant over time.
We calculate $P(I)$ based upon an income-based repayment system.
Let the disposable income of an individual DI be the individual's income above the poverty line as determined before:

$$DI(A) = I(A) - 23469$$

If income is below the poverty line, disposable income is zero.
In many income-based repayment systems, 15% of the disposable income is expected to go towards repaying the loan. We assume that the individual will do so each year. Thus,

$$L(A+1) = L(A)^{1.0466} - 0.15(I(A) - 23469) .$$

This recursion continues until the loan is completely paid off. That is, until $L(A) = 0$. Testing has shown that given our piecewise formula for income, this always occurs before the retirement age of 67, so all of the loan is paid off.
Let $L_p(A)$ be the amount of money spent on paying of the loan by age A. Then

$$L_p(A) = \sum_{i=18}^{A} 0.15(I(i) - 23469) .$$

The total cost of attending to college TC is

$$TC = L_p(A)_{max} + O$$

$$TC = \sum_{i=18}^{A_{max}} 0.15(I(i) - 23469) + \int_{grad\ age}^{22} I(A)dA.$$

Thus, we have a closed formula for the total cost depending upon the income of the individual.

Results:
Below is a tabulation of the opportunity cost of obtaining a Bachelor's Degree versus remaining a high school graduate for a student in a nuclear family.

Gender	Ethnicity	Opportunity Cost of a Bachelor's Degree (USD)
Male	White	79,957
	Black	52,149
	Asian	127,702
	Hispanic	118,831
Female	White	62,212
	Black	32,263
	Asian	74,401
	Hispanic	69,528

Below is a tabulation of the cost of college to a student obtaining a Bachelor's Degree versus remaining a high school graduate for a white male student, comparing different family sizes.

n_P	n_C	Cost of College (USD) for a given Parental Income (USD)		
		$25,000	$75,000	$125,000
1	1	14,046	23,378	23,410
	2	14,046	15,592	18,712
	3	14,046	15,076	17,156
2	1	14,046	16,547	22,787
	2	14,046	15,297	18,417
	3	14,046	14,880	16,960

The $25000 value yields the same for all families because it is a zero EFC.

Part II: Cost-Benefit Analysis

We have a formula to find the total cost of attending college. Given the prices of attending college, students must then consider the benefits for which they are paying such a price.

Short-Term Cost-Benefit Analysis:
In the short term, net wealth cannot be a good measure of quality of life while the majority of a college loan is has not yet been repaid, because the loan will not significantly impact quality of life. We will thus compare the disposable incomes of individuals. This is reasonable because in the short term the amount of money that can be used for non-survival related goods and services is determined by disposable income. This becomes a comparison of entry wages. Only 85% of the "disposable" income for college graduates is actually disposable, while the other 15% is used to repay the loan, which provides a depressant on "wages" of a college graduate.

Long-Term Cost-Benefit Analysis:

In the long term, net wealth NW is a reasonable estimate of quality of life because it displays the amount of money that has been made over the course of a lifetime. Then we measure net wealth as the total amount of income gained before the retirement age of 67 subtracted by the total cost of loans.

$$NW = \int_{grad\ age}^{67} I(A)dA - L_{p}(A)_{max}$$

$$NW = \int_{grad\ age}^{67} I(A)dA - \sum_{i=18}^{A_{max}} 0.15(I(i) - 23469)$$

Again, this results in a closed formula depending upon the piecewise income function.

Results:

Below is a tabulation of the benefit of obtaining a Bachelor's Degree versus remaining a high school graduate, and the benefit of obtaining a STEM degree versus a high school diploma degree. for a student in a nuclear family. Benefit is calculated as the difference in net wealth between a student that obtains a Bachelor's Degree and one that is only a high school graduate by retirement.

Gender	Ethnicity	Benefit of Bachelor's Degree vs. a High School Diploma (USD)	Benefit of STEM Bachelor's Degree vs. a High School Diploma (USD)
Male	White	738,040	938,649
	Black	367,410	470,929
	Asian	1,016,533	1,309,698
	Hispanic	359,236	446,962
Female	White	544,112	661,879

	Black	709,415	978,993
	Asian	730,048	902,105
	Hispanic	504,360	642,157

Below is a tabulation of the benefit of obtaining a Bachelor's Degree versus remaining a high school graduate for a white male student, comparing different family sizes.

n_P	n_C	Benefit of Bachelor's Degree (USD)
1	1	643,022
	2	731,890
	3	758,924
2	1	656,605
	2	738,040
	3	762,615

Part III: Ranking System

Assumptions:

1. We will ignore personal philosophy and religion, as both vary greatly from individual to individual within traditional demographic categories; it is difficult to set up causal relationships between philosophy and religion and happiness.
2. Factors that raise quality of life are essentially homogeneous throughout the world. Since we are directing our model towards inhabitants of the Western World who are able to consider post-secondary education, we can safely assume that people in both America and Europe have the same components of quality of life.
3. All physiological needs, i.e. physical requirements for survival, are met. We can make this assumption because struggling for subsistence greatly out-prioritizes considerations for secondary education.
4. Standard of living is directly related to income. This is a safe assumption because the definition of standard of living is the degree of wealth and material comfort available to a person.
5. By definition: having a high school diploma is more prestigious than having none; having an Associate's Degree is held in more esteem than having a high school diploma; having a Bachelor's Degree is more august than having an Associate's Degree.

Qualitative Analysis:

Quality of life is defined as: "the standard of health, comfort, and happiness experienced by an individual." In this paper, these will be analyzed using qualitative measures, based on the works of Carl

Jung and Abraham Maslow, as well as quantitative measures, based on correlational studies conducted in Europe. This data will be used to create a model that will allow students to weigh their personal values to life satisfaction and whether or not higher education is necessary to meet those values.

Because health and comfort are both highly correlated with income, and college graduates have been demonstrated to earn substantially more income than their non-graduating counterparts, we can qualitatively assume that people with more education will tend to be healthier and more comfortable.

Two psychological schools of thought predominate on the concept of happiness. Both Carl Gustav Jung and Abraham Maslow created theories that expressed their relative view on the components of happiness. Their respective theories are reflective of their wider schools of psychology: whereas Jung's proposed composition of happiness incorporates psychodynamic thought, Maslow's is derived from humanistic psychology.

According to Maslow, there is a hierarchy of needs in which each of the lower needs must be fulfilled to consider the next. The hierarchy follows as such, from lowest to highest.[24]

1. Physiological needs, i.e. the physical factors for survival, such as nourishment and shelter.
2. Safety, i.e. the composite of personal security, financial security, and health.
3. Love/belonging, i.e. friendship and family.
4. Esteem, i.e. the desire to be recognized and valued by others.
5. Self-actualization, i.e. the desire to be the most that one is able to.

Instead of the traditional pyramidal, linear structure of the hierarchy, we take a more literal interpretation of Maslow's work, in which he does not mention anything about a pyramidal structure and states that multiple deficiency needs, in other words, the needs under self-actualization, can be experienced at the same time.[25] Also, Maslow directly relates self-actualization to attaining general happiness: "Self-actualizing people enjoy life in general and practically all its aspects, while most other people enjoy only stray moments of triumph."[26]

We hence can rank options out of highschool based on how well they fulfill each deficiency need. It follows from how well each As stated above, physiological needs will be assumed to have been met.

- No high school diploma: according to our models in parts II and III, people without high school diplomas have the poorest average financial security and health. Also, people without high school diplomas have the lowest rate of marriage and highest rate of divorce.[27] Per our assumption, having no high school diploma means receiving the lowest level of prestige and esteem.
- High school diploma: from our models in parts II and III, people with high school diplomas have better average financial security and health, but still lose to college degrees. In terms of marriage/divorce rate, people with high school diplomas are similarly better than those with no high school diploma, but worse than those with college degrees.[27] Per our assumption, having a high school diploma means having more prestige than having no high school degree but less than those with a college degree.
- Associate's Degree: as per the trend in the previous two categories, those with an Associate's Degree are second to those with a Bachelor's Degree in terms of financial security and health, have slightly better marriage rate and success compared to people with high school diplomas, and esteem.[27]
- Bachelor's Degree (STEM and non-STEM): people with a Bachelor's Degree have the best financial security and health, marriage success, and have the highest prestige out of the categories listed here.[27]

Hence, we can safely conclude that by using Maslow's Hierarchy of Needs, getting a Bachelor's degree will yield the optimal path to achieving self-actualization, hence the optimal path to achieving happiness and high quality of life.

According to Jung, happiness is determined by five elements, which are listed below.[28]

1. Good physical and mental health
2. Good personal and intimate relationships, such as those of marriage, the family, and friendships.
3. The faculty for perceiving beauty in art and nature.
4. Reasonable standards of living and satisfactory work.
5. A philosophic or religious point of view capable of coping successfully with the vicissitudes of life. (no causal link between this and college education, so can disregard)

Jung's the fifth element of happiness may be disregarded from this analysis as per the assumption iterated above. With regard to elements one through four, all are unequivocally better fulfilled by college graduates than by those who did not attend college. Universally, college graduates are healthier both physically and mentally, have more meaningful relationships, are better able to perceive beauty in art or nature, and enjoy more reasonable standards of living or work. Therefore, in terms of Jung's theory, it may be concluded that a college education is superior to any other course of action, for achieving a life of happiness.[21 27 29 30]

For Jung's model, we do not possess credible data distinguishing STEM graduates from non-STEM graduates, so college graduates are considered as a whole. Likewise, Associate's Degree holders are unable to be distinguished from high school graduates, so all are considered college non-graduates.

Quantitative Analysis and Life Satisfaction/Education Model:

A study by Borja Noval and Marta Garvi using 2010 Survey on Health, Aging, and Retirement in Europe (SHARE) data used the weighted factors such as health and job security to determine life satisfaction for people with varying educations.[21]

For each factor measured, there was a direct correlation between years of education and life satisfaction, but to different extents. For example, there is a high correlation between income and education received, as verified in part two, but a low correlation between social interaction and and education. It should be noted that, by the Easterlin Paradox, increase in income does not result in an increase in life satisfaction past $75000 annual income.[22]

In order to quantify such factors in an applicable way, students will be asked to respond to the following question: "Rank the following, giving 1 to the item you value the most, and 5 to the item you value the least: Health, Income, Job Security, Marriage, and Social Interaction."

Using values obtained from Noval and Garvi's study, the relative importance of each factor is taken from SHARE data using the following equation:

$$\Sigma H_i = \alpha + \beta y_i + \gamma x_i + u_i$$

where H_i represents, for a given person,the life satisfaction for a parameter of interest: β. α and u_i represent predefined error terms, y_i represents the number of years of education, and γ measures rank correlation. The resulting values, scaled for the purpose of this paper are shown below.

	Ranked Worst	Ranked Best	Range	Scaled Values	Rank 5	Rank 4	Rank 3	Rank 2	Rank 1
Health (Very Poor to Very Good)	-1.0399	-.0648	2.145	1.976	1.976	3.951	5.927	7.902	9.878
Income (Poverty to $75000)	0	1.411	1.411	1.300	1.300	2.599	3.899	5.198	6.498
Job Security (Unemployed to Self-Employed)	-.7825	.0961	.8686	0.800	0.800	1.600	2.400	3.200	4.000
Marriage (Divorced to Married)	-.3206	.3255	.6461	0.595	0.595	1.190	1.785	2.380	2.975
Social Interaction (None - Active)	-.1517	.1334	.2851	0.263	0.263	0.525	0.788	1.050	1.313
Total	-3.1719	4.60	5.36	4.93	4.93	9.87	14.79	19.72	24.65

The maximum possible life satisfaction requirement using this model is 19.191 whereas the minimum life satisfaction requirement is 10.668. By comparing life satisfaction requirement values obtained above to survey results, minimum education for a certain life satisfaction score was obtained based on a Python algorithm comparing SHARE data to this ranking system:

Required Life Satisfaction Score Range	Recommended Minimum Education
17.178-19.191	Bachelor's Degree
15.613-17.171	Associate's Degree
10.668-15.613	High School Diploma

In regards to STEM vs non-STEM fields, students should pursue a field that they enjoy and are interested in since life satisfaction is highly correlated to job satisfaction.[23]

Above sections concluded that higher education has a high economic payout meaning students whose required life satisfaction scores call for higher education should pursue that education regardless of current socioeconomic class. Students whose life satisfaction requirement does not call for higher education can meet all of their socio-economic needs without higher education, but will generally benefit from higher education regardless.

Strengths and Weaknesses:

The strength of the model for Parts I and II is predicated upon the strength of the assumptions. A strength with our model in Parts I and II is that it likely very accurately predicts the amount of money a person makes if he or she follows our assumptions, many of which are based upon the economic logical decision-maker assumption. Some of the weaker assumptions are:

1. "The family does not pay any upfront costs for college tuition and thus the student must take out loans for any portion that is not covered by financial aid." This was a worst case scenario. In reality many parents choose to pay some or all of their expected contribution.
2. "Everybody that attends college obtains a degree at the expected time." This is true for the majority of students, but there may be a disparity based upon gender and ethnicity. A student cannot necessarily expect this when considering the costs and benefits.
3. "We assume that everybody is employed." Everybody must factor the risk of unemployment when actually making cost-benefit decisions. College qualifications likely reduce the rate of unemployment, so would likely strengthen results.
4. "The economic situation will not change in the near future." This is clearly a fallacy, but it does not invalidate our results. For example, because we have made no adjustment for inflation, we in fact have wage values comparable to real wage calculation.

Strengths with our model in Part III is that it yields results corroborated by two widely accepted social theories and it relies on mostly safe assumptions. Our quantitative model is robust in that there are multiple ways to assign preferences and still get the same post-secondary education recommendation, i.e. there is not just one set of preferences that will yield a certain recommendation, which is realistic. However, there are some weaknesses in our model. Albeit inescapable, we assign to quality of life a concrete definition, which, even if the definition represents the largest proportion of people to the largest degree, will inevitably lead to a large number of unrepresented people for which the model is less effective. Though also inescapable, we assumed certain subjective factors to be objectively true, such as assuming that certain educational levels are always more prestigious than others.

Conclusion:

According to Part I, the family income is the most determining factor in the loan cost, as less of it is covered by federal grants. The family size is only significant in a range where family income does not result in a zero EFC or a maximum EFC. Ethnicity and gender result differentials in the opportunity cost of attending college, but they are not large compared to the net wealth.

According to Part II, larger family sizes result in an increase in net wealth at retirement. A Bachelor's education will benefit everybody in the long term, and a STEM degree consistently provides higher benefits than a non-STEM Bachelor's degree. Asian males benefit the most in absolute cost, while Hispanic and Black males benefit the least. Males benefit more than females for Asians and Whites, but females benefit more than males for Hispanics and Blacks. This may be correlated to the perception of Asians as a "model minority."

According to Part III, a college education, specifically a four-year degree, is superior to any alternatives. By the calculations from our models in Parts I and II, we can determine that STEM-graduates earn greater incomes both in the short term and over their lifetimes. Therefore, we arrive at the conclusion

that a STEM-degree in college is the best future course of action for a high school student to embark upon, in terms of both finance and quality of life.

Our team was asked to answer the following two questions: “Can modelling show the cost, return and value of higher education?” and “What is higher education really worth?” By modelling college education using cost, return and value, we developed an accurate model for how much college will cost. Using the data from our model and qualitative analysis borrowed from widely accepted socio-psychological models, we determined the value of higher education. It is said that money cannot buy happiness. But a college graduate can earn both.

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