Analysis of impact in College Education attainment driven by Parental Income, Race and Gender

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Abstract

Education has always been considered as the most important aspect of a country's growth. Accessibility of education is of prime importance irrespective of the economic status. Studies have already been done to show the rise in college education fees along the course of time Figure 1 [5]. Even though we expect the socio-economic status of a country's population to improve over time, has the rise in college education fees been at the same rate as the growth of a country's economy? The project plans to look at the college education levels in each of the income percentiles across the US along with the implications of gender and race in the same. In the light of recent surges in college education, do the weaker sections of society find it difficult to join degree earning programs.
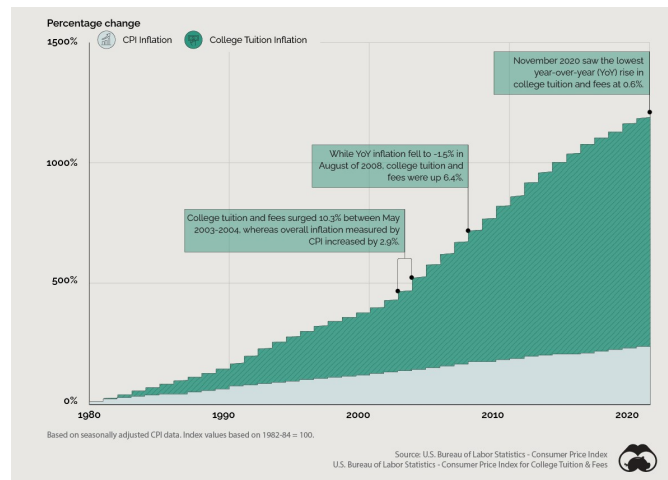
Figure 1: Rising cost of College in the U.S.

1 Introduction

Even though there are various policies in place to provide equitable education to all of the population, how difficult has it become for the government to subsidize the study in the United States for students coming from poorer economic backgrounds? Recent studies show that the affordability gap of college education is increasing year by year. And this can negatively impact the students from weaker economic strata to not have an opportunity to go for college education. This in turn hinders their opportunity to get a better earning job fueling the cycle again. If income becomes a barrier in

attaining something as basic as a college education in a developed country like the United States then efforts need to be put forward in improving the affordability of education. Does the chances of attaining a college degree diminishes with the parental household income? Is college education getting too costly in the US?

This project plans to examine the impact in college education levels in each income bracket by gender, race and parental Income by utilizing the major data-set "National Statistics by Parent Income Percentile, Gender, and Race" along with other data-sets. The project is influenced by previous analysis done on income affecting the college degree attainment [1][2]. This literature aims to study the effect of all the factors together on the admission rates. We also aim to test the existence of Simpson's Paradox in our analysis for income, race and gender factors.

2 Data

In order to analyze the impact of parental wealth on Children's college education enrollment we are using the data on National Statistics by Parent Income Percentile, Gender, and Race. The data is for the children born in the year 1978-83 [3] and is based on the Census 2000 and 2010 data. This data contains information on children falling in each of the income percentiles from 1-100, one row for each parent income percentile, and includes information of the percentage of children with college attendance by race and gender and mean child family(household) income rank by race and gender among many others.

The college education completion rate data is from U.S. Department Of Education College Scorecard [4]. The scorecard contains data aggregated at college level in the period starting from 1996-1997 to 2019-20.This literature also plans to combine the college graduation rates across the income group to check whether there are any relationship between the people getting enrolled and people graduating. We have also used the Statistics By Parent or child Income Percentile data set for our analysis [14]. The data gives us information about various statistics computed by the income percentile of parents and by income percentile of children for the share of children attending college in that percentile. For additional analysis we have used Baseline Estimates of Absolute Mobility by Parent Income Percentile and Child Birth Cohort data set[15]. It contains information about the probability of the child earning more than their parents at a given parent income percentile for child birth cohort in the range 1940-1984.

3 Literature Review

3.1 The Gender Income Gap and the Role of Education - Donna Bobbitt-Zeher, The Ohio State University

The paper talks majorly about the difference in the earnings of males and females based on various factors such as choice of college major, skills as measured by the different tests, college attended and amount of education. It is seen that there is a significant difference ($7000 approx) between the yearly income of males and females, with males getting paid more than females. The research shows based on the data used, females have less highly valued skills(generally math) and that leads to a low paid job. Another factor taken into consideration is family formation (marriage and parenthood), which also implies a disparity. The analysis shows that most women tend to take non-professional courses which in turn affects their earnings. The author also points out that women are more likely to take up public sector job roles rather than private sectors, which also adds to the difference. But on the other hand it is also stated over time the gaps in the mentioned factors are decreasing as women are now taking up professional courses and their cognitive skills are much appreciated which in turn might help disappear the gap [6].
However, the analysis only considers the Gender gap and how it affects the final earning, but it doesn't consider the family income factor for the education which can be a crucial factor for the output.

3.2 Tamborini, Christopher R., et al. "Education and Lifetime Earnings in the United States." Demography, vol. 52, no. 4, Springer, 2015, pp. 1383–407,

Tamborini et.al explores the impact of education attainment on the lifetime earnings of subjects. Gross lifetime earnings have been estimated for a 50 year work career earnings of both men and women. They found that difference in lifetime earnings by education likely contributes to the inequality in households. Sample is restricted to people from 4 birth cohorts (1932-39, 1942-49, 1952-59, 1962-69). The research helps to show that single parent households are likely to have an inequality in income distribution based on their education attainment. And even in conjugal family there is sufficient reason to suspect that male counterparts earn more than the females [7].
This research has focused on the dependency of education level to the lifetime earnings of people, we're trying to bridge the gap by finding the link between education attainment to the family income.

3.3 The impact of parental wealth on college degree attainment. Evidence from the housing boom and bust

Almost 80 percent of wealth for the average US household is accounted by home ownership. There is substantial increase in the cost and returns to college over the years and hence we can witness differences in college completion by parental income among students with similar test scores. The study shows that 85% of the students in college come from a family who owns a house or they have a home equity loan or line of credit. Income in adolescence (13-17) and family wealth also impacts on completed schooling because adolescence is among the critical development stages. The results indicate that parental wealth and income together have a strong influence on college completion compared to income effects alone. The house price fluctuations also have an impact on the educational attainment for the parents who are house owners with no impact on renters. The effect is only impacted on post-secondary education and no significant impact on high school. As per the study, the house price shocks during the years just after high school have a strong impact on college education attainment for middle and lower income students since it has an effect on parents wealth [8].
The study has only taken parental wealth (only household wealth) and income into consideration for its impact on college attainment. Gender could also have been considered for the analysis.

3.4 Cross National Patterns in educational attainment and achievement

The survey has studied the research on educational attainment based on gender across various countries. Studies that assess the impact of gender in Standardized tests (nationally and cross-nationally), reading literacy, math performance and even the grades received shows sufficient difference in the results between genders. The study constructively examines the various researches that have been done in the field across geographies and on various control variables. Smyth points out that the choices in fields of study and courses have been shaped by the existing gender differences, where females lean more towards soft science subjects and math. Author also points out that these trends are declining over the course of time and would change in the years to come. It has also been studied that the upbringing and also the interaction of teachers with students have an impact on many of the differences seen in educational attainment [9].
The paper helps us understand that there is a dearth of research on the impact of parental income on the education attainment of students. This when combined with the gender an racial profiles can show how deeper the impact can be.

3.5 Parental Aspirations for Their Children's Educational Attainment: Relations to Ethnicity, Parental Education, Children's Academic Performance, and Parental Perceptions of School Climate

The study looked at the impact of educational attainment of children based on their parent's aspirations. It's theorized that there is a varying impact race had on parental aspirations. There have already been theories on how the children's performance is impacted by the setting at home. The study looks at two major areas on how the parental inspirations varies based on the ethnicity, parental education and children's academic performance and how parental outlook on school climate such as quality of curriculum and instructors, availability of counseling services impact the aspirations of parents [10]. Still the study has not looked at how impactful parental income can be on educational attainment. The

study helps in directing our research to look for discrepancies across the races to see whether there are sufficient differences in educational attainment. This would also directly point to the parental aspirations in each of these races.

3.6 The Impact of Gender Inequality in Education and Employment on Economic Growth: New Evidence for a Panel of Countries

This research has analyzed the economic growth of certain geographic regions based on employment and education with the impact of Gender bias in it. The data covers the regions such as MENA (Middle East and North Africa), SSA (Sub-Saharan Africa), LAC (Latin American and Caribbean) and ECA (Eastern Europe and Central Asia). The results convey that the economic growth is greatly affected by Gender inequality in the regions of MENA and South Asia due to a large difference of male-female in education and employment. It is seen that in the 21st century also, women are very much discriminated against in both economic and education participation in South Asia. Whereas in MENA, the male-female gap in education has reduced over the time, but the gap in employment is still prevalent. It is inferred that gender inequality is an important factor that is restricting the economic growth in these regions from the results. The article does mention about caveats of model errors, lack of data for cross-country comparisons which are controlled to some extent but more work will be required to solidify the findings [11].

The article does not take parental income or students' background into account for the lack of education and employment which in turn can affect the economic growth drastically for different regions.

4 Results & Analysis

The analysis spawned mainly two datasets the Parent or Child Income percentile statistics as well as the National Statistics by Parent Income Percentile, Gender, and Race.[1]

The initial analysis on the the parent or child income percentile statistics showed that there is a strong linear relationship between the income percentile of the family and the share of students attending college from each of those income brackets in Figure 2. This clearly showed that those who are at the lower income strata of the society are clearly at a strong disadvantage of enrolling their children to colleges. But a comparison against the average family income for each bin tells us a rather different story, Figure 3. The relationship is not linear rather there is an exponential growth on the children attending college on the higher percentile. Median household income in the United States was $42,148 in the year 2000 [12].
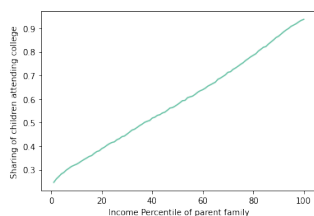

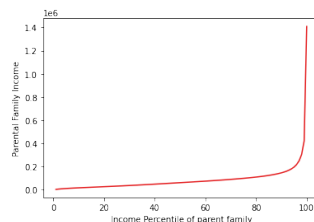Figure 2: Parent Income Percentile vs Children Attending College

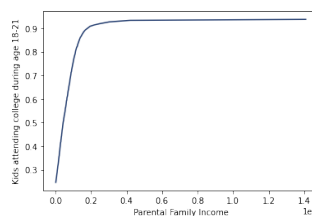Figure 3: Parent Income Percentile vs Parental Family Income

Figure 4: Parental Family Income vs Kids attending college during age 18-21

We see that the 90% mark of college attendance is reached at a household income of almost $200,000. This is a quite staggering amount when compared to the median family income of 2000. The inefficiency of the societal structure is evident here. Given that there is an increase in the cost of education every year this would make the younger generation deprived of college education given that they are from a poor family background. This is similar to the sharp rise in income towards in top percentile, Figure 3. There also is a staggering relation between the average family income of the kids compared to their Parent's income in the same bin, Figure 5. The kids who earn or are in the higher income brackets often come from affluent families. This shows us a repeat in the cycle. That

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[1]The data and the code can be found at: $https://github.com/ngupta72/DSCI531-Project$
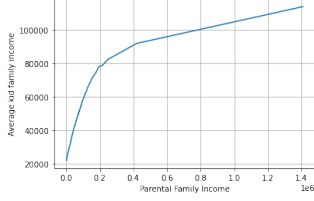
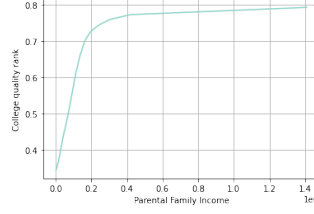Figure 5: Parental Family Income vs Average kid family income

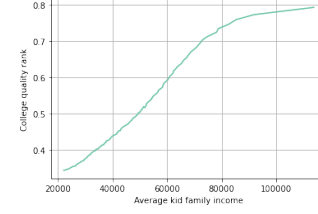Figure 6: Parental Family Income vs College Rank

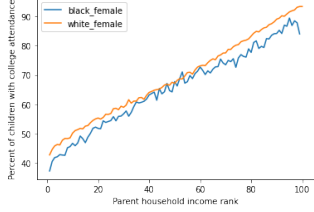Figure 7: Average kid family income vs College Rank

Figure 8: Comparison of Black and White Female for Parent Income rank vs Children college attendance
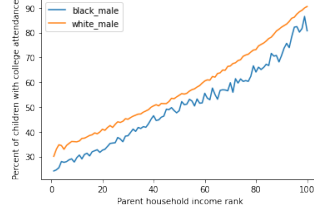

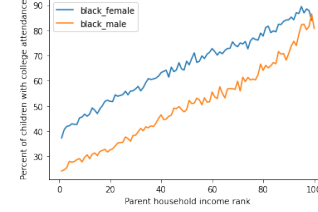Figure 9: Comparison of Black and White Male for Parent Income rank vs Children college attendance

Figure 10: Comparison of Black Male and Female for Parent Income rank vs Children college attendance

being born into lower class families on average makes the children earn in similar income brackets. Another interesting factor that we could see is the relation between college quality rank and the Parental Income, Figure 6. The graph shows that most of the people below the 200K average income bracket attend college which are on or below the 70% mark. If we look at the amount of people with whom the study was conducted then it shows a rather alarming trend. Count of people in study with income greater than $200,000 is just 49,3387. This is close to 5% of the total people being studied. Only kids born into family above this income bracket has chances of attending college which were having quality rank greater than 75%. That count is almost equal to 937,4349. This clearly shows the huge gap in the attainment of quality of education. Given that most of the top colleges in the country are private and only the affluent are afford to get their children join such colleges would also be a reason for the same. The scholarships and financial aid in these colleges would also be available only for exceptional students which would be a small fraction of the total students in each of those income percentiles. This is also in contrast to Figure 7. This graph shows a general trend where there is a linear relationship between the income and the quality of the college attended. This comes as no surprise as students attending better college on average tend to earn more than other students who had attended a college with a lower rank.

Next we went for the analysis of race and gender differences in the college admission rate. This data was based on [3]. The comparison of household income to college attendance rate for for females who are either black or white indicated that there is a smaller gap, Figure 8. Even though white females were at advantage throughout the income groups the difference was not prominent. Even though white females in higher income brackets achieve attendance rates of more than 90% black females achieve maximum attend rate close to 85%. And there is also a small dip in the values for black females towards the top. But the difference is more prominent for males. The gap in education attainment is visible throughout the income percentiles. The black males attendance in lower wage group can go as lower as 20%. But for white males even at lower levels they show attendance rate above 30%. This huge difference might be indicative of the conditioning existing within these races or can also be indicative of the dearth of ample opportunities.

Another interesting fact her is the difference between male and females within the same race. Black females are shown to be active in getting educated compared to their counter parts in the same income bracket, Figure 10. The education attainment of black females are in par or even better than white males. And this difference is much more prominent in the lower income group. We have similar graphs when the white males and females are compared. The education attainment in much higher for females (close to 45% compared to 30% in males).
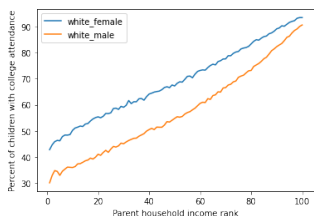
Figure 11: Comparison of White Male and Female for Parent Income rank vs Children college attendance
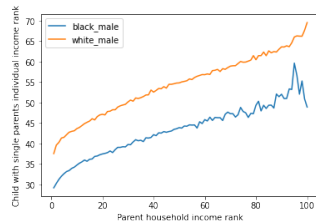

Figure 12: Comparison of Black and White Male for Parent Income rank vs Children with Single Parents individual Income rank
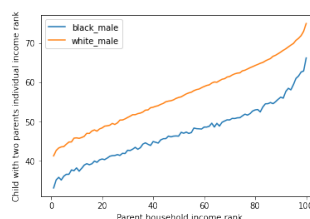

Figure 13: Comparison of Black and White Male for Parent Income rank vs Children with Two Parents Income rank
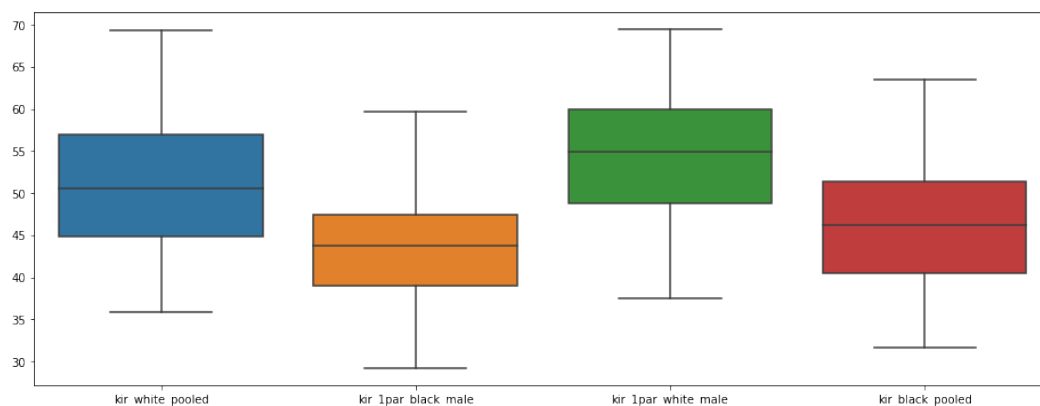

Figure 14: Plot for Mean child individual income rank by race and gender

The next set of comparison was based on the familial ties. Whether there are consistent differences between single parent families and conjugal families. The analysis was again done of the basis of race and gender. Since female data was not available we had to limit the analysis just to males. Comparison between black male and females show that there is a huge difference between the income attainment on black and white males on single parent families, Figure 12. It looks as if the difference is exacerbated by the familial ties. Around the 50th percentile the difference is close to 12%. This is double compared to the 6% difference in education shown in the pooled data, Figure 9. Even though we have similar difference for conjugal families. The kids are seem to be faring better compared to the children in single parent family. A good indication of this is the lower income values are above 30% for both white and black children. Whereas in former the values are going below 30%. Figure 14 Shows this better in the form of a box plot. The differences in the max min and mean values are better visible here.

We also compared the percentage of children getting employed around the age 30. This comparison was also done between black and white children. This was an extension to the education attainment rates. We also compared the mean family income of the kid from the same income percentiles of parents. A same linear relationship can be seen between the college attendance and the Mean child family income rank. Figure 15, 16, 17. White females have the best performance indices. Black males and females are on the lower side of the graph with their income going as low as 25% for black males. Same is the case for black females as well but the lowest points are around 30%. Their high incomes are also bounded with a 60% limit. The white males and females on the other hand achieve income ranks as high as 70%. This might be quite noticeable when we analyze the kind of work these groups of people were doing. And also the unemployment rates within these races could also give us good insight. Right now we have done analysis on how parental income has an impact on college attendance rates. We have delved deeper into how these impacts at a gender as well as race level. Now we would like to extend the analysis at a college level. Whether there is a difference on how various income levels are getting admitted on to various tier colleges. The impact gender and race can contribute to this attendance can also be analyzed. We're in the process of gathering more
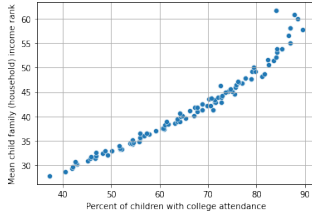
Figure 15: Percent of Black Females children with college attendance vs Mean child family (household) income rank
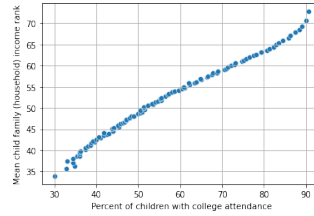

Figure 16: Percent of White Males children with college attendance vs Mean child family (household) income rank
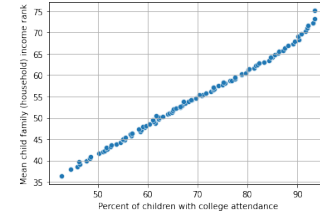

Figure 17: Percent of White Females children with college attendance vs Mean child family (household) income rank
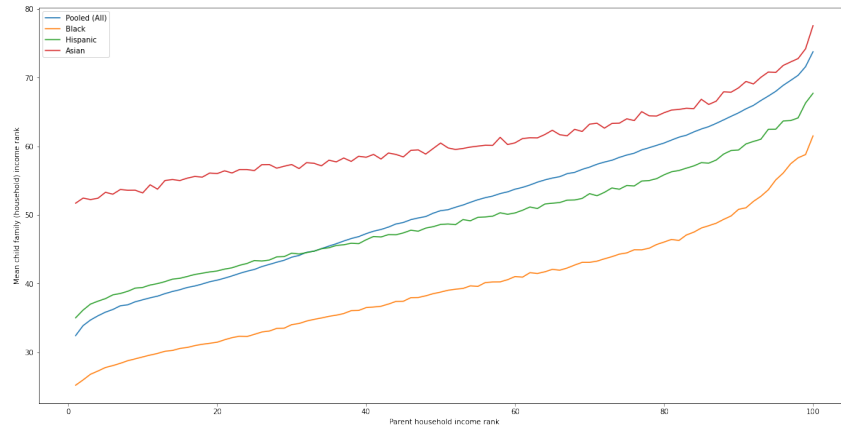

Figure 18: Parent household income rank vs Mean child family income rank for different race

data which can be tied along with the analysis that we have done.

Figure 18 shows the analysis that we did for the pooled mean child income and the mean child income for various races individually. We saw that there is always a linear increase in the income among the individual race and the pooled data. Hence there was no effect of Simpsons's paradox with respect to the income.

One of the another analysis that we did along with the project was to analyze the upward mobility of income[13]. This was important to see how well the wealth was getting transferred across generation. The graph in Figure 19 shows that there is an year on year decrease in the percent of children earning more than their parents. This decrease is consistent and we believe that this along with the rising prices of college education fees can be really hurtful for students planning to pursue higher education.
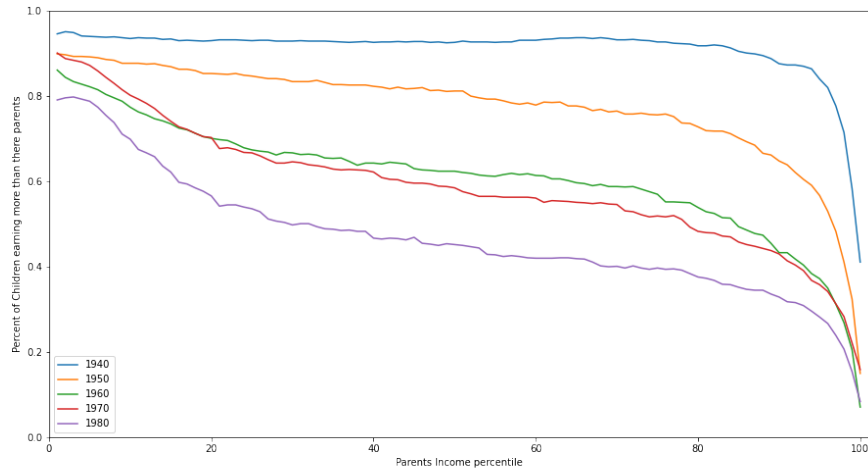
Figure 19: Percent of Children earning more than their parents

5   Conclusion

The analysis done on National Statistics by Parent Income Percentile, Gender, and Race shows that there are considerable impact on the college education attainment by Race, Gender and Parental Income.[2] Income has been a driving factor and the data shows us the same. There is a strong linear relationship between education attainment and income. When looking at the absolute income percentiles we see that the relation is non linear and exponential after a certain income range. 90% of attendance is attained only at income mark of $200,000, this shows how much of an impact parental income has on education attainment. The next driving factor is Gender. The analysis on Gender shows that females outperform males in almost all income brackets. Quality of Black females attaining college education is in-par with white males. With respect to race white have better chances of education attainment compared to black. These factors can be read along with the decline in the income mobility. We hypothesize that these gaps can be aggravated due to other socio-economic factors and these factors can be further analyzed to evaluate the impact. Results of the project would make it easier to make finer analysis in the area.

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