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### The Gap Between Family Income and Graduation Rates

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State University of New York  
College at Buffalo  
Department of Applied Economics and Finance

The Gap Between Family Income  
And Graduation Rates

A Thesis in  
Applied Economics and Finance

By:

Kaylee Gatto

Submitted in Partial Fulfillment  
Of the Requirements  
For the Degree of

Master of Arts  
December 2020

## **Abstract**

Family income has determined to have a significant effect on graduation rates for students. A family's income can impact many aspects of a student's life. There has been numerous studies performed on the effect that family income has on student's graduation rates. This thesis focuses on the hypothesis that students who come from families with higher income are more likely to succeed and graduate than those from lower income families. This thesis focuses on how family income effects these students and in what ways. This thesis shows the differences that high income and low income students face. The findings performed in this thesis have shown that family income in fact does have a significant effect on graduation rates. Findings also have shown that race plays a role in graduation rates as well. This thesis will go into greater detail on graduation rates based on family income and race.

State University of New York  
College at Buffalo  
Department of Economics and Finance

The Gap Between Family Income and Graduation Rates

A Thesis in Applied Economics

By: Kaylee Gatto

Master of Arts

December 2020

Dates of Approval:

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& Finance  
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## Contents

Introduction:.....	5
Section 1: Literature .....	10
Section 2: Loans and Grants .....	18
Section 3: Regression .....	29
Section 3.1: The MEANS Procedure.....	29
Section 3.2: The Univariate Procedure for Prop Tax.....	31
Section 3.3: The Univariate Procedure for Exp Ed .....	38
Section 3.4: The Univariate Procedure for Med Inc.....	40
Section 3.5: The Univariate Procedure for Grad Rate .....	41
Section 3.6: The REG Procedure .....	43
Section 3.7: The AUTOREG Procedure .....	47
<b>Conclusion:</b> .....	50
References .....	53

## Introduction:

In prior generations, earning a high school diploma was sufficient enough for the average person to achieve a middle class income. In today's society, in order for most individuals to have a career that he or she will obtain a middle class income he or she must earn a higher degree of education. Individuals achieve earning a middle class income or higher by furthering their education and attending college to obtain a degree such as a Bachelors, Masters, or Doctorate degree. Applying to college is an overwhelming experience for anyone who is of interest in attending college. Some students have an advantage over other students strictly based of their families' income. A family's income has a significant effect on student's success in college and preparation for college. There is a gap between those high income families and low income families. Throughout this paper the gap between high and low income families will be discussed in greater detail.

High income families are able to provide their children with the tools they need in order to prepare for college. Such tools include paying for the college applications and providing him or her with additional assistance such as tutors to help them with their classes and SAT prep. This is an advantage for these students because they are able to work harder and get into better colleges, which ultimately sets them up for a higher success rate. This is because these students are able to get into higher graduation rate colleges. While attending a higher graduation rate college, students are more focused on achieving the goal of successfully completing their degree. These higher graduation colleges also accept only the best candidates to attend their college. A student who has low grades in high school, are not going to be accepted into the same college that a

student whom earns high grades in high school. This partially has to do with the type of family these students come from. Students who earn high grades are typically the students who care about school and have their families whom are involving in their daily life and school work. Lower income family students may not have the advantage of having their families as involved in the school work as higher income families.

Earning a college degree after high school graduation is an opportunity many individuals intend to accomplish. There are numerous reasons in which an individual choses to attend college and earn a degree. Most individuals want a college degree because he or she wants to excel in life and be successful earning an income where he or she are able to support themselves and their families. Also, most people must obtain a higher degree of education in order to be considered a middle-income class person and can barely make ends meet with a minimum wage or low salary job. Although, a higher income career can be accomplished without a college degree, it has become much more difficult to obtain a higher paying career with no sort of education other than a high school diploma. Many careers that pay more than a middle class income require that an individual has a degree in that specific field.

Many individuals choose to attend college after high school graduation in order to obtain a higher degree of education because education is so significant in society today. Earning a higher education is a goal some individuals pursue after high school graduation because he or she feels successful and gains a rewarding feeling once a college degree is received. Earning a college degree is a huge accomplishment and a rewarding degree of achievement once completed. When an individual has a college degree he or she is looked at in a different manor. When college education is shown on an individual's

resume while applying to an open position for a certain job, this makes them stand out and be noticed by employers. Employers look for college education in almost every job. With no college education, some individuals may not qualify for certain jobs. Individuals with no college degree might not meet the basic requirements in which an employer looks for in their perfect candidate for the job.

An individual may choose to higher their education for numerous reasons. One of the main reasons is to improve their future and get a career in a position of their interest. In a world full of competition, it has become very difficult for people to find a high earning career, even with a college degree. Landing a job even after graduation could be a struggle for come individuals because the job field has become more and more competitive. Some students may take a pay cut and accept a job that is not even in their field of education. This is seen so often because after graduation, finding a job has become stressful and competitive. Job interviewers look at many different aspects on a person's resume, education being one of the main items, followed by experience. There may be one open position for a job with hundreds of applicants, which makes finding a job after college difficult for many students. Individuals may find themselves interviewing for months before landing a job, which may not even be their "dream job."

Although attending college is a great opportunity for all students, making the decision to attend college also comes with an expense. There are many factors students have to think about when choosing what colleges to apply to and which college they want to attend once they have been accepted. Some of these factors may include the cost of tuition and choosing to attend a public or private university. In order for most students who do not have the advantage of their parents assisting in paying for their tuition, these



students must finance their education. The average student cannot pay entirely out of pocket to attend college. When these students graduation college they are faced with a tremendous amount of student loan debt, which puts a financial burden on their future. The students that do not have the assistance from their parents that some other students do, may find themselves unable to complete college due to having to drop out of college for personal reasons. Some of these reasons may be because they are unable to focus completely on their education due to them having to work while continuing their education and attending classes. Students that are fortunate enough to have their parents pay for their college has a greater advantage of being able to focus on their school work and not worry or stress about financial expenses.

When deciding where to attend college, students are faced with many different options, which include different types of meal plans, living on or off campus, private or public universities, and what scholarships they intend to apply for. Scholarships are beneficial to students, although there are many students that may not have the advantage to get certain scholarships. For example, some students may be provided with the opportunity to get certain athletic scholarships. This ties in to students who come from well income families having a better advantage than those students who may not come from a wealthy family. Wealthy families will be able to provide their children to attend different sport camps and hire private athletic trainers that help them better themselves in a certain sport and learn the required skills that college recruiters look for. The same goes for academic scholarships. Students from wealthier families are able to get the private teaching lessons they need and may have parents that are more devoted into their schoolwork. These parents spend quality time with the children at night and ensure that

their homework is completed.

Another topic of interest is the difference in the amount of financial aid offered to different families based on their income. Why are some students offered grants, scholarships, and loans while others are not given the opportunity? It is obvious that some students will get offered more financial aid based on their family income. It can depend if a student's parent is single or divorced and the amount of income their family has per year. A student who has a single parent and makes minimum wage is going to be offered more assistance than a student whose parents make six figures and are not separated. These families will be offered less assistance because it is assumed that they will be able to pay for college themselves without assistance. Families that have a high amount of income may be offered little to no assistance with student loans. This could cause difficulties for the student, as they will have to take out more private loans themselves if their families are unable to fully pay for their college expenses. Students may then have to finance their tuition through private loans. Private loans may be difficult to be approved for and may not offer the exact amount to cover student expenses.

The final topic of interest is how many students whom go to college complete their courses and graduate. A student may decide to go to college, but only complete one or two years of college before they decide to drop out or not continue to attend college. Some of these students are forced to drop out of college. They may decide to not complete college for numerous reasons, such as not being able to receive enough student loans, being forced to drop out due to unsatisfactory grades, losing interest in their major, or personal reasons. Some students have to completely pay for their college themselves

with little to no help, which may lead them to having to drop out of college and not completing their courses. Some other reasons may include that they are a single parent and unable to provide for their children while attending college.

The purpose of this research paper is to understand the gap between college graduation rates and family income. Throughout time, research has been performed on the graduation rates of the rich and the poor and how family income contributes to this. Some of the questions that will be addressed throughout this research paper are as follows. How is family income related to graduation rates? How is family income contributed to where a student attends college? What is the graduation rate of students who get financial aid? How are graduation rates related to family income? What type of financial assistance is offered to students who attend college? How does race have an impact on graduation rates? Family income and race have a major effect on graduation rates in college. While performing research on such topics, many authors have done their own research on family income in relation to graduation rates and how race affects graduation rates as well. Throughout this paper different research papers and articles will be discussed on the topic of graduation rates in relation to family income and race.

## Section 1: Literature

There have been numerous papers written on graduation rates and how family income affects these graduation rates. Also, how family income affects students in general regarding their schooling. Students may not realize how family income affects the graduation rate of college students. A family's income sets up a standard expectation of a child's success. If a child comes from a low income family whose parents have no

college education, he or she will likely not further their education either. Parents are setting an example for their children that furthering ones education is not a requirement.

The following paragraphs provide literature based on the graduation gap related to family income and on student loan debt by different authors. The have also provided how family income has an effect on students school work. The following paragraphs are based on the different literature discovered and what other people around the world have researched regarding the topic of graduation rates and family income. Research on what has been conducted by other authors on the topic of graduation rates and family income and what they have concluded from their own research. These readings are interesting and knowledgeable. These research papers were helpful to see what other people around the world have written and researched regarding this topic. While performing research I have gained knowledge based on the topic of discussion and realized how much of an impact family income does in fact have on graduation rates.

The following paragraphs will also discuss topics on student loan debt. Many students are faced with a tremendous amount of student loan debt after graduation. This ties into the relation of family income. Students without the financial support of their families may have to completely finance their education as many students do. Many students suffer with student loan debt after the completion of the degree, and sometimes without even completing their degree due to having to job out of college for various reasons. Not every student that goes to college completes their degree, but are still faced with student's loans that they have borrowed for school. Even without completing their degree, students are required to pay back the money that they borrowed.

The first research paper known as “Family Income and the College Completion Gap,” written by Alanna Bjorklund-Young of John Hopkins School of Education written in March of 2016.<sup>1</sup> Throughout her research paper the author discussed how family income contributes to the graduation rates of college students. She discussed the importance of people in the 1970s not having to attend college in order to become a middle class income family. The average family could have a middle class income with only a high school diploma because college simply wasn’t as demanding as it is today. Back during the time of the 1970s, a household didn’t need two family incomes in order to survive and provide for their family. During this time, necessities such as cars and homes were also not as expensive as they are today. Today, most households need incomes from both the husband and wife in order to live a comfortable life; whereas in the earlier time frame women were able to stay home with the children. In fact, 60% of people were able to obtain a middle class income during this time with just a high school diploma. Bjorklung-Young states that in 2007 this number fell to 45%. This is a significant decrease in a short amount of time. Over half of families were able to obtain a middle class income in the 1970s in comparison to less than half able to obtain a middle class income in 2007. Some children come from families with only one parent, which tends to lead them to being in the lower class. There are many contributing factors to this. For example, a single mother or father may only make minimum wage, but only have 1 child to take care of, whereas another single mother or father may have multiple children to take care of making the same minimum wage income.

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<sup>1</sup> Alanna Bjorklund – Young. “Family Income and the College Completion Gap. Edpolicy.education.jhu.edu (March 2016).

There is such a significant gap between college graduation rates for the rich and the poor. There are many different reasons that this may occur. One of the reasons could be that students from a lower income are not as educated about college as students from a higher income family. Students from a lower income family may also have less of a support system and have to strictly pay for college themselves with no support or guidance. This may lead to he or she having to work full time while also attending college, which puts a burden on their grades as they focus on their job and coursework at the same time. Lower income families may suffer due to the fact the children are not provided with the same materials that high income families have such as tutors and being able to be home with their child to assist on homework. High income families are typically more involved in their children school work and grades, so these students may have a greater pressure to succeed and achieve high grades. Having a parent whom stays home every night and works on homework with their children, have a major impact on their coursework and their focus in school.

During a study performed by the National Center for Education Statistics, they showed that 6 in 10 students who were involved in this study stated that they had to pay for college themselves. These findings are not surprising as many students do not have families that prepare well ahead for their child's education or these families may not be able to put any extra money aside to contribute to their child's college fund. Many students attend college with no savings at all and are forced to work while attending college. It was shown that students from lower income families tend to go to colleges with lower graduation rates. This is because these students are likely unable to be

accepted into colleges such as Harvard and Yale. Students attending a lower graduation rate college, sets up the expectation that they may not graduate as well.

Also provided in Bjorklund-young's research paper was that merit scholarship programs in Georgia and Arkansas increased the graduation completed rate by 3 to 4 percent. When students are offered assistance to pay for college, this could lead to one of the factors in the graduation rate. There was a report by The Education of Trust which analyzes the completion rates of students who were offered Pell Grants. Pell grants are offered on a needed base scenario provided by the Federal Government. Their report found that the difference in graduation rates was 5.7% from those who were offered Pell grants and those who were not. They also discovered that many students who are offered Pell grants go to colleges whom have lower graduation rates.

In her research paper, she discussed the National Center for Education Statistics findings they obtained from the Education Longitudinal Study. In their study, they included 15,000 students who were sophomores in high school in the year 2002. They determined a few different findings during their study such as there being lower graduation rates from students who are from low SES backgrounds and that lower graduation rates of low SES students cannot fully be explained by the lack of academic preparation. The researchers also determined that students from low income families are less likely to be prepared academically in comparison to those students of high income families. It is stated in her research paper that there has been research conducted which has been established to show that when college tuition rates are reduced, graduation rates are increased. Students are more likely to enroll into classes when college tuition is lowered because it is more realistically possible for them to afford it and not have to

borrow so much money for their education. She discovered during her research that the top two reasons students didn't finish college is because they were trying to balance work and school. Students of a lower income class may have to get a job while attending college in order to afford basic necessities of college such as books and supplies.

The second research paper of discussion was written by Lane Anderson in June of 2015, called "The Graduation Gap: Why Poor Kids Aren't Getting through College."<sup>2</sup> Throughout his article, he included his research provided by different statistics and potential reasons as to why there is a gap between the rich and the poor in terms of graduation rates. He stated that poor income families lack the proper tools they need to prepare their children for college, such as SAT prep, private tutors, and parental encouragement. With the help of SAT prep, students are able to obtain a higher score on their SAT, which leads them in the right direction for applying to colleges. SAT scores are one of the major factors colleges look at in an application.

When students have tutors, he or she are able to have that practice they need and a one on one interaction with someone who is helping them based on their specific needs. Parental encouragement may also play a major role in how students apply themselves when it comes to school work. Students who have support from their parents and guidance are more likely to earn better grades because their families are there to support them and work with them. Students of lower income families may be left alone while their parents are working trying to provide for their families. This can cause them not to

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<sup>2</sup> Lane Anderson. "The Graduation Gap: Why Poor Kids Aren't Getting Through College." (June 15 2015).



care to finish homework assignments, which leads to lower grades and getting into trouble in school as well as outside of school.

In Lane's research he stated that the College Boards data showed students of families whose income is more than \$200,000 score an average of 350 points higher on their SAT scores. He also discussed the study from the National Center for Education Statistics. Lauren Musu-Gillette is the co-author of this study. The study shows 15,000 high school students who continue on to college. Their progress was recorded and found that 60 percent of students from high income families graduated from college and 14 percent of those were from low income families. Families who have an income of \$25,000 or lower had about 44 percent of students who attended community colleges after high school. Community college graduation rates are also lower than four-year public or private college graduation rates.

Lane provides information about the Yonkers Partners in Education. This is a program designed to help students or lower income in Yonkers, New York. There are about 75 percent of students in Yonkers whom qualify for free or reduced lunch prices, which shows how low the income of these families are. The Yonkers Partners in Education program provided assistance to these children of lower income families with SAT prep and counseling. With their help, over 70 percent of high school students were admitted into college and about 42 percent went to nearby community colleges. When looking at these students 3 and a half years later, only 6.7 percent of these students were still enrolled in community colleges. This is an extreme decline of the 42 percent who were enrolled in community colleges 3 and half years prior. In only a few years that number dropped from 42 percent to 6.7 percent who remained in community colleges.

There are many different reasons as to why these students may have not been able to continue their education. Lane states that these students may have to travel 3 hours in order to get to college and still have to work to support their families. The commute along with the hours that have to be spent in classes would be exhausting to most people while also have to work to help their families income. It's not shocking that these students would choose to drop out of college due to these conditions.

Students who come from poverty are effected in many ways when it comes to schooling and their personal life. These students may not be able to have the materials needed for school and guidance at home from their parents for homework and study time. These students may also find that one of their parents are absent. Many children are raised with only one parent, which has an effect on them. This leads them to being deprived of emotional support and encouragement in school work. As stated by Stanley H. Master in his research paper “ The Effect of Family Income on Children’s Education: Some Findings on Inequality of Opportunity,” “family income may also have a more general effect on children’s education since more income should lead to better food and medical care and thus to brighter, more attentive students. Increased income should also lead to better housing.”<sup>3</sup> This statement is significant. Students that come from a high income family likely have home cooked meals with their families every night.

Students from lower income families may find themselves having to cook for themselves and may not have healthy choices as eating healthy is not cheap. Masters also

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<sup>3</sup> Stanley H. Master. “The Effect of Family Income on Children’s Education: Some Findings on Inequality of Opportunity.” The Journal of Human Resources, 1 April 1969, Vol. 4(2) pp. 158-175.

states that students whom have larger families may have a disadvantage because their parents may not be able to pay as much attention to each child as a family that has only one a two children. Families that have four or more siblings may not get the one on one attention that a single child would get.

Lastly, Masters advises that students who come from better educated families are able to provide additional encouragement to their children to succeed and do well in school. When a parent is well educated they are able to assist better on homework and be able to teach their child, other than just in the classroom. Educated families are able to work with their children outside of the classroom. They are able to sit home with their children at night and ensure homework is being completed and assist on what he or she may need help on. Children are able to learn at home as well as in school, which is an advantage since their parents are guiding them to success.

Masters also makes the connection that if one or both of a child's parents are not around, that child may be deprived of emotional support as well and encouragement in school. Some children may be left home alone most nights while their parents are working. Some children may only have one parent present due to separation or the loss of a parent. Such situations would put a great effect on student's ability to do well in school. With only one parent making an income, likely this child would come from a home that is low income due to the lack of additional support from another parent. One parent having to provide for one household is not an easy task.

## Section 2: Loans and Grants

When students do get into college and start taking college courses, some students are unable to graduate for various reasons. There are many reasons that students may not be able to graduate and earn their diploma. One of the reasons is because of the amount of student loan debt that students face when attending college. Most students are unable to pay for their college tuition out of pocket and are forced to finance their education. This puts a financial burden on their future and they may find themselves unable to complete their program, due to the amount of money that needs to be borrowed. Many students have to completely finance their entire education. There could be obstacles along the way that affect them from receiving their financial aid, which often leads to dropping out. Some of these obstacles include not being able to borrow more money or not being able to keep certain scholarships that they have earned forcing them to drop out of college.

Although grants and scholarships are available to students, due to the recession in 2008, there was less money that universities could contribute to grants and scholarships. This also led to people having to borrow more money for tuition because those grants and scholarships were no longer enough to cover tuition. Students who would depend on grants and scholarships would now have to depend on borrowing money to pay for college. “From 2005 to 2011 alone, total private student loan debt more than doubled from \$55.9 billion to \$140.2 billion,” as stated by Anne Johnson, Tobin Van Ostern, and Abraham White in their paper “The Student Debt Crisis.”<sup>4</sup> This is a shocking result to see that in 6 years the amount of students taking our private loans more than doubled.

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<sup>4</sup> Anne Johnson, Tobin Van Ostern, and Adaham White. “The Student Debt Crisis.” October 25, 2012. Americangross.org.

College is becoming so expensive that students are unable to pay for tuition without the help of borrowing money from private lenders. When students have no other option than to borrow money for tuition, this comes with a great deal of burden on their future. For instance, when an individual borrows money, there is interest on these loans. Some interest starts right when the loan is taken out, while some interests occur after payments start being made. Due to interest rates on these loans, students often end up paying more than they actually borrowed. Interest rates are partially the reason that it takes individuals many years to pay off their debt. Many individuals can only afford the minimum payment on their loans and only end up paying a little portion of what they really owe. This is because the minimum payment that they are making monthly is mostly going towards the interest on the loan.

There are different types of loans and grants that students can take advantage of while borrowing money to pay for college. The first item to understand is what type of loan an individual is borrowing. Federal and nonfederal loans are available to students.<sup>5</sup>Federal loans are offered by the federal government and nonfederal loans are offered by private lenders and banks. The advantage of federal loans is that the interest is typically lower than nonfederal loans and they have a better payment plan for students. If students are unable to pay their loans, they are more lenient towards payments. Students should avoid at all costs taking out nonfederal loans. It is not stressed enough for students to fully take advantage of all the federal loans that are available to them. When students apply for financial aid they may be offered two types of loans, subsidized and

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<sup>5</sup> Federal Student Aid website. Studentaid.gov.

unsubsidized. These are federal student loans as known as Stafford Loans or Direct Stafford Loans. When students decide they need assistance in paying for college they must complete what is known as a Free Application for Federal Student Aid otherwise known as FASFA. This application allows the students school to determine how much aid a student needs based on their financial situation. This may be based on many different items such as if the students' parents are together or separated and how much income their household brings in. Also, how many family members are in their household.

There are many differences between federal and nonfederal loans. Federal loans will not have to be paid until a student graduates or leaves school. Also, if their enrollment status is changed from full time to part time. This may be an encouragement for students to stay full time and complete their bachelors in four years as they do not want to have to focus on paying their loans while attending school. With federal loans, the interest rates are fixed and mostly lower than nonfederal loans and there is not a credit check excluding PLUS loans which can benefit students by helping them with their credit score. Another positive to federal loans is there is no co-signer necessary for students to take out these loans. Federal student loans offer multiple repayment options for students depending on their current financial situation and can also be postponed or lowered if needed.

Nonfederal loans may require that payments be made while the student is currently enrolled in school. This may cause additional stress on students as they may need to work in order to pay for their current loans while still attending school. They will not be able to provide their full attention to school when having to worry about making

payments on their nonfederal loans. As previously mentioned, the interest rates on nonfederal loans are higher than on federal loans. They are also not subsidized which means that students are responsible for all the interest on the loan. There are many disadvantages to nonfederal loans. One of the disadvantages includes that student may need a cosigner. Finding a cosigner may be difficult for some students. Another disadvantage is that these loans may not have deferment options if students find themselves in a financial situation where they cannot afford their loan payments.

Subsidized loans have more of an advantage to students because they do not rely on the student to pay the interest while they are in school. While the student is in school, the United States Department of Education pays interest on the loans, which is better for the student not having to pay this interest while they are currently attending school. The United States Department of Education will pay the interest on these loans while the student is at least half time. They will also pay the interest the first 6 months after a student leaves school. This 6-month period is known as a grace period. It allows students to get on their feet after leaving school and intention to find a job in that period of time. These types of loans are available to undergraduate students. The school that the student is attending is who determines the amount of money a student is allowed to borrow. This must not exceed the financial need of the student. In other words, a student is not allowed more money to borrow than what they actually need and they must use this money for school related expenses. In some cases, students may get enough money to cover the cost of tuition and still have a remaining balance left over. This amount is given back to the student, but must only be used for school expenses such as books and housing.

Unsubsidized loans are offered to both undergraduate and graduate students. Like subsidized loans, the school determines the student needs and what is the acceptable amount a student should be offered to borrow. Students again must only use this money towards educational purposes such as tuition, books, and housing. The disadvantage to these types of loans is that the student is responsible for the interest immediately unlike with subsidized loans. The interest is added to the principal of what a student owes and is not paid by the United States Department of Education. It is important for a student to know the difference between these two types of loans.

Another loan program that is offered to students is known as the Federal Perkins Loan Program. This program is offered to undergraduates and graduates who need exceptional financial assistance. With this program, the college the student is attending is the lender of the loan. It is important for students to look at all their options before deciding how they want to finance their degree. Students much take advantage of the federal loans that are available to them because taking out private loans to pay for college is not ideally for anyone.

Analysis has shown that under half of students that receive Pell Grants for college actually finish their four year program. Many low income college students are not completing their degrees within the four year time frame and some are not finishing at all. According to Nathan Favero, author of “Why graduation rates lag for low-income college students,”<sup>6</sup> available data suggest that reason Pell Grant recipients have lower graduation rates is related to both the nature of the colleges these students attend, as well as the

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<sup>6</sup> Nathan Favero. “Why Graduation Rates Lag for Low-income College Students.” (May 12, 2018).



personal barriers these students face.” He states that the students who receive Pell Grants are more likely to belong to racial minority, have parents whom never attended college, and are parents themselves. Some of these students whom receive Pell Grants are single parents and may not have attended college right after high school graduation. For students that are single parents, they face greater obstacles than those who have a partner, or those who do not have children of their own at all. Single students with children have to balance their school life with their personal life which may include having to find a daycare on days they attend school or work. It’s no surprise for one individual trying to balance school, work, and providing for their children may be difficult. This leads to them not being able to take as many courses each semester and makes getting their degree take even longer.

Favero also states that students who receive Pell Grants usually go to schools that have lower overall graduation rates. One of the reasons for this is because some of these students may be unable to be accepted into a college that has better graduation rates due to their previous academic performance in high school. A C average student is not going to get into a college that an A or B average student might. Those schools typically have a higher graduation rate due to having students who are able to keep up with their work and get the help they need from tutors and their professors.

In the article “The Persisting Racial Gap in College Student Graduation Rates,” by The JBHE foundations, Inc states, “Department of Education data shows that black students who earn a four year college degree have incomes that are substantially higher than blacks who have only some college experience but have not earned a degree.”

<sup>7</sup>According to their research blacks are 21 percent below the graduation rate of white students. There are not many colleges in the United States that have a higher graduation rates for black students than white students. This could be for many different reasons. Some of the reasons include these students coming from low income families which may not have the proper material such books and tutoring. Also, many of these families are not from families who have college education. Without having a parent or grandparent who has a college education they may not have the proper tools and guidance of those who come from families who have college backgrounds. These students may lack academic preparation and study habits. Their expectation levels may also be lower. When a student comes from a high income family who is college educated and involved in their child's life, they have more pressure to complete their programs and earn their college degree.

Harvard University is one of the highest black student graduation rates of any other college. There are many different reasons behind this. For starters, not every student is capable of being accepted into Harvard University. Harvard University is a much more competitive college to be accepted into compared to other colleges. They choose the best of the best so, likely the graduation rates will be better. They choose students whom receive the highest grades and highest SAT scores. It is shown that every 19 of 20 black students who get accepted to high competitive colleges such as Harvard, Princeton, and

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<sup>7</sup> The JBHE Foundations Inc. "The Persisting Racial Gap in College Student Graduation Rates." (November 23, 2015)

Amherst complete their programs and earn their college degree. These students are more likely to earn their diploma based on the reputation of these universities as well.

“High dropout rates appear to be primarily caused by inferior K-12 preparation and an absence of a family college tradition, conditions that apply to a very large percentage of today’s college- bound African Americans,” according to JBHE Foundations, Inc. Students that do not have the family support and preparation for college are more likely to drop out of college than those students who are given the preparation and support needed to succeed. Another reason that students dropout is due to high amounts of student loan debt.

According to Anne Johnson, Tobin Van Ostern, and Abraham White in their research paper, “The Student Debt Crisis,” America now exceeds \$1 trillion dollars in student loan debt. I was not surprised by this statement as so many people in America are faced with student loan debt. The issue that continues to occur is when an individual graduates from college because majority of these lower class income families are not able to pay for college. Students are faced with loan debt that can average \$30,000 and as high as \$100,000. Over the years, college tuition has only increased. To help assist students with college expenses, financial aid is offered to those students who qualify. “Two-thirds of students who earn four-year bachelor’s degrees are graduating with an average student loan debt of more than \$25,000, and 1 in 10 borrowers now graduate owing more than \$54,000 in loans,” stated in the article “The Student Debt Crisis” by Anne Johnson, Tobin Van Ostern, and Abraham White. Most students are faced with some sort of debt when they graduate college. It is not uncommon for students to have a significant amount of debt after graduation. Young people are forced to finance their

education through student loans because they are unable to pay for college on their own due to the high cost of tuition. The price of college can range on many different levels such as, whether an individual chooses to attend a 2-year school or a 4-year public or private school. Community colleges are less of an expense than private or public schools. Private schools are significantly more expensive than public schools. The cost of attending college has changed drastically over the years.

Jill Barshay wrote an article titled, “Federal data show 3.9 million students dropped out of college with debt in 2015 and 2016.”<sup>8</sup> She researched the amount of debt students were in that were college dropouts. She gained her data from the U.S Department of Education which tracks the number of students who drop out of college for every college in the nation. She stated, “My figures show a total of 3.9 million undergraduates with federal student loan debt dropped out during fiscal years 2015 and 2016.” This is a very large amount of students that have student loan debt without even completing college. These students that drop out of college may find difficulty finding jobs to pay for the loans that they took out, therefore it leads to their credit being ruined and instead of bettering themselves by getting an education, and they have put themselves financial in a worse situation. In her research, she discovered that 2.5 million or 64% were from public community colleges and four year universities for 2015-2016 with an average debt of \$6,871. 0.5 Million or 13% were from private nonprofit colleges and universities with average debt of \$9,668. Lastly, 0.9 million or 23% were for-profit

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<sup>8</sup> Jill Barshay. “Federal Data Show 3.9 Million Students Dropped Out Of College with Debt in 2015 and 2016.” (November 6, 2017).

universities average debt of \$5,812. This leads to the total amount of undergraduates who dropped out during 2015-2016 3.9 million with an average debt of \$7,174.

I found it interesting to research how students are able to pay off their debt, even having very little income after graduation. Students are able to put their loans on deferment. This means that their loans are put on hold for a certain period of time, due to them being unable to make their payment requirements. College graduates are offered a 6-month grace period after graduation where they are not required to make payments on their loans. This allows students to get on their feet and search for a job before their loans have to start being paid off. Luckily, this is a nice break for students as they desperately search for a career, which could take a couple months to find as jobs have been so competitive. Paying off student loans has become manageable based on the individual's needs and current situation. There are many different options for students to repay their loans such as, income driven repayment option. This option allows individuals to get the lowest payment possible on their loans based on the amount of income they are receiving at that time period in the life. They have to submit a new application every year to provide their current income and get the approval of the amount he or she owes monthly for their loans. This is beneficial because it allows students to not have to over-exceed the amount they have to pay on their loans and put a huge burden on their daily lives.

## Section 3: Regression

The purpose of this paper is to see how the family income of a student's families relates to the graduation rate of these students. There is a gap between the graduation rates of low income and high income families. There is also a graduation gap between different racial groups. There has been research which shows that white individuals tend to have a higher graduation rate than black individuals. The purpose of this research paper is to see what that gap is and how it may have changed over the years. The SAS program, Statistical Analysis System, was used in order to obtain these results. While using the SAS program The MEANS, UNIVARIATE, REG, and AUTOREG procedures were derived. This study uses four variables which include property tax, expected education, median income, and graduation rate. These variables were found for all 50 states in the United States. The data was collected from IPEDS.

### Section 3.1: The MEANS Procedure

The MEANS Procedure used in the SAS program provides data summary tools to derive statistics for variables used in SAS. The MEANS Procedure, which is the first procedure shown estimates quantiles such as mean, standard deviation, minimum, and maximum. This procedure also has the ability to perform a t-test. In the results derived from the MEANS Procedure, the N variable in the chart is for the number of observations. The mean is the arithmetic average, the minimum is the lowest value, and the maximum is the highest value.

**The SAS System**  
**The MEANS Procedure**

<b>Variable</b>	<b>Label</b>	<b>N</b>	<b>Mean</b>	<b>Std Dev</b>	<b>Minimum</b>	<b>Maximum</b>
PropTax	PropTax	51	8906051.82	11987853.28	520679.00	51605448.00
ExpEd	ExpEd	50	22612159.56	23529348.93	2736343.00	135078056
MedInc	MedInc	51	45840.49	7357.26	32938.00	61672.00
GradRate	GradRate	51	82.9901961	5.4156165	68.5000000	90.8000000

*Figure 1: (SAS: The MEANS Procedure)*

The variables used while performing the Mean Procedure were prop tax, ExpEd, MedInc, and GradRate. The number of observations used were 51. Mean is the average of all the data. Our results derived from running this regression was that the mean of prop tax was 8906051.82, the minimum was 520679.00, and the maximum was 51605448.00.

The results derived for ExpEd was the mean being 22612156.56, the minimum was 2736343.00 and the maximum was 135078056. The results derived in the MedInc was the mean was 4584049, the minimum was 32938.00, and the maximum was 61672.00.

Lastly, the GradRate mean was 82.99019161, the minimum was 68.5000000, and the maximum was 90.8000000. The standard deviation for PropTax was 11987853.28, for exp ed was 23529348.93, for medinc was 7357.26, and for grad rate was 5.4156165. All these figures are shown in the Figure 1 above. Shown in Figure 2 below is a line graph of the variable in The MEANS Procedure as just discussed.

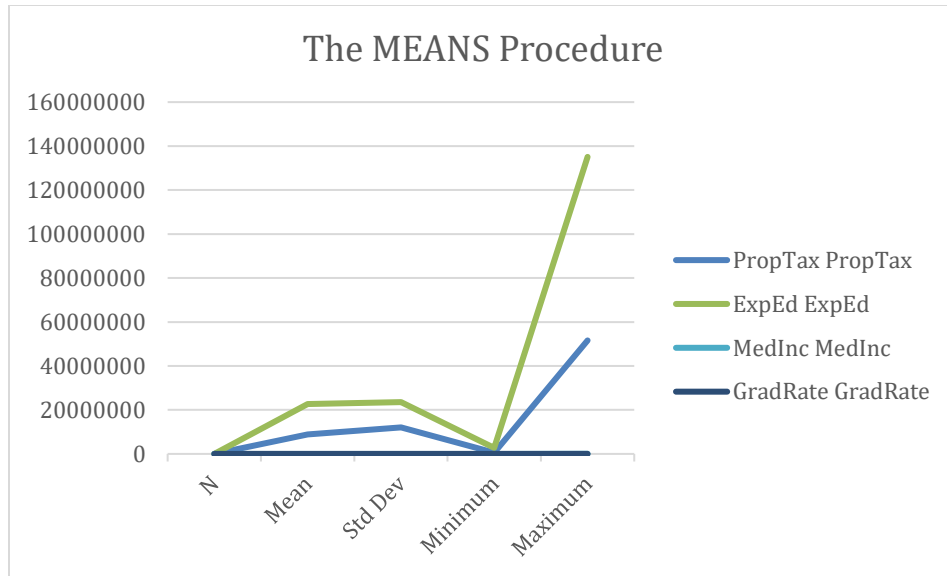


Figure 2: (SAS: The MEANS Procedure graphed)

### Section 3.2: The Univariate Procedure for Prop Tax

The second procedure derived from the SAS program was The UNIVARIATE Procedure. This was ran for all of the variables, proptax, exp ed, medinc, and grad rate. The Univariate procedure derives moments, basic statistical measures, tests for location  $\mu_0 = 0$ , Quantiles, and extreme observations.



**The UNIVARIATE Procedure  
Variable: PropTax (PropTax)**

<b>Moments</b>			
<b>N</b>	51	<b>Sum Weights</b>	51
<b>Mean</b>	8906051.82	<b>Sum Observations</b>	454208643
<b>Std Deviation</b>	11987853.3	<b>Variance</b>	1.43709E14
<b>Skewness</b>	2.47875845	<b>Kurtosis</b>	6.03140298
<b>Uncorrected SS</b>	1.12306E16	<b>Corrected SS</b>	7.18543E15
<b>Coeff Variation</b>	134.603453	<b>Std Error Mean</b>	1678635.22

<b>Basic Statistical Measures</b>			
<b>Location</b>		<b>Variability</b>	
<b>Mean</b>	8906052	<b>Std Deviation</b>	11987853
<b>Median</b>	4776257	<b>Variance</b>	1.43709E14
<b>Mode</b>	.	<b>Range</b>	51084769
		<b>Interquartile Range</b>	7899889

(Figure 3: SAS The Univariate Procedure)

The proptax created the mean 8906051.82 as shown in the MEAN Procedure as well. The Moments chart provided the mean standard deviation, skewness, uncorrected/corrected DD, coeff variation, sum observations, variance, kurtosis, and standard error mean. The variance shown was 1.43709E14, and kurtosis was 6.03140298. The basic statistical measures showed the range and interquartile range as well as mean, median, standard deviation, and variance. The tests for location  $\mu_0 = 0$  provided students T which was 5.305531, sign which was 25.5 and signed rank which was 663. The  $Pr > |t|$  was  $<.0001$ ,  $Pr > = |M|$  was  $<.0001$ , and  $Pr > = |S|$  was  $<.0001$ . The quantiles chart showed the level of 100% maximum, 50% median, and 0% minimum. The highest quantile was 51605448, the median was 4776257, and the minimum was

520679. The extreme observations showed the lowest and the highest observations. The lowest value was 520679 for the 46<sup>th</sup> observation and the highest was 26157504 with 14 observations. The UNIVARIATE Procedure was used with all of the variables and explained in further detail in the following paragraphs.

In the moments chart,  $N$  is the number of observations for the variable. In our case the number of observations for the variable was 51. In discussion of the mean for the PropText, the mean of our data for prop tax is 8906051.82 which is also known as the average. Our standard deviation is 11987853.3 which is calculated by the square root of the variance. When the standard deviation is high, this means that the observations are more spread out. In our observation, the standard deviation is a high number, therefore the observations are more spread out. The skewness measures the direction of the variance. Our skewness is 2.47875845. Since the mean is more than the median, our results have a positive skewness. The uncorrected SS for our variables was 1.12306E16. The uncorrected SS shows the sum of the squared datas. In other words, variance is equal to the sum of squares – the sum of observations squared divided into the number of observations then divided by the number of observations minus 1. The formula is written as  $\text{variance} = (\text{sum of squares} - (\text{sum of observations})^2 / N) / (N-1)$ . Variance is known as the measurement of variability. Kurtosis shown on the moment's table is the measure of the heaviness of the tails in a distribution. Normally a kurtosis of 0 is known as normal in the SAS program. Our kurtosis is 6.03140298 which is a positive number. The positive number shows that these tails are heavier for a normal distribution. Shown in Figure 3 and Figure 4 is a table of the Moments and a graph from our variable PropTax.

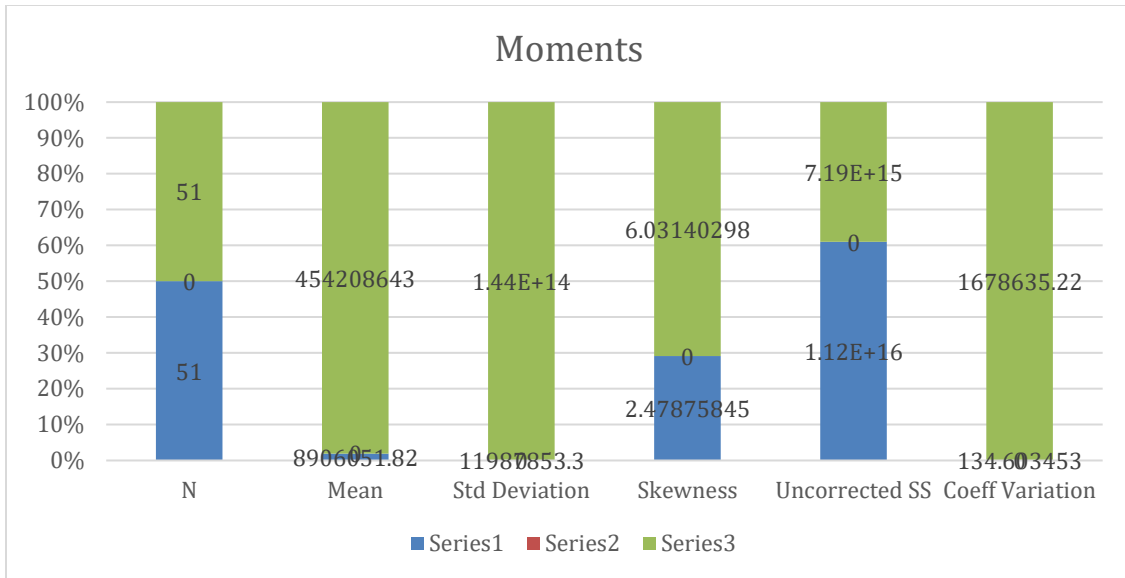


Figure 4: (SAS: Moments Graph: PropTax)

The next chart shown below as Figure 5 is known as the basic statistical measures. In this chart it shows the mean, median, mode, standard deviation, range, and interquartile range. The median is the middle number of the values. In our example, the median is 4776257. We did not obtain a mode from our results for property tax while our mean was 8906052. Our range was 51084769 which is the measurement of the spread of the variables. This is determined by the difference of the highest and smallest observation. Our interquartile range was 7899889.

The next chart shown in Figure 6, derived from the Univariate Procedure tests for location:  $\mu_0 = 0$ . In our results we used the tests statistics and *p value*. In statistics we used student's *t*, sign, and signed rank. In the *p-value* column the chart shows  $Pr > |t|$ ,  $Pr \geq |M|$ , and  $Pr \geq |S|$ . The student's *t* is used to test the null hypothesis. Since our *t-value* is 5.305531 and the p value is less than .0001 this shows that the null hypothesis is rejected. The sign test is used to test the null hypothesis due to the population median.

Our value was 25.5 and the p value is less than 0.0001. This shows that the median for the variable is different than zero. Lastly, the signed rank which is also known as the Wilcoxon test, tests the null hypothesis that the median equals  $\mu_0$ . In our property tax example the signed rank is 663 and the *p-value* is less than 0.0001. From these variables it is shown that the median of the variable is different from zero as well.

Tests for Location: $\mu_0=0$				
Test	Statistic		p Value	
Student's t	t	5.305531	Pr >  t	<.0001
Sign	M	25.5	Pr >=  M	<.0001
Signed Rank	S	663	Pr >=  S	<.0001

Figure 5: (SAS: Tests for Location: PropTax)

The quantiles chart shown in Figure 6 below provides levels and quantile from 100% to 0%. The 100% is the maximum value of the variable and the 0% is the minimum value of the variable. Our maximum value is 51605448 and our minimum value is 520679. 50% shows the median value which is 4776257. The percentages are broken into quantiles. The 25% is the first quantile while 50% is the second and 75% is the third followed by 100% being the fourth quantile. The extreme observations chart is broken into the five lowest and five highest values. Our smallest value from the quantiles chart is 5206479 and it is observation 46. Our highest value is 51605448 and it is observation 5. Below is the Quantiles results shown in a line graph. From the graph, we can see there is a significant increase from 1 to 2. At 4 it slowly starts to decrease at a constant rate.

Figure 7 shown below shows the Quantiles in graph form.

<b>Quantiles (Definition 5)</b>	
<b>Level</b>	<b>Quantile</b>
<b>100% Max</b>	51605448
<b>99%</b>	51605448
<b>95%</b>	44108869
<b>90%</b>	23828378
<b>75% Q3</b>	9970863
<b>50% Median</b>	4776257
<b>25% Q1</b>	2070974
<b>10%</b>	1122768
<b>5%</b>	819463
<b>1%</b>	520679

*Figure 6: (SAS: Quantiles PropTax)*

The quantiles is shown in graph form in Figure 7. Based on the graph, we can see from 0 to 1 there was no change and the graph shows a constant value. From 1 to 2 there is a drastic increase then stays the same from 2 to 3. We also begin to see starting at 3 on to 12 there is a steady decrease and it has a steady slope where it then starts to have an almost constant value from 8 to 12.

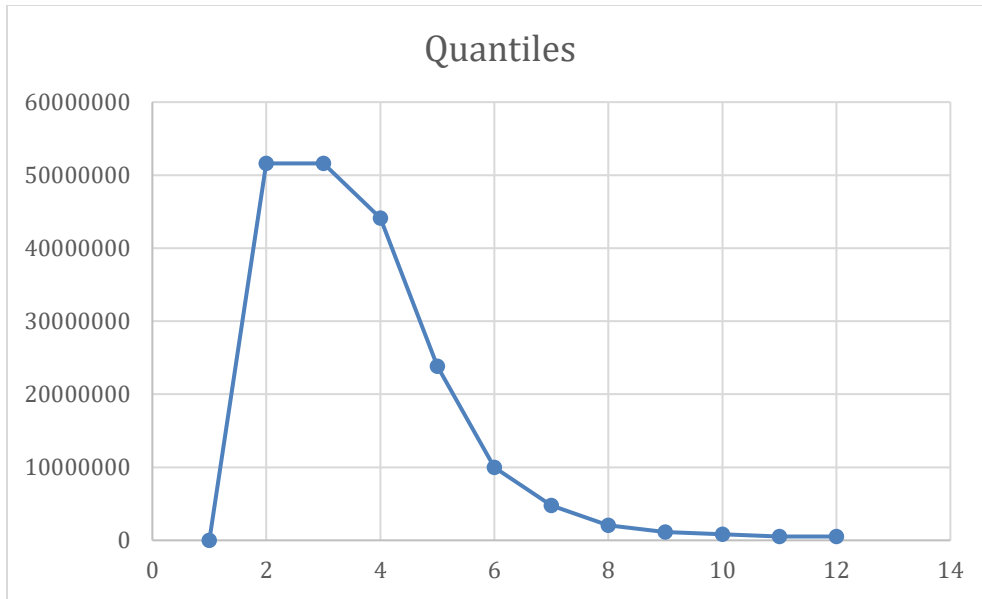


Figure 7: (SAS: Quantiles Graphed: PropTax)

Extreme observations is our next chart shown below in Figure 8. There is a low and a high column with the value and observation section shown. The lowest value was 520679 for observation 46 and the highest was observation 5 with a value of 516605448.

Extreme Observations			
Lowest		Highest	
Value	Obs	Value	Obs
520679	46	26157504	14
775147	8	27219351	31
819463	35	44108869	44
914762	4	51398616	33
1031802	51	51605448	5

Figure 8: (SAS: Extreme Observations)

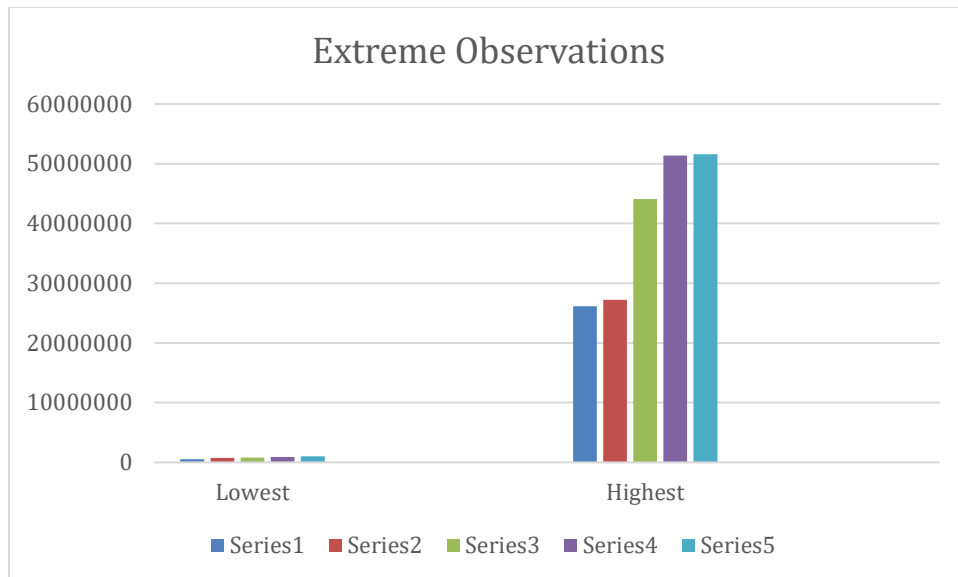


Figure 9: (SAS: Extreme Observations Graphed)

### Section 3.3: The Univariate Procedure for Exp Ed

In the moments chart for Exp ed, the result provided us with a mean for our data as 22612159.6. The standard deviation derived was 23529348.9. Since it is shown that the standard deviation is high, this means that the observations are more spread out. Our skewness shown for exp ed is 2.84098694. Since the mean resulted in 22612159.6 is more than the median of 17058766, our results have a positive skewness. The uncorrected SS for our variables was 526934E16. Kurtosis shown on the moments table is the measure of the heaviness of the tails in a distribution. Normally a kurtosis of 0 is known as normal in the SAS program. Our kurtosis is 10.5224112 which, is a positive number. The positive number shows that these tails are heavier for a normal distribution.

Moments			
<b>N</b>	50	<b>Sum Weights</b>	50
<b>Mean</b>	22612159.6	<b>Sum Observations</b>	1.13E+09
<b>Std Deviation</b>	23529348.9	<b>Variance</b>	5.54E+14
<b>Skewness</b>	2.84098694	<b>Kurtosis</b>	10.52241
<b>Uncorrected SS</b>	5.27E+16	<b>Corrected SS</b>	2.71E+16
<b>Coeff Variation</b>	104.056178	<b>Std Error Mean</b>	3327552

The next chart for exp ed is the basic statistical measures. The median shown is 17058766 and we did not obtain a mode from our results for exp ed. As previously noted our mean was 22612160 and our range was 13234171. This is known as the measurement of the spread of the variables. This is determined by the difference of the highest and smallest observation. Our interquartile range was 1918095.

Our chart for the tests for location:  $\mu_0 = 0$ . The *student's t* is used to test the null hypothesis. Since our *t-value* is 6.795433 and the *p-value* is less than .0001 this shows that the null hypothesis is rejected. The sign test is used to test the null hypothesis due to the population median. Our value was 25 and the *p-value* is less than 0.0001. This shows that the median for the variable is different than zero. Lastly, the signed rank is



637.5 for our expected example and the *p-value* is less than 0.0001. This shows that the median of the variable is different from zero as well.

The quantiles chart provides our maximum value at 135078056 and our minimum value is 2736343. 50% shows the median value which is 17058766. The extreme observations chart is broken into the five lowest and five highest values. Our smallest value from the quantiles chart is 2736343 and it is observation 42. Our highest value is 135078056 and it is observation 5.

### Section 3.4: The Univariate Procedure for Med Inc

In the moments chart for Med inc, the mean of our data is 45840.4902. Our standard deviation resulted in the value of 7357.25831. Since standard deviation is high, the observations are more spread out. Our skewness shown for med inc is 0.46182693. In our case for med inc the mean is very close to the median. Our mean is 45840.49 and our median is 44282.00. Since the mean is still more than the median, our results have a positive skewness. The uncorrected SS for our variables was 1.09875E11. Kurtosis shown on the moments table is the measure of the heaviness of the tails in a distribution. Normally a kurtosis of 0 is known as normal in SAS. Our kurtosis is -0.4198771 which is a negative number. The negative number shows that these tails are lighter for a normal distribution.

In the basic statistical measures chart, the median shown is 4428200 and we did not obtain a mode from our results for expected. Our mean was 45840.49 while our range

was 28734 which is the measurement of the spread of the variables. This is determined by the difference of the highest and smallest observation. Our interquartile range was 9923.

In our chart for the tests for location:  $\mu_0 = 0$ . The student's  $t$  is used to test the null hypothesis. Since our  $t$ -value is 44.49573 and the  $p$ -value is less than .0001 this shows that the null hypothesis is rejected. The sign test is used to test the null hypothesis due to the population median. Our value was 25.5 and the  $p$ -value is less than 0.0001. This shows that the median for the variable is different than zero. Lastly, the signed rank is 663 for our med inc example and the  $p$ -value is less than 0.0001. This shows that the median of the variable is different from zero as well.

The quantiles chart provides our maximum value at 61672 and our minimum value is 32938. 50% shows the median value which is 44282. The extreme observations chart is broken into the five lowest and five highest values. Our smallest value from the quantiles chart is 32938 and it is observation 25. Our highest value is 61672 and it is observation 31.

### Section 3.5: The Univariate Procedure for Grad Rate

In the moments chart for grad rate, the mean of our data is 82.9901961 and our standard deviation is 5.41561649. Since standard deviation is higher than 0, the observations are more spread out. Our skewness shown for grad rate is -0.9274887. This is the only results that had a negative number for the skewness. This means that the mean is less than the median because of the negative skewness. In our case for grad rate the mean is very close to the median. Our mean is 82.99020 and our median is 84.8000.

Since the mean is less than the median, our results have a negative skewness. The uncorrected SS for our variables was 352722.45. Kurtosis shown on the moment's table is the measure of the heaviness of the tails in a distribution. Normally a kurtosis of 0 is known as normal in SAS. Our kurtosis is 0.40337659 which is a positive number. The positive number shows that these tails are heavier for a normal distribution.

The next chart for grad rate is the basic statistical measures. The median shown is 84.80000 and unlike the results of our other values, grad rate is the only observation that has a mode. The mode for grad rate was 85.60000. Our mean was 82.99020. Our range was 22.30000 which is the measurement of the spread of the variables. This is determined by the difference of the highest and smallest observation. Our interquartile range was 8.10000.

Our chart for the tests for location:  $\mu = 0$ . The student's t is used to test the null hypothesis. Since our *t-value* is 109.4369 and the *p-value* is less than .0001 this shows that the null hypothesis is rejected. The sign test is used to test the null hypothesis due to the population median. Our value was 25.5 and the *p-value* is less than 0.0001. This shows that the median for the variable is different than zero. Lastly, the signed rank is 663 for our med inc example and the *p-value* is less than 0.0001. This shows that the median of the variable is different from zero as well.

The quantiles chart provides our maximum value at 90.8 and our minimum value is 68.5. 50% shows the median value which is 84.8. The extreme observations chart is broken into the five lowest and five highest values. Our smallest value from the quantiles chart is 68.5 and it is observation 9. Our highest value is 90.8 and it is observation 16.

### Section 3.6: The REG Procedure

The REG Procedure provided dependent variable COL COL, college, shown in Figure 9 below. There were 51 observations read and 50 observations used. It provided tables for analysis of variance and parameter estimate which will be further discussed in the following paragraphs.

**The REG Procedure  
Model: MODEL1  
Dependent Variable: COL COL**

<b>Number of Observations Read</b>	51
<b>Number of Observations Used</b>	50
<b>Number of Observations with Missing Values</b>	1

<b>Analysis of Variance</b>					
<b>Source</b>	<b>DF</b>	<b>Sum of Squares</b>	<b>Mean Square</b>	<b>F Value</b>	<b>Pr &gt; F</b>
<b>Model</b>	2	1.69178E11	84588978353	561.82	<.0001
<b>Error</b>	47	7076486991	150563553		
<b>Corrected Total</b>	49	1.762544E11			

<b>Root MSE</b>	12270	<b>R-Square</b>	0.9599
<b>Dependent Mean</b>	46288	<b>Adj R-Sq</b>	0.9581
<b>Coeff Var</b>	26.50891		

<b>Root MSE</b>	12270	<b>R-Square</b>	0.9599
<b>Dependent Mean</b>	46288	<b>Adj R-Sq</b>	0.9581
<b>Coeff Var</b>	26.50891		

Parameter Estimates										
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr >  t	Heteroscedasticity Consistent			Variance Inflation
							Standard Error	t Value	Pr >  t	
<b>Intercept</b>	Intercept	1	23933	10959	2.18	0.0340	8552.09652	2.80	0.0074	0
<b>ExpEd</b>	ExpEd	1	0.00253	0.00007606	33.33	<.0001	0.00014530	17.44	<.0001	1.04220
<b>MedInc</b>	MedInc	1	-0.76303	0.24087	-3.17	0.0027	0.19837	-3.85	0.0004	1.04220

Figure 10: (SAS The Reg Procedure)

Our regression equation is written as follows:

$$P = A - BQ$$

Or

$$Q = \beta_0 + \beta_1 P + U$$

The Q equation is a function of P.

The first table shows analysis of variance. In the table is degree freedom or DF, sum of squares, mean square, *F-value* and *Pr > F*.

- 1) Degree freedom: degree freedom is associated with the sources of variance. In order to obtain total variance we use N-1. In our example there were 50 observations used for the degrees freedom is 50-1= 49.
- 2) Sum of Squares: the sum of squares is determined by the SS total – SS residual or SS total = SS model + SS Residual = 0.9599. This is our r-squared value.

- 3) Mean square: The mean square is equal to the sum of squares divided by the degree freedom. In our example, this would be  $1.69178E11 / 2 = 84588978353$  for the model. For the residual it would be  $7076486991 / 47 = 150563553$ .
- 4) The F- value is calculated by dividing the mean square and error. In our case our equation looks like  $84588978353 / 150563553 = 561.83$ , so our *F- value* is 561.82. This shows us that we have significant results as the  $Pr > F$  is  $< .0001$ . The value for our F is 561.82,  $p < 0.0001$  this shows that our model has a significant portion of variation with the data used.
- 5) Root MSE: Our root MSE is equal to 12270. We get this by the standard deviation of the error term. The value for our Root MSE was 12270 which shows a standard deviation of the error term in the data. Our coefficient of variance was 26.50891 shows the variation in the data.
- 6) R- Squared and adjusted R-squared: We see that our change in P is 0.9581 or 95% of the variation in the change in Q. The R-squared value was 0.9599 or 95.99% and the adj R-squared value was .09581 or 95.81%. Values that are close to 1 mean this is a more significant fit. The R-squared value of 0.9599 shows that medinc accounts for 95.99% of the variation for exped. The change in p explains 95% of the variation in the change in Q. For Medinc, we see that the parameter estimate or Beta is negative, which is good for our hypothesis.

We use our regression equation,  $Q = \beta_0 + 1P + U$

$$Q = 23933 - 0.76303 P + U$$

We obtain these numbers by our intercept parameter estimate is equal to 23933 and our Medinc parameter estimate is -0.76303. For every 1 unit increase in college, the medinc will have 0.76303 less. However, we see in our exped parameter intercept is it a positive number, 0.00253 which means they are substitutes. As they increase, so does Q, college.

- 7) Parameter estimates: The parameter estimate values are used to predict the dependent variables from the independent variables and shows the relationship between the independent and dependent variable. There is one dependent and 2 independent variables. Our hypothesis equation is written as:

$$Q_b = \beta_0 + \beta_1 E + \beta_2 M + U$$

Where:  $\beta_0 = 23933$ ,  $\beta_1 = 0.00253$ ,  $\beta_2 = -0.76303$ ,  $U = \text{error term}$ .

This is the demand for (E) exped and (M) medinc. When plugging in the numbers we obtain

$$Q_b = \beta_0 + \beta_1 E + \beta_2 M + U$$

$$Q_b = (23933) + (0.00253)E + - (0.76303)M + U$$

- 8) T-test shows the degree freedom is 1. Degree freedom is used to check for accuracy of the data input and of the model. The corrected total is always less than the total number of observations in the chart. Our total number of observations used were 50. For our example  $50-1=49$ . For exped  $\beta_1 = 0.00253$ , standard error = 0.00007606, and degree freedom = 1. We use  $t = 0.00253 / 0.00007606 = 33.33$ . The absolute value of  $t < .0001$ .

For medicine  $\beta_2 = -0.76303$ , standard error = 0.24087, and degree of freedom is 1. We use  $t = -0.76303 / 0.24087 = -3.17$ . The absolute value of  $t$  is 3.17 which is less than 2 so it is not different from zero.

The second table in the parameter estimates also shows heteroscedasticity consistent with standard error,  $t$ -value,  $Pr > |t|$ , and variance inflation. Our coefficients were ExpEd and MedInc. In order to get the  $t$ -value we divide the parameter estimate by the standard error. For our results our  $t$ -value for intercept was 2.80, for expEd 17.44, and for MedInc -3.85. The negative number is a reduction due to the number being below zero.

**The SAS System**

**The REG Procedure**  
**Model: MODEL1**  
**Dependent Variable: COL COL**

<b>Durbin-Watson D</b>	<b>1.796</b>
<b>Number of Observations</b>	<b>50</b>
<b>1st Order Autocorrelation</b>	<b>0.098</b>

Figure 11: ( SAS The REG Procedure)

Our next model is The REG Procedure that provides Durbin-Watson D that is used to test for autocorrelation. From the regression results the Durbin Watson D was 1.796 with 50 observations which shows a positive autocorrelation. The first order of autocorrelation was 0.098. Since our D value was 1.796 this shows positive autocorrelations.

### Section 3.7: The AUTOREG Procedure



The AUTOREG Procedure was also derived in the SAS program. This procedure provided ordinary least square estimates, parameter estimates, estimates of autocorrelations, preliminary MSE, estimates of autoregressive parameters, and the yule-walker estimates. This procedure is used when errors are auto correlated or heteroscedasticity to estimate and predict linear regression models for time series and used to correct them.

## The SAS System

### The AUTOREG Procedure

<b>Ordinary Least Squares Estimates</b>			
<b>SSE</b>	7076486991	<b>DFE</b>	47
<b>MSE</b>	150563553	<b>Root MSE</b>	12270
<b>SBC</b>	1092.03094	<b>AIC</b>	1086.29487
<b>MAE</b>	8641.85352	<b>AICC</b>	1086.81661
<b>MAPE</b>	40.9764755	<b>HQC</b>	1088.4792
<b>Durbin-Watson</b>	1.7962	<b>Regress R-Square</b>	0.9599
		<b>Total R-Square</b>	0.9599

<b>Parameter Estimates</b>						
<b>Variable</b>	<b>DF</b>	<b>Estimate</b>	<b>Standard Error</b>	<b>t Value</b>	<b>Approx Pr &gt;  t </b>	<b>Variable Label</b>
<b>Intercept</b>	1	23933	10959	2.18	0.0340	
<b>ExpEd</b>	1	0.002535	0.0000761	33.33	<.0001	ExpEd
<b>MedInc</b>	1	-0.7630	0.2409	-3.17	0.0027	MedInc

*Figure 12: (SAS: The AUTOREG Procedure)*

The first chart labeled ordinary least squares shown in Figure 12, provided SSE, MSE, SBC, MAE, MAPE, Durbin Watson, DFE, Root MSE, AIC, AICC, HQC, regress r-square and total R-square. SSE means sum of square errors, MSE means mean square error, MAE means mean absolute error, MAPE stands for mean absolute percentage error, and DFE stands for degree freedom error. In our chart the intercept value of parameter estimate is 23933, exped is 0.00253, and medin is 0.76303. Our standard error for intercept was 10959, exped 0.0000761, and medinc 0.2409. Our t-values were 2.18, 33.33, and -3.17. The approximate  $Pr > |t|$  was 0.0340, <.0001, and 0.0027.

- 1) *Root MSE*: in our example, the root MSE was 12270 and  $R^2$  was 0.9599. The total r-square had the same value of 0.9599 meaning the auto regressive error was not used.
- 2) *Estimated model*:  $(y_i = 23933 + 0.002535t + E_i)$  or  $y_i = \text{Intercept} + \text{ExpEd}(t) + E_i$ . Our estimated variance error ( $est\ var(E_i) = 150563553$  or *MSE*)
- 3) *Yule Walker*: our MSE found in the Yule Walker results was 152596764. We notice that  $R^2$  is 0.9602. It was adjusted to help predict the next y-value.

The program known as SAS was used to run the regressions as just discussed. This program provided a visual of the results based on family income and the graduation rates. As predicted, students who come from a family of higher income are more likely to graduate from college. These students have a better advantage than the students who are from low income families. The variables used in the regression were property tax, medium income, and graduation rate. The charts show mean, medium, and mode.

## **Conclusion:**

In conclusion, based on the articles and regressions presented, the gap between the rich and the poor has an effect on college graduation rates. It is no surprise that students from higher income families have a better advantage towards success and completing their college education, simply due to the support he or she has from their families. Lower income family students may not have the same type of support system. Children from lower income families may lack having their parents and/or parents' home to assist on school work due to their parents having to work odd hours at low income jobs. Having guidance from an older individual such as parents and grandparents, help a student head on the right path for success in life. This is not to say that lower income families are not supportive of their children when it comes to attending college, but these lower income families are unable to provide what the higher income families can for their children; such as SAT prep, money for expenses, and tutoring.

Lower income family students face different obstacles that higher income family students do not. These lower income students typically find themselves having to work while attending college, which has a great effect on the amount of time they can spend on their coursework. Trying to balance both school and work is a difficult task for many people. This leads to dropping out because they are unable to work and attend school at the same time. Higher income students may not have to get a job while attending college because they are provided with the money expenses they need by their families.

Another important topic in regards to the lower graduation rate between students is students that have children prior to attending college or during college. Completing college becomes more difficult for those students who has another individual other than

themselves to take care of. While having children and attending college at the same time this could be extremely difficult, especially for a single parent. He or she will have to find a sitter or pay for daycare while they attend classes. Fortunately, some colleges offer daycare on site for students. Although this is a helpful opportunity for these single parents, it has been shown that single parents are less likely to graduate and complete their programs than those students who do not have a child. Students with children may also take much longer to complete their degrees due to having to attend less courses every semester opposed to a student who is able to be full time instead of part time. Single parents attending college are forced to face difficult obstacles than those students who do not have children while attending college.

There likely will continue to be a gap between the rich and the poor in terms of graduation rates seen in college throughout the years. Of the many students that attend college every semester, there are numerous students that drop out for many different reasons. Some of the reasons include failing classes or unable to pay for these college classes. If completing a college degree was an easy achievement, everyone would have a college degree. It has been shown that students who come from low income families are not given the tools and guidance they need in order to prepare themselves for college. This could even be providing students with the required textbooks every year for each course in high school. Some lower income areas may not be able to provide their students with the same amount of tools that a higher income schools are able to. Some schools even provide laptops and tablets for their students, while lower income areas might not have this advantage.

Lower income families are provided with better financial assistance than those of higher income families and the more aid offered to these students, the greater the amount of students attending college. These lower income students may take advantage of getting these certain grants and scholarships. Although these lower income students enroll in college, the likely outcome that they will complete their programs is less than those students of high income families. These students may not know what it is to be disciplined regarding school work and could see themselves failing out due to this. As shown throughout this paper, this is because students from lower income families are not as prepared for college. They lack the student techniques, prep, and tutoring that is provided to high income families. They also lack the family support, which has a great impact on a student's self-esteem and confidence. Without change provided for lower income families, the gap between the rich and the poor is unlikely going to change.

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