The Education Lorenz Curve: Exploring Education and Social Mobility in a Lorenz

Curve Framework

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ABSTRACT

Within any society the level of social mobility, the distribution of income, and

equality of opportunity work together to determine the ease with which a child born into

poverty can make it to the middle class during his or her lifetime. Education plays a large

part, if not the largest part, in the analysis of these areas within a given

society. Therefore, an equal distribution of education among those born into all income

levels is one key ingredient to ensuring that all children who are born into poverty get the

same chance of succeeding in the workforce as their more privileged peers. Looking at

the United States in particular, the levels of education inequality seen among 4-year

college graduates are calculated using the NPSAS and are then compared to the levels of

income inequality for the graduation years 1993, 1996, 2000, 2004, 2008, and 2012. The

level of education inequality for each year of analysis is displayed by creating an

Education Lorenz Curve and analyzed by calculating the equivalent Education Gini

Coefficient for each year.

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CHAPTER 1: INTRODUCTION

There is a popular song by the *Flobots* called "Handlebars" which explores the

potential human beings have to be creative or destructive. A few lines stand out, which

say:

> "I'm proud to be an American; I can make money open up a thrift store; I can
> make a living off a magazine; I can design an engine 64 miles to a gallon of
> gasoline; I can make new antibiotics; I can make computers survive aquatic
> conditions; I know how to run a business; I can make you wanna buy a product; I
> can see the strings that control the system; I can do anything with no assistance; I
> can lead a nation with a microphone; I can split the atoms of a molecule"
> (AZLyrics).

The idea that any child can grow up to do these things, particularly any child born in the

United States, is an idea that has stretched decades, known as the American Dream; the

United States prides itself on being a meritocracy, where regardless of how humble one's

beginnings are, through hard work and motivation anything is possible. But how often

does this actually occur? If a child born into poverty starts kindergarten already behind

to no fault of her own, struggles through school unable to learn effectively due to a lack

of nutrition and stresses from home, and finally finishes high school without any prospect

of being able to attend college, how likely is it that she will grow up to make antibiotics

or split the atoms of a molecule? Sawhill et al. (2012) points out "Americans believe that

everyone should have the opportunity to succeed through talent, creativity, intelligence,

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and hard work, regardless of the circumstances of their birth" (1). However, there is factual evidence that America is not as strongly meritocratic as the population tends to believe.

I propose that an equal distribution of higher education among those born into all income levels is necessary to ensure that those who are born into poverty have the same chances of succeeding in the work force as their more privileged peers[1]. This is not to say that low-income students should just be given degrees without earning them; it is saying that low-income students should be given the same opportunities to succeed as higher-income students, and equal abilities, motivation, and effort should be rewarded with similar life chances. In order to obtain a full sense of the prospects facing those who are born into poverty, it is necessary to explore not just social mobility, income inequality, or equality of opportunity each on its own; it is necessary to look at the current state of all three fields of study to gain a true understanding of what it means to grow up impoverished in the United States. Income inequality makes social mobility a necessity in a meritocratic society and equality of opportunity is a gateway that determines how much social mobility can occur. If there is a high level of equality of opportunity, it is an open gate that allows for social mobility.

The fields of study of social mobility, income inequality, and equality of opportunity all work together to help determine the life chances of those born into poverty, and education is the key that links them all together. Research has shown that

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[1] It is important to note that an equal distribution of higher education is a necessary condition, but not a sufficient condition for true meritocracy. An equal distribution of higher education is just one of many conditions that would be necessary for this state to occur.

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areas with higher levels of income inequality also have lower levels of upward mobility and inequality lowers mobility because it shapes opportunity, particularly access to a quality education; it changes opportunities, incentives, and institutions that form, develop, and transmit characteristics and skills valued in the labor market (Chetty et al. 2014 [1]) (Corack 2013). Social mobility matters more in societies with higher levels of inequality because the advantages of rising to the top are greater and the consequences of staying at the bottom are worse; the OECD has stated that rising income inequality can stifle upward social mobility, making it harder for hard-working, talented people to reap the rewards they deserve, and they point out that mobility is low in countries where inequality is high, particularly in Italy, the United Kingdom, and the United States (Beller and Hout 2006) (Corak 2013). Equality of educational opportunity promotes social mobility by distributing human capital in ways that are independent of family income, as well as by loosening the ties between family socioeconomic status and career destinations among college students (Beller and Hout 2006).

I choose to look at higher education attainment because it is an important indicator for future income and socioeconomic status, thus giving a measurable proxy for the levels of social mobility within a society; 76 percent of those who receive a college degree and live independently by age 29 will make it to the middle class by age 40, regardless of their circumstances at birth (Sawhill et al. 2012). Chapter 2 looks at income inequality followed by equality of opportunity. I establish that there is a high level of income inequality within the United States, including a level of inequality among those in the bottom 90 percent of the income distribution that can at least partially be explained by

differences in higher education attainment. This level of inequality makes it necessary to have upward social mobility within the United States. However, upward mobility is only possible if there is a high level of equality of opportunity, particularly equality of educational opportunity. I explore the current state of educational opportunity in the United States, paying particularly close attention to the unequal access to higher education seen by those from the lowest income groups.

Chapter 3 covers social mobility and before looking at how education alone impacts mobility I explore the factors outside of education that have been shown to have an impact as well. It is important to look at each of these factors because they may be working against the benefits that would be provided by equal education legislation; equality of education would need to surpass these other factors in order to be effective. I then look at how education affects social mobility and how college education in particular has the power to increase mobility among those who are born into poverty. I also look at how mobility has changed throughout the 20th century to get to the state that it is in today, compared to the state seen in other industrialized countries.

In chapter 4 I propose a new way of looking at education inequality. In particular, I take the concept of the Lorenz Curve, which is commonly used in the study of income inequality, and construct my own Education Lorenz Curves and Education Gini Coefficients, which look at the states of education inequality in different years. I am able to conduct this analysis using data from the National Center for Education Statistics (NCES) and the surveys they conducted[2]. By this point it has already been established

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[2] A description of each of the 6 data sets used can be found in Appendix A.

that income inequality has a high impact on social mobility, and that income levels for different individuals are highly correlated with their levels of schooling. Thus, the equality of opportunity for higher education has a direct impact on the levels of social mobility seen within the United States. By looking at the distribution of 4-year college degrees among students from different socioeconomic backgrounds, it should be possible to make observations about the current state of social mobility. Due to the limitations of the NCES data I am not able to confidently compare data from year to year, however I do find that there is a measureable degree of inequality within the higher education system; for the 6 years of data, an average of 49.2 percent of the population fell into the bottom income quintile, but only an average of 11.7 percent of the awarded 4-year degrees went to students from this quintile, with a low of only 4.3 percent in 1993.

It is important to point out that in an effort to simplify matters, I am primarily looking at mobility and opportunities attainable by students who are born below the poverty level, into the lowest income quintile. The cycle of poverty within the United States is composed of individuals who are born below the poverty level, stay there throughout their lives, and give birth to children who continue the cycle; those who are born into poverty are the ones with the lowest life chances and on average, the least successful outcomes throughout their lives. In a true meritocracy, those who are born into poverty would have the same chances of financial success as those born into higher-income families, and those born into wealthier families would have the same chances of being impoverished adults as those born into low-income families. Since I am particularly interested in the chances for upward mobility of those born into poverty I

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place particular emphasis on how social mobility, income inequality, and equality of opportunity affect those within this socioeconomic class. I also focus primarily on income levels as opposed to levels of wealth. In terms of social mobility and equality of opportunity, differences in wealth have the same effects as differences income, and wealth inequality is actually higher in the United States than income inequality (Belley and Lochner 2007). For this reason, I stick to income throughout the paper, but it is important for the reader to understand that when income is replaced with wealth, the differences become even more pronounced (ibid).

Finally, there are many topics that have presented themselves throughout the research and analysis processes that should be considered for future research projects. The first is an exploration of downward social mobility. As already stated, I am looking only at upward mobility by those who are born below the poverty level, but Reeves and Howard (2013) point out that "the concern with upward mobility has obscured the importance and amount of downward mobility…[but] it may well be that downward mobility is a better indicator of fluidity" within a society (2). Another study that I would love to undertake would be how pre-primary education impacts the level of social mobility within a society, as opposed to college education. While higher education is an indicator for future life chances, pre-primary education has been shown to greatly influence and perhaps even determine future educational outcomes, including high school and college graduation rates. For example, I would like to explore whether $1 invested in preschool education by the government would have a higher impact on social mobility than $1 invested in college education. Lastly, I only look at the distribution of degrees

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among those who graduate with 4-year degrees from all types of 4-year degree granting institutions. It would be very interesting to look at how the distribution of degrees differ between graduates from different kinds of institutions, such as 2-year public, 2-year for-profit, 4-year public, 4-year private, top tier, etc. Including this kind of analysis would enrich and strengthen the discussion of equality of educational opportunity; however, none of these topics are explored in this thesis.

CHAPTER 2: INCOME INEQUALITY AND EQUALITY OF OPPORTUNITY

2.1: HOW HIGHER EDUCATION AFFECTS INEQUALITY

As stated earlier, income inequality is that which necessitates social mobility. Without inequality, social mobility would not be necessary so the overall level of inequality within a society is an important part in the analysis of social mobility and opportunity within a given society. Higher education has a large impact on the level of income inequality seen within a country; however, it isn't completely clear *how* education affects inequality and different models explain it different ways (Gregorio and Lee 2002). The human capital model of income distribution implies that the distribution of income is determined by the level and distribution of schooling across the population (ibid). This model predicts a positive association between education inequality and income inequality, so it argues that if the level of education inequality increases, the level of income inequality will increase as well. But, when looking at the effects caused by changes in the average level of education obtained by the population, this model isn't as clear. According to the human capital model, an increase in the average level of education across the population can either cause an increase or decrease in the level of income inequality, depending on what happens to the rate of return on education (ibid). At first, an increase in the average level of education makes low-skilled workers scarcer, which increases their wages and at the same time it increases the supply of highly

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educated workers and lowers their relative wages; this reduces the income gap between high- and low-skilled workers thus decreasing the level of income inequality (Teulings and Rens 2008). In the U.S., higher education financing is usually conducted privately, by the student or his or her family. Looking at the rate of return to education, it has been shown that the rate of return of a four year degree in the United States is equivalent to an investment that returns 15.2 percent per year (Baum et al. 2013). However, it is a long run investment project that is perceived as being highly risk by many low-income families and as a result many low-income students and their families do not invest very actively in higher education; this leaves the ratio of low-educated to highly-educated workers roughly the same from year and year and the gap between their incomes does not shrink (Rillaers 2002). The return to higher education increases as educated workers gain human capital as well as signal to the labor market that they have qualities such as work ethic and timeliness that are highly valued by employers[3]. As the return to higher education increases, more families choose to invest, but this inflates the pool of highly educated workers and their income premium decreases, thus decreasing the level of income inequality, but also lowering the rate of return to education. Currently in the United States, there is a very low ratio of highly educated to low-educated workers; as a result the income premium for a college degree is very high,

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[3] This phenomenon has been recorded particularly in regards to the employment rates of those who have a high school diploma vs. those who obtain a GED. Theoretically, these two groups have the same measurable level of education and human capital; however, the former group has a much higher employment rate than the latter, due to signals sent to employers that they have the qualities needed to be a good employee such as timeliness, work ethic, etc (Murnane 2013). Those who obtain a GED do not necessarily have these qualities and thus find it harder to become employed (ibid).

resulting in a large income gap between the two groups of workers and a very high level of inequality. For example, a college-educated worker in the United States with no advanced degrees makes on average, $21,200 more per year than a worker with just a high school diploma (Baum et al. 2013).

Moving from the human capital model to the literature on development economics, there is an argument that says the expansion of education within an economy has two separate effects on the earnings distribution. There is a composition effect which increases the relative size of the more educated group of workers and initially raises the level of income inequality but eventually lowers it, and there is a wage compression effect which decreases the premium on education as the supply of more educated workers increases, which decreases the level of inequality in a very similar way to that described by the human capital model (Gregorio and Lee 2002). Therefore there is an ambiguous effect on income inequality in the short run, but in the long run there is a decrease in the level of inequality as the overall level of education rises and the education premium decreases. Gregorio and Lee (2002) use cross-country data to show that an increase in education inequality and an increase in the overall level of schooling both lead to an unambiguous increase in income inequality; however, if the return to education and the level of education are not independent from one another, and have a negative covariance, then they find that an overall increase in schooling can reduce income inequality.

Education in and of itself, at any level, will have an impact on the level of income inequality seen within a country, but in the United States college education in particular has a very large impact. According to the skill-biased technological change hypothesis,

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increased computerization of the workplace has made it increasingly more important to have a college degree for many positions, increasing the value of a college education and thus the returns to higher education (Neckerman and Torche 2007). In recent decades as earnings for those without a college degree have stagnated or even fallen in real terms, they have risen greatly for those with a college degree; in the United States, the average college graduate earns 70 percent more than the average high school graduate and wage growth has been even higher for those who have graduate and professional degrees (Sawhill et al. 2012)(Corak 2013).

Besides education, inherited assets also play a part in income inequality. These assets themselves compose part of wealth, not income, but the interest earned does contribute toward income and not to an insignificant degree. Harding et al. (2005) estimates that dividends, interest, and rent accounted for 7 percent of all income received by individuals between the ages of 25 and 64 in 1999. Since low income individuals rarely inherit or have the ability to invest in interest- or rent-bearing assets, it is likely that this income is secluded in the upper income levels, thus contributing toward the growth in income inequality explored in the next section, particularly the tremendous growth in the extreme upper tail of the income distribution seen in recent decades.

2.2: 20TH CENTURY CHANGES TO INCOME INEQUALITY

Since the 1970s, the level of income inequality has increased in the United States along with other high-income countries around the world (Corak 2013). Since 1970, the Gini coefficient for the United States has increased year by year, from 0.394 in 1970 to

0.477 in 2012, which results in an increase of 21% over the past 42 years (DeNavas-Walt et al. 2013). A completely clear, proven reason for the increase in income inequality has not been established, and it may not be possible to establish; what is known is that most of the growth in inequality over this time period has been caused by growth in the extreme upper tail of the income distribution. Since 1970, the income share of the top decile has increased from approximately 32 percent to over 50 percent in 2007 (Piketty and Saez 2006) (Atkinson et al. 2011). In 1970 the top 5 percent of the income distribution controlled 16.6 percent of the income, and this has increased steadily until the top five percent controlled 22.3 percent of the income in 2012 (DeNavas-Walt et al. 2013). Piketty and Saez (2006) and Atkinson et al. (2011) point out that since 1970 the income share of the top 1 percent increased from 8 percent to approximately 23 percent. Neckerman and Torche (2007) support this claim, pointing out that during the 1990s, the highest 1 percent of the population experienced faster income growth than the next highest 9 percent, while the highest 0.1 percent gained more than the others in the top 1 percent. Looking at the level of middle class inequality, the Gini coefficient for just those in the bottom 99 percent of the income distribution shows that the effective inequality experienced by most of the population has changed relatively little compared to the overall increase in the regular coefficient (Chetty et al. 2014 [1]) (Gordon and Becker 2007) (Schneider 2013). Neckerman and Torche (2007) point out that the increased income among the rich is not driven by capital income but rather by labor market and entrepreneurial earnings; Picketty and Saez (2006) as well as Atkinson et al. (2011) mention this as well, and in particular salary income now accounts for as much as

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capital gains and business income combined for those in the top 1 percent. However, it should be noted that many corporate level employment contracts are written in such a way that much of their capital gains and business income are in fact counted as salary income. This does not mean, however, that there is not a large wage premium between educated and uneducated workers in the bottom 99 percent of the income distribution; wage premium for those working full-time, year round with a bachelor's degree or higher has increased from 43 percent for women and 25 percent for men in 1971, to 56 percent for both in 1991, and finally to 70 percent for both in 2011 (Baum et al. 2013). This results in the median full-time earnings of those with a bachelor's degree and no advanced degree being $21,100 more than the median full time earnings of high school graduates, and median earnings for those with a professional degree being $66,800 more than the median earnings for those with only a high school diploma (ibid). The returns to higher education also include a higher level of job security; in 2012 when 25- to 34-year-olds with only a high school degree saw a 11.2 percent unemployment rate, the unemployment rate for those with a bachelor's degree was only 4.1 percent (ibid).

Looking at the current state of inequality, in 2012 the median household income was $51,017, but household type played a large part in determining where a household's income would fall (DeNavas-Walt et al. 2013). In addition to the individual returns to education increasing over time, the returns to education in terms of other family members' earnings have also grown, implying a sharper increase in inequality for family income than for individual income (Neckerman and Torche 2007). This is reflected in the 2012 income statistics, which showed that the real median income for family

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households was $64,053 while it was $30,002 for nonfamily households; married-couple family households had the highest median income at $75,694, followed by family households maintained by men with no wife present with $48,634 (DeNavas-Walt et al. 2013). Unfortunately, family households maintained by women with no husband present had the lowest median income at $34,002; this stark difference in median family household earnings, $75,694 - $34,002, is an example of the high level of inequality currently seen in the United States (ibid).

Among the rich OECD countries, the United States has shown the highest levels of income inequality and, along with the UK, has experienced the sharpest growth in inequality over the past 30 years; inequality has also risen in the other industrialized countries, albeit to a much lesser extent, but in most of the European countries and Canada the increased levels of inequality in market outcomes have been offset by social welfare provisions carried out through their governments (Neckerman and Torche 2007). For example, in the United States a child in the top income decile has 14 times as much economic resources as a child in the bottom decile, while in Canada a child in the top decile only has 7.5 times as much as a child in the bottom decile due to the redistributive qualities of its social welfare system (Corak 2013). The United States is also unique among industrialized countries in the fact that its government programs tend to provide more aid to the advantaged than the disadvantaged, which tends to exacerbate the labor market inequalities (ibid). For example, the American education systems spends almost $15,000 per student, more than almost any other high-income country, but much of this goes to tertiary education which benefits the wealthier students over the

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poorer: for every $1 spent on primary education, the United States spends $3 on tertiary education (ibid). Currently the US is only one of three OECD countries that spend on average less on disadvantaged students than on other students; additionally, the highest-quality teachers tend to work in the highest income school districts, which is the opposite of what takes place in countries with high-performing education systems (ibid).

2.3: EQUALITY OF OPPORTUNITY

Equality of opportunity can be seen as a gateway that controls the possibility of social mobility within a given society. While there is not a clear consensus on the definition of equal opportunity, it is generally interpreted to mean a distribution of education and jobs on the basis of actual or potential performance, not ancestry; those with similar abilities have equal chances of success, regardless of their family's social and economic circumstances (Harding et al. 2005) (Sorensen 2006). On the surface, this seems to be a position that anyone and everyone would agree with; whatever the type of welfare state, political leanings, or level of income inequality seen within a country, the idea that everyone deserves a fair chance of competing for the good positions and rewards within the labor market is one that most politicians support (Sorensen 2006). In the United States, this idea is the foundation of the ideology around the "American Dream". However, the labor market in the United States does not strictly follow this meritocratic principle; while equality of opportunity is greater among college educated adults of different class backgrounds than among the entire workforce, there is still evidence even in this small subsection of the population that recruitments for senior

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positions in the corporate world restrict access to white males over equally qualified women and minorities (Beller and Hout 2006) (Sorensen 2006). When broadening the scope of analysis to include the entire population, one sees that the United States actually has a relatively low level of equality of opportunity, due in a large part to the overall low levels of educational opportunity (Beller and Hout 2006).

The unequal opportunities seen in the job market stem from unequal educational opportunities that start at a very young age. Pre-school education is not a publicly provided resource in the United States and as a result higher income children are the ones who have the most access to pre-school education. Combined with the lower levels of cognitive stimulation seen in lower-income households, it is not surprising that by age 5, 78 percent of students who come from families in the top quintile are prepared and ready to start kindergarten, while only 48 percent of students from the lowest quintile are prepared (Sawhill et al 2012). This disparity continues throughout the k-12 education system, with students from higher income families receiving educational enrichment that isn't available to lower income students due to their cost; as previously mentioned, in the 2000s families in the bottom quintile only spent $1300 per child per year on education and enrichment activities while families in the top quintile spent $9,000 per child per year (Corak 2013). As a result, by the age of 19, 76 percent of students from the top quintile have graduated from college with at least a 2.5 GPA, no criminal record, and no children, while only 33 percent of students from the lowest quintile have achieved this outcome (Sawhill et al 2012). Access to private vs public k-12 education, and the educational differences exhibited between the two systems in the United States is another piece of

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this story, but one that would be another paper in and of itself. However, it is important to mention that even with numerous scholarships available at private schools, these private schools have much higher high school graduation rates and average test scores. It is clear that a high-quality preschool and k-12 experience for less advantaged children would play a strong part in equalizing educational opportunities and the resulting labor market opportunities in the United States; as the system stands now, by the time children can be reasonably held accountable for their choices, many are already behind their more advantaged peers simply due to the educational opportunities available within their parent's income level (ibid).

While inequalities still exist in the pre-k and k-12 school system, it is important to note that these differences have lessened over time and low income students still receive a better education today than they did 100, 50, or even 20 years ago. Research has shown that the declining importance of family background on k-12 educational opportunities is due to equal opportunity legislation and enforcement (Beller and Hout 2006). In particular, the Head Start program that started in 1969 and expanded in 1977, 1984, 1995 and 1998 works to improve the school-readiness of low-income children under the age of 5, giving them the same pre-k advantages obtained by higher income children[4]. However, research has also shown that opportunities for *higher* education have actually gotten worse over time, not better. Belley and Lochner (2007) compared students from

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[4] It is important to note that while the Head Start helps many impoverished children, there are still many low-income students who do not receive these services. They are usually available only in urban areas and they are only able to help if parents take the initiative to register their children and take them to the centers. For example, I used the program locator tool on their website and found that none of my previous addresses in Ohio had an office within 5 miles.

1979 to those from 1997 and found that income played a larger role in 1997 than it did in 1979. They looked at both the ability levels of the students as well as their income levels and came to the conclusion that the expansion of higher education in the United States has left the least able from low-income backgrounds behind (ibid). They point out that ability and family income both have positive correlations with college attendance and that for both cohort of students, ability plays the larger role; however, while differences in family income played a substantial part for only those in the highest ability quartiles in 1979, income differences played a substantial part in all ability levels in 1997 (ibid). This is saying that while the role of ability has changed little over time, the role of family income has become more and more important in determining whether the student will attend college. In 1979, only students from the highest ability quartiles attended college, while there were still differences in attendance by those highest achieving students based upon family income level. But in 1997, high-income students from all ability levels attended college, while low income students still only attended college if they were in the highest ability level. Comparing college attendance rates at age 21, in 1997 the college attendance rate of those from the highest income quartile was 16 percentage points higher than the college attendance rate of those from the lowest quartile; this was twice the difference found between the 1979 students (ibid). In 1979, among the high ability quartiles, moving from the lowest to the second family income quartile increased college attendance rates by 10 percentage points, and moving from the second to the top income quartiles raised attendance rates by an additional seven to nine percentage points (ibid). Looking at the most able students in 1997 actually showed little

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difference in college attendance rates among income levels, but among all *but* the highest ability level, moving from the lowest to the highest family income quartile raises college attendance rates by 15-30 percentage points (ibid). Additionally, a higher family income reduced amount of work, both weeks worked and hours per week, for college students in 1997, but it had little effect on the amount of work among students in 1979 (ibid).

Today, high achieving students from all income levels show little difference in ability; the average low-income high achiever scores at the 94.1th percentile on the college entrance exams (ACT and/or SAT) while the average high-income high achiever scores in the 95.7th percentile (Hoxby and Avery 2013). However, the lowest achieving students from the high income groups are still just as likely to graduate from college as the highest-ability students in the lowest income groups (Long 2010). In fact, most low-income students who would be first generation college students don't even take the ACT/SAT exams that are required to apply for college; Hoxby and Avery (2013) found that only 3.8 percent of test takers reported neither parent having more than a high school degree. The growing gap in college attendance rates between those from the lowest and highest incomes can be mainly attributed toward the increase in the *sticker*[5] price of college attendance. In constant 2012 US dollars, the average tuition cost at a 4-year institution has increased from $9,554 during the 1981-82 school year to $23,066 during the 2011-12 school year; this equates to an increase of 141.4 percent (NCES). For just

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[5] It has been well documented that while the sticker price of attendance has increased dramatically, the net price (what students actually pay) has increased at a much lower rate. However, it has also been shown that low income, first generation students do not understand this distinction, and thus the increase in sticker price still affects their rates of attendance, simply by affecting their application rates.

public 4-year institutions the increase has been from $6,942 to $16,789 (141.8%) and just

for private 4-year institutions the increase has been from $15,306 to $33,716 (120.3%)

(NCES). During the same time frame, the average household income in the United States

has only increased by 29.1 percent and the median household income has only increased

by 10.4 percent, also using constant 2012 US dollars[6]. This means that in 1981 the

average cost of tuition was only 17.3 percent of the average household income and 20.7

percent of the median household income, while in 2012 the average cost of tuition was

32.3 percent of the average household income and 45.2 percent of the median household

income[7]. It is important to note that the net price of a college education, the amount

students actually pay after taking into account scholarships and grants, is drastically

different than the sticker price of an education, however the net price is still a significant

percentage of the average income. In 2012, the average net price of tuition, fees, room,

and board for public 4-year institutions was $12,110, 16.9 percent of the average income,

and $23,840 or 33.4 percent of the average income for 4-year private institutions

[8](College Board 2012). These figures are more substantial when looking at only those

families in the bottom quintile. In 2012 the upper bound of the first income quintile was

$20,599; this means the average net price of college tuition, fees, room, and board at a

public college was 58.8 percent of these families' annual incomes, and for private

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[6] Calculations completed using data from DeNavas-Walt et al. (2012)

[7]Calculations completed using data from NCES and DeNavas-Walt et al. (2012).

[8] Calculations completed using data from College Board (2012) and DeNavas-Walt et al. (2012)

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colleges it was 115.7 percent, more than the family's entire annual earnings[9]. While the American media constantly touts the high sticker prices attached to earning a degree, it is very uncommon to see the net prices discussed, which leads low-income students from uneducated families to feel "priced out" of college access, even though the reality of the situation isn't quite as bad as they think. Long (2010) points out that "awareness about aid and college costs appears to be especially limited among low-income students" (32).

Inadequate information and rising costs, combined with a confusing financial aid system, keep many low income students out of higher education (Long 2012). Many of these students either do not attend college at all, or they drop out before attaining a degree, earn so few credits each term that they cannot graduate in even 1.5 times the correct time frame for their degree, or they attend institutions with such poor resources that even when they do graduate, they earn much less than the median college graduate (Hoxby and Avery 2013). Over the past 15-20 years, loans have become the most prominent form of funding for higher education, but low income students and their families often face borrowing constraints that do not exist for those from higher income families; Long (2010) points out that "the financial aid system is not addressing the problems facing students. Although financial aid can dramatically reduce the overall cost of college, many students still have significant unmet need" (27).

The federal government has tried to ease the burden of borrowing constraints by creating the Federal Stafford Loan Program, which is a means by which most students receive loans to pay for higher education. However, these loans have limits, theoretically

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[9] Calculations completed using data from College Board (2012) and Census Bureau (2012)

to keep students from borrowing more than they could feasibly pay back after graduation. The limit for a freshman undergraduate student is $3,500 subsidized and an additional $2,000 unsubsidized, for a total of $5,500; assuming these students are from low-income families with borrowing constraints, if their parents are denied for the Parent Plus Loan, they are able to receive up to an additional $4,000 in unsubsidized loans, assuming the FAFSA estimated their family contribution to be $0 (Historical Loan Limits 2014). However, this only puts their maximum eligible financial aid at $9,500; $2,610 less than the average net cost of attendance at a public university, or $14,340 less than the average net cost of attendance at a private university[10]. The loan limits increase as the student progresses further into his/her education, but if the student cannot pay for the first year of college, it is impossible to obtain subsequent standings within the university. Loan limits max out at the junior year, with $5,500 possible in subsidized loans and an additional $7,000 possible in unsubsidized loans (once again assuming parents were denied for the Parent Plus Loan), which just barely meets the net cost of attendance at a public university, and is still $11,340 less than the net cost of attendance at a private university [11](Historical Loan Limits 2014). When faced with this reality, many low-income students find it too difficult to work while attending classes and instead choose to forego college altogether (Belley and Lochner 2007).

The above figures are all calculated using the net cost of attendance, which is after subtracting what the students receive in the form of grants and scholarships. Most

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[10] Calculations completed using data from Historical Loan Limits (2014) and College Board (2012)
[11] ibid.

middle- and upper-income students will attend college regardless of whether or not they receive financial aid, but the problem of college access, or the opportunity for higher education, lays with the gradual real decline in need-based scholarships and grants (Long 2010) (Belley and Lochner 2010). The Pell Grant, which was introduced in 1972 as the Basic Education Opportunity Grant, is the nation's largest need based grant program and while tuition rates and net costs of attendance have both increased drastically since then, the pell grant has only increased from $5,393 in 1976-77 to $5,800 in 2008-09, in 2008 inflation-adjusted US dollars (Long 2010). In the past 10 years, spending on merit based financial aid has grown by 203 percent, while need-based aid has only grown 60 percent; given that the ability to do well on merit-based criteria is related to income directly and indirectly through school quality and educational enrichment, even the most high-achieving of low income students may be at a disadvantage for qualifying for merit based aid (ibid). While merit based aid helps proportionately more affluent students than their poorer counterparts, other programs aimed to combat the increasing costs of a college education such as the federal Higher Education Tax Credits and college savings programs have shown similar results (ibid). Additionally, qualifying for any form of aid, including loans, is based upon the successful completion of the Free Application for Federal Student Aid (FAFSA).

Unfortunately, low program visibility, the complex application process, and intimidating audit procedures have limited the impact of the FAFSA program among low income students (Long 2010). Long (2010) found that low-income students who received assistance with the FAFSA and information about the financial aid options

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available were significantly more likely to submit the application. Additionally, by providing a program that brought awareness and assistance, Long observed an increase in college enrollment for dependent students and for independent students with no prior college experience. Awareness and assistance programs that specifically target those individuals in the lowest income quintile are one mechanism for increasing the level of higher education opportunity seen within the U.S.

Similar to social mobility and income equality, the United States ranks fairly low in terms of opportunity compared to other countries, particularly the Scandinavian countries. In fact, the Annie E. Casey Foundation found that the U.S. ranked 27th out of 31 developed countries in measures of equal opportunity in 2012 (Sawhill et al. 2012). In the United States, the completed schooling of parents correlates on average .35 with the completed schooling of children, while it is somewhat less in most studies of other Western countries (Duncan et al. 2005). Over time there have been gradual decreases in the correlation between parent's educational level and that of their children, leading to increases in the levels of opportunity seen in Denmark, Norway, Sweden, and Canada, but *not* in the United States, the United Kingdom, or Germany (Sorensen 2006) (Beller and Hout 2006). The democratic social welfare states invest directly in children from an early age, eroding the effect family income has on their educational, labor, and income opportunities; Sweden in particular is a nation where equality of opportunity for a majority of wage earners has been able to coexist with capitalism (Sorensen 2006) (Reeves and Howard 2013). These countries have successfully been able to reduce, if not eliminate, the influence of the family on the life chances of the children (Sorensen 2006).

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CHAPTER 3: SOCIAL MOBILITY

3.1 THE FACTORS AFFECTING UPWARD SOCIAL MOBILITY

Table 1: The Factors Affecting Upward Social Mobility
Education • Pre-Primary: Pre-Primary education is perhaps the single most important factor that affects social mobility as it sets the framework for future educational attainment. • Primary & Secondary: Education at this level is where most students either fail or flourish. Students who fail are likely to have lower income levels and low levels of upward mobility. • Higher Education: Higher education is what opens the door for higher income levels and upward mobility. However, higher education cannot be achieved without success at the prior education levels.
Family Level Factors • Family Structure: Levels of control, discipline, and growing up in a two-parent family have been shown to have positive impacts on upward mobility • Personality Traits: Personality traits help determine many of the qualities that result in good employees and financial success such as amiability, the ability to work with others, motivation, goal-setting, work ethic, and risk taking, among others. • Social and Capital Environment: Low income students raised in families with high social capital and community involvement show high levels of mobility; overall, low income families tend to display certain traits and values (not valued by employers) that are linked to their low income levels and students raised in environments surrounded by low income families who are all displaying these traits and values will tend to display the same, thus decreasing their chances of social mobility. • Genetics: The inheritance of certain genetic traits such as IQ, learning disabilities, and physical traits can inhibit a child's ability to experience upward social mobility
Economic Factors • Level of Economic Growth: High economic growth leads to new opportunities that give low income students more opportunities for upward mobility • Teenage Labor Force Participation Rate: Areas with a high teenage LFPR show higher levels of upward mobility. Work experience and formal training sends signals to future employers that lead to lower unemployment rates and higher incomes, which result in higher levels of upward mobility • Segregation within the Economy: Areas with higher levels of segregation between families of different income levels show lower levels of upward mobility.

The high level of income inequality seen within the United States makes it essential for there to be a level of social mobility within the country; however, the lack of educational mobility that has already been explored makes it hard for low-income children to experience social mobility throughout their lifetimes. It is undeniable that education plays a large role in social mobility due to the increased future wages that result from obtaining higher degrees. In the past it was assumed that once adequate measures of school quality were developed, and public schools were held to a minimum criteria, parental economic status would not have much of an effect on that of their children outside of inherited cognitive differences; there may be some argument over whether public school standards have increased, but parental effects on child socioeconomic status have remained incredibly robust over time in the United States, while k-12 education has at least marginally increased (Bowles et al. 2005). Education and the effect it has on social mobility will be explored in great detail below, and it has the biggest individual impact of all the factors explored by accounting for 10 percent of the intergenerational persistence in income, but there are many other factors that affect mobility and which may be contributing toward the persistence of low mobility in the United States, and these factors must be considered (ibid). Many of these factors impact the ability a child has to learn and education herself and thus they play a very important part in the analysis of opportunity and mobility.

The first group of factors affecting social mobility stem either directly or indirectly from the family the child is born into and they consist of family structure, personality traits, social capital and environment, and genetics. Family structure,

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particularly living in a single-family household, has been seen as a very strong predictor of future socioeconomic status. Duncan et al. (2005) found that the main mechanism through which parents transfer characteristics to their children is parenting style, assessed in terms of parental involvement and control. They cite many studies that have shown that authoritative parents tend to raise children who demonstrate higher levels of competence, achievement, social development and self esteem, and who have fewer mental health problems. These characteristics then translate into higher education and higher income levels. It has also been shown that children raised in two-parent households have higher levels of social mobility. Chetty et al. (2014)[1] found that the fraction of children living in single-parent homes was the strongest correlate of upward mobility of all the variables they tested, showing a strongly negative correlation. This is likely due to the fact that a single parent is often unable to be as authoritative and involved with his/her children as two parents. Chetty et al. (2014)[1] also make the point that single parent households not only cause an individual-level effect on the children raised in those households, but also a community-level effect, "perhaps because the stability of the social environment affects children's outcomes more broadly" (45). This means that living in an area with mostly two-parent families will have beneficial effects on children raised in single parent households, and living in an area with mostly single parent families will have negative effects on children raised in two-parent households. Sawhill et al. (2012) also makes note of the importance of being born into a two-parent family. They created five life-stages and corresponding "success indicators"

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which were used to calculate the chances a child has of reaching the middle class by middle age[12] and the first life stage is birth:

> "Unfortunately, birth circumstances are highly predictive of the likelihood of achieving success in the [other] four life stages preceding middle age. If a child is born at a low birth weight or has a mother who is poor, unmarried, or a high-school dropout – circumstances we denote as 'disadvantaged' – that child has only a seventeen percent chance of achieving all four interim markers of success" (11).

Because childbearing within marriage is no longer the norm for women in their twenties, except among college-educated women, it is highly likely that a large percentage of the children born into single-parent families are the very same children for whom upward social mobility is increasingly important (Sawhill et al. 2012).

Personality traits are another factor that affects social mobility and which is passed from parents to children. Groves (2005) explored the impact personality has on income mobility and found that not only it is statistically significant, but that it accounts for approximately 11 percent of the total father-son correlation in earnings. Other researchers have speculated on how personality affects earnings and have raised many interesting points. Besides obvious traits such as the ability to work well with others and general amiability, family personality traits seem to influence people's choices about how many hours they work, the weight individuals assign to earnings relative to other goals, and overall motivation (Harding et al. 2005)(Mazumder 2005).   Personality traits also affect social mobility by influencing wealth accumulation through traits such as orientation toward the future, a sense of personal efficacy, work ethic, and risk taking; it

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[12] Sawhill et al. (2012) define the lower bound of "middle class" to be 300 percent of the poverty line and "middle age" to be age 40.

has been observed that those with lower incomes tend to be those who are more risk averse, who discount the future, and who have a low sense of efficacy (Bowles et al. 2005). Other personality traits that have been shown to pass from parents to children, and which play a part in determining wages are empathy, reliability, ambition, impulsiveness, and leadership (Harding et al. 2205).

Parents also influence their children's future through the environment where they raise them and the social capital they allow them to obtain. The environment a child is raised in has a very large impact on his or her future earnings and this happens through a number of different channels. As mentioned above, community-level effects can influence children who live in a specific cultural environment, even if the behavior isn't seen in that child's home, i.e. a child who is raised in a two-parent household that is situated among mostly single-parent households will tend to show similarities to the children raised in the single-parent homes. A majority of low-income families are raised by single mothers and looking specifically at mothers, it is shown that math scores, self esteem, mastery, participation in school clubs, having sex before the age of 15, and getting suspended from school are the strongest predictors of mothers' future incomes; these traits along with smoking, taking drugs, and committing crimes are all behaviors that are linked with low socioeconomic status (Duncan et al. 2005). The low income of the parents results in their living and raising their children primarily in areas surrounded by others who also have low socioeconomic resources and who demonstrate the same traits and behaviors. In turn, their children also demonstrate these traits and behaviors and as a result have low incomes as well; Duncan et al.(2005) observed that 100 percent

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of the women in their study who used drugs as adults also had children who used drugs. These behaviors are also linked to social-psychological dispositions such as depression, emotional withdrawal, and lack of control over one's future (ibid). Some of these behaviors have biological or genetic predispositions but Duncan et al. (2005) posit that the social conditions and socialization environment the children are raised in can moderate the expression of these predispositions and as a result, well-functioning parents may insulate their children against the the emergence of these negative potentials. Guo and Stearns (2002) even provide evidence that children raised in low socioeconomic environments show a decreased inheritance of cognitive skills. On the other end of the spectrum social capital, or strong social networks and engagement in local community organizations, has been shown to increase economic outcomes; religiosity in particular has been shown to be very positively correlated with upward mobility (Chetty et al. 2014 [1]). Low-socioeconomic areas that show high levels of upward mobility also tend to show higher levels of religious individuals and participation in community organizations (ibid).

There is a long-standing debate about the role genetics play in the intergenerational persistence in income and social mobility. Many researchers argue that genetic variation influences an individual's chances of economic success and children get half their genes from each parent, therefore children of successful parents inherit a disproportionate share of whatever genes lead to success and children of unsuccessful parents inherit a disproportionate share of those genes that don't lead to success (Harding et al. 2005). On the most basic level genetics have a role in determining outward

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appearances, which plays a small part in determining future earnings. In the United States, both height and beauty have been shown to influence wages and these characteristics both come from genes; it may be that parents who have a certain level of these traits and thereby a certain level of income pass on their traits to their children and as a result their children have similar income levels (ibid). But beyond this, there is a great deal of argument about how much of an effect genetics has; is it necessarily true that successful parents are passing on their success through genetic differences? It *is* true that brothers' incomes are more similar than the incomes of randomly chosen males of the same race and similar age differences, but it may not be just a result of genetic similarities between the brothers (Bowles et al. 2005).

It could also be argued that parents with high human capital and the traits that employers value also have high incomes and as a result they are able to invest more into their children's nutrition, health care, and education, in addition to living in better neighborhoods, thus increasing the likelihood that their children also develop the traits that employers value (ibid). The idea of family environment and personality was explored earlier and it could be that many of the "genetic" differences that lead to income differences are actually just differences in personality, which has been shown to be highly heritable through a combination of environmental and genetic mechanisms (Groves 2005). It has also been argued that genes influence IQ and as a result income levels through differences in cognitive differences, but it has been shown by Bowles et al. (2005) and Harding et al. (2005) that IQ is not actually an important contributor to the inheritance of economic status and that the genetic transmission of IQ is even less

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important; genetically unrelated siblings who are reared together show earnings correlations just as monozygotic and dizygotic twins show a correlation in incomes. Additionally, Harding et al. (2005) found that the father-son earnings elasticity is reduced by two-thirds when sons have never lived with their fathers. In reality it may be that genetics have a small role in the intergenerational persistence in income, but that the family the child is raised in, as opposed to the biological family, and the resulting socialization environment plays a bigger part.

All of the previously mentioned factors affecting social mobility were factors stemming from the child's family: family structure, personality traits, social capital and environment, and genetics. There are also economic factors which influence the ease to which upward social mobility can be realized, mainly the level of overall economic growth, the teenage labor force participation rate, and the degree of segregation within the economy. When there is widespread economic growth, new opportunities appear which help lift up those who are born into the lower rungs of the socioeconomic ladder, but when there is little or no economic growth there also tends to be little or no upward social mobility (Beller and Hout 2006). When there is economic growth, there also tends to be a higher teenage labor force participation rate, which has been shown to strongly correlate with upward mobility; Chetty et al. (2014)[1] found that the highly robust correlation between the teenage labor force participation rate and absolute upward mobility was 0.629. This could be due to the fact that formal jobs help disadvantaged teenagers directly, in addition to the fact that areas with good schools and other

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characteristics that lead to upward mobility are also the areas which tend to have more teenagers working in the formal sector (ibid).

The degree of segregation in the economy also has a large impact on the level of social mobility seen within an area; Chetty et al. (2014)[1] included segregation as one of the top five factors that exhibited the strongest and most robust correlations with intergenerational mobility. In cities with less sprawl[13], upward mobility is distinctively higher and this could be because families from different income levels are generally mixed together more (ibid). The importance of environment has already been explored and in less segregated environments children from low-income families are exposed to peers from higher income families which increases the likelihood that they will emulate the traits associated with higher income families, as opposed to those traits associated with lower income families. Chetty et al. (2014)[1] also found that it is the isolation of lower income families rather than the isolation of higher income families that seems to be the most detrimental for low income children's chances of moving up the socioeconomic ladder; separating the middle class from the poor reduces the beneficial community-level effects already explored and it reduces funding for public goods which benefit the children from low income families. In contrast, separating the affluent from the middle class may not directly affect low income children (ibid).

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[13] Chetty et al. (2014)[1] measure the degree of "sprawl" by the average commute time to work

3.2: HIGHER EDUCATION'S EFFECT ON SOCIAL MOBILITY

Higher education has a large impact on social mobility because it affects intergenerational income mobility; this is due to the fact that income levels are closely tied to education levels (Groves 2005). Chetty et al. (2014)[2] argue that "the correlation between college attendance rates and parent income is a strong predictor of differences in intergenerational income mobility across areas within the U.S." (7). In the past, simply graduating from high school was enough education to facilitate entrance into the middle class, but due to structural economic changes during the 20th century, it has become exceedingly difficult to attain middle class status without graduating from college; in the past 40 years, the value of each additional year of school has increased dramatically (Harding et al. 2005). Even controlling for differences in cognitive skills, the relationship between college attendance and family income has increased significantly since 1960, almost doubling its impact (Corak 2013). Sawhill et al. (2012) include graduating from college as one of their life-stages and find that only 38 percent of those who do not earn a college degree make it to the middle class by middle age, as opposed to 76 percent of those who do. This means that while college enrollment is important, the real key is college graduation which lags enrollment (ibid). Reeves and Howard (2013) find that for those who are born into lower income brackets and who have the drive to get into a higher income bracket, their chances are increased by 42 percent if they obtain a college degree. It is not always clear why higher education levels are so closely linked to higher incomes, but Groves (2005) posits that success in higher education is seen as an indicator of cognitive performance by the labor market.

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Human capital theory says that education is an investment decision and that the positive returns to education will provide the incentive to make the educational investment; however, it has also been shown that in countries where the return to college education is higher, the rates of social mobility tend to be lower (DiPrete and Buchmann 2006)(Corak 2013). This is partly because low-income families are unable to make the investment in education due to borrowing constraints. Corak 2013 found that expenditures per child for educational enrichment[14] increased from the 1970s to the 2000s for all income groups as the returns to education increased, but that this increase was much higher among the highest income families. Among families in the bottom income quintile, annual expenditures rose from $830 per child to $1300 per child, but in the highest income quintile, expenditures rose from $3500 per child to almost $9000 per child (ibid). Additionally, when comparing children born in the 1960s to those born in the 1980s he found that the rate of college graduation increased four percentage points among those who were born into low income families, while the rate of college graduation increased by almost 20 percentage points for those who were born to high income families (ibid). He also found that even when the highest achieving children from low income families go to college, they tend to apply to lower ranked colleges which aren't as selective, as those their higher income counterparts with similar test scores apply to; even though the better college would offer a higher return on investment and generally end up being cheaper for lower income students due to their numerous

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[14] "These expenditures included money spent on books, computers, high-quality child care, summer camps, and private schooling, among other things that promote the capabilities of children" (92).

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income-based grants and scholarships (ibid)(Hoxby and Avery 2013). For these reasons, as the returns to education increase it is necessary for public education, particularly funding of public education, to maintain steady in order to facilitate intergenerational mobility. Borrowing constraints faced by low income parents with "high potential" children mean that these parents will be forced to underinvest in their children's education and as a result, these children must rely upon public education and government-funded grants and student loans (Mazumder 2005). Beller and Hout (2006) argue that the combination of higher economic returns to education and lower levels of public expenditure on education decrease intergenerational mobility; since income depends on education, children from low income families must graduate from college to be upwardly mobile. But, if there is a decreasing level of public expenditure on education, fewer low income children will be able to go to college and the levels of social mobility will decline (ibid). Holding all of the other factors affecting social mobility constant, it would make sense to argue for the improvement of educational achievement seen by those born into the lower income brackets, as a means of increasing the level of upward intergenerational income mobility. Bowles et al. (2005) calculate that 10 percent of the intergenerational income correlation seen in the U.S. is a result of the more extensive schooling received by the offspring of high-income parents. But, as they point out, improving educational achievement by those born into lower income brackets is a goal that is much easier stated than accomplished.

It is difficult to increase income mobility through policies impacting the level of educational achievement because there are many factors impacting the level of education

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attained by those in the lower income groups. These factors consist of their parent's level of income, their social environment, their personality, their level of health, and overall levels of public funding for education. It is important to note that many of these factors are similar to those that were explored as factors affecting social mobility in general. This is not a coincidence; many of the factors that researchers have found to affect income mobility and social mobility as a whole are the same factors that others have found to have an impact on educational achievement. Corak (2013) has a good explanation for how these factors all work together:

> "Socioeconomic status influences a child's health and aptitudes in the early years - indeed even in utero - which in turn influences early cognitive and social development, and readiness to learn. These outcomes and the family circumstances of children, as well as the quality of neighborhoods and schools, influence success in primary school, which feeds into success in high school and college. Family resources and connections affect access to good schools and jobs, and the degree of inequality in the labor markets determines both the resources parents have and ultimately the return to the education children receive. This entire process then shapes earnings in adulthood" (85)

Education is the key component which links parental income levels, the factors affecting mobility, and child's future income levels, which is fortunate since education is strongly affected by policy interventions.

The first factor that impacts a child's educational achievement is the level of education obtained by his or her parents. Even a basic level of parental education, high school graduation at the time of the child's birth, is an important component of future success and Sawhill et al. (2005) include it as part of the first life stage on their path to future success[15]. Children who are born to a mother without a high school diploma are

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[15] "Success" is defined as reaching middle class by middle age.

immediately categorized as disadvantaged at birth (ibid). The mother's level of schooling is most often used when looking at children born into the lowest income levels because these families are most often headed by single mothers; looking at father's education would not provide as much benefit because the fathers are less likely to live with the children and be part of their development (Duncan et al. 2005).   Parents' level of schooling is important because higher-educated parents may produce a more cognitively stimulating environment at home and may be more verbal and aware of different teaching styles (ibid). Additionally, Duncan et al. (2005) point out that "skills acquired through schooling may enhance parents' abilities to organize their daily routines and resources in a way that enables them to accomplish their parenting goals effectively" (50); thus ensuring that intentions for cognitively stimulating environments are realized. Due to the large impact that parental education has on their children's future education levels, it has been found that mother's math and reading scores were two of the maternal characteristics most predictive of her child's future outcomes (ibid).

One way to aid children who are born to parents with lower levels of education is to provide them with access to pre-primary education. Preschool attendance is one of the strongest predictors of school readiness, the second life stage used by Sawhill et al. (2012). Being ready for school is an incredibly important step on the path toward economic success because for the small group of disadvantaged children who do succeed throughout school and early adulthood, meaning they live independently and have graduated college by the end of their 20s, their chances of being middle class by middle

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age are similar to those of their peers who born into more advantaged families; however, only 17 percent of disadvantaged children make it to that point (ibid).

One factor that negatively impacts the education levels of low income children not just in the U.S., but in developed and developing countries around the world, is health care and nutrition. Children from higher income families generally have better access to healthcare and nutrition and as a result grow up to be healthier children and adults[16]; the poorer health experienced by low income children results in their receiving less education (Neckerman and Torche 2007). Bond (1981) points out that poverty contributes toward educational failure because the health and nutritional status of low income children is less than what their bodies need for maximum mental development and full realization of their educational potential; from the moment of their birth, low income children are at a higher risk for deficient development. There are higher incidences of premature birth and low birth weight among low income children and while premature birth poses a threat to the cognitive development of any child, this threat tends to be fully realized among the lower socioeconomic classes (ibid). While low socioeconomic status need not imply poor or malnutrition, they are generally observed to coincide with one another (ibid). The reason why inadequate healthcare and nutrition negatively affects education is logical; when a child is hungry because her family can't give her enough food to eat, or is chronically ill because her family cannot give her the medical care she needs, it is almost impossible for her to focus and learn. This is the concept of Maslow's Hierarchy

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[16] Recent legislation such as the Affordable Care Act may make access to high quality healthcare more equitable among children from different income levels in the near future.

of Needs; one needs to have the basic human requirements of food, water, shelter, and health before higher-level concepts can be grasped such as learning.

One of the factors already explored for its effects on social mobility as a whole, but which also affects education in particular, is the social environment the child lives in. For example, controlling for income levels, areas with higher test scores, lower dropout rates, and smaller class sizes have been shown to have higher rates of upward mobility (Chetty et al. 2014[1]). This is most likely due to the community-level effects explored earlier; when a child is surrounded by peers who value education and achievement, this can overcome a lack of importance placed on these qualities at the home level. Unfortunately, many families with low socioeconomic status are unable to move to areas with high percentages of high achieving schools and students (Mazumder 2005). Another factor which was explored for its effects on social mobility, but which also affects social mobility in particular, is the personality the child develops. As previously mentioned, personality is developed in part through the child's family and in part through his or her social environment. The personality traits already mentioned such as orientation toward the future, work ethic, motivation, ambition, and leadership, along with locus of control, impulsivity, machiavellianism, self-esteem, and emotional intelligence have been shown to explain differences in educational attainment among different students (Groves 2005). It is also important to note that personality characteristics that contribute toward educational success for students in one socioeconomic group may not be the same for those in other socioeconomic groups, or their impact may be increased or lessened (Bond 1981); i.e. a student from a low income

family whose parents do not understand the college system will need to be much more motivated and organized than a student from a high income family whose parents have already been through the college experience and who help with the transition. The low income student will need to work harder to learn the ins and outs of college success than a student whose parents have already taught him about them.

The quality of local public schools is another factor which affects the education level of low income students, and through this medium their overall level of social mobility. The inputs and the outputs of the school system are both shown to impact the quality of education children receive and it often comes down to the level of local tax revenue, which is predominantly used to finance public schools (Chetty et al. 2014[1]). Areas with more public goods, larger tax credits for low income families, and higher local tax revenues tend to have higher levels of upward mobility and the correlation between public school expenditures and upward mobility is very similar to that between local tax rates and upward mobility (ibid). This causes a problem because areas with primarily lower income families will have lower levels of tax revenue and thus poorly funded schools[17]. Looking at the outputs of the school system, graduation rates and test scores, it has been shown that these measures of quality also plays a role in educational attainment and upward mobility, which makes perfect sense because the input (educational spending) directly influences the outputs and thus the average level of educational attainment in the area (ibid).

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[17] Burgeoning legislation, such as Colorado's Amendment 66, which was put before voters in the 2013 election, changes this policy of allocating tax dollars to the school district where the money came from. Instead, it proposed to allocate tax dollars to schools with higher levels of low-income students.

It is important to note that one factor previously thought to influence overall levels of education attainment and thus mobility has recently been shown to not have a statistically significant effect: local access to higher education. It was previously thought that having local access to higher education would impact overall education levels of low income students because it would be easier for them to attend institutions of higher learning, and through this mechanism they would see higher levels of upward mobility. Chetty et al. (2014)[1] explored this option and found that it was not statistically significant. It appears that low income students with the motivation and ability to complete tertiary education will do so regardless of how far they have to travel. This is not to say that college isn't important, or that college does not play a part in upward mobility. It plays a very important part in upward mobility, but having *local* access to college does not play a very large role; "this is perhaps because the marginal impact of improving local access to higher education on college attendance and later outcomes is small" (ibid. 43).

3.3: CHANGES THROUGHOUT THE 20TH CENTURY

At the beginning of the 20th century, particularly during the depression era, there was a relatively high level of social mobility in the U.S., but afterward the level of social mobility declined until the 1960s (Neckerman and Torche 2007). During the 60s, the level of mobility actually increased slightly, but not to the levels seen during the depression era, and then declined from the 1970s through the 1990s; during the 1990s, several studies showed that there was an even greater level of intergenerational

persistence of earnings, i.e. an ever more decreasing level of social mobility, which led to the conclusion that since the end of the 1960s the level of social mobility had been steadily declining (Harding et al. 2005)(Mazumder 2005). However, Bowles et al (2005) points out that this conclusion was reached in error and that the previously high levels of social mobility measured during the 1960s were the result of two types of measurement error: mistakes in reporting income and parents' incomes, along with fact that current income could be uncorrelated with permanent income if the respondents were under the age of 30. For example, current correlations with fathers' earnings are between .2 and .3 if sons' earnings are measured when the sons are in their twenties, but are .5 if measured with the sons are in their thirties (Duncan et al. 2005). It has also been noted that using different data sets for the same generation leads to different results; the PSID[18] usually shows a declining intergenerational persistence in income, while the National Longitudinal Surveys do not (Harding et al. 2005).

Several recent studies have found that once these measurement errors are taken into account and the most reliable data possible is used, the correlation between the current generation's incomes and their parents' is very similar to what it has been for the past 25 years (Harding et al. 2005)(Beller and Hout 2006)(Chetty et al. 2014[1])(Chetty et al. 2014[2]). It has also stayed constant for those entering the labor force in the past 10-20 years; Chetty et al. (2014)[2] found that the probability of a child moving from the bottom fifth to the top fifth of the income distribution was 8.4 percent for children born in 1971, incredibly similar to the percentage for those born in 1986 which was 9
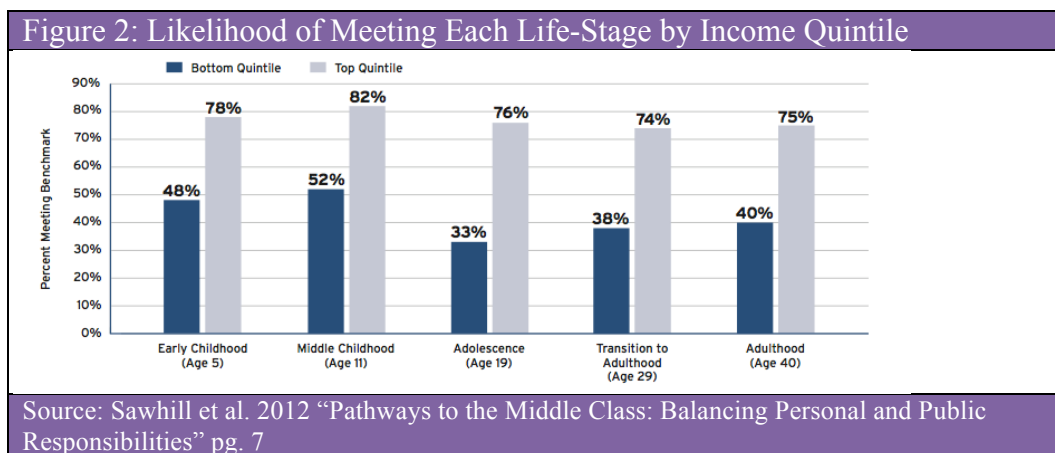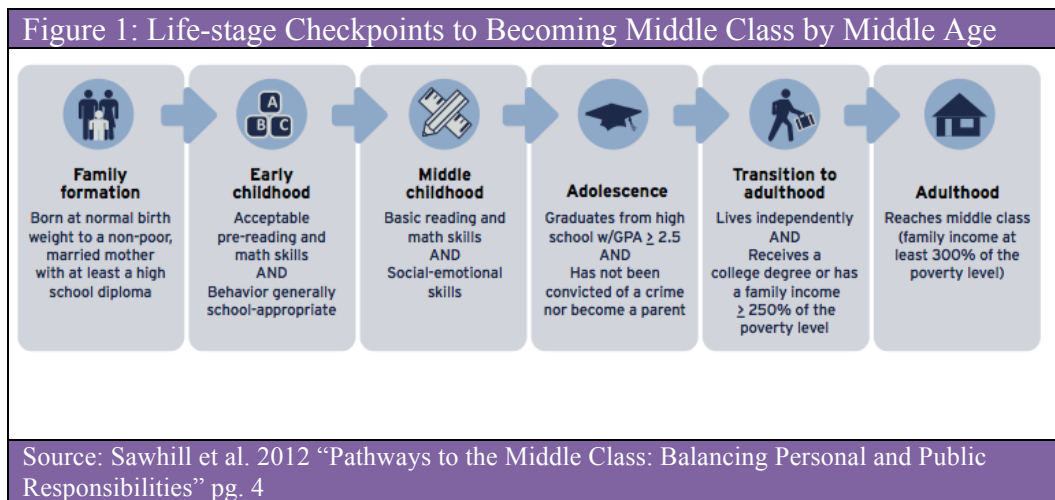
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[18] Panel Study of Income Dynamics (PSID)

percent. However, it must be noted that while the level of social mobility has stayed the same, the level of income inequality has increased; the income gap between those raised by advantaged rather than disadvantaged parents has widened from the 1970s until today, so the relative consequences of being born into a low income family are greater today than they were previously (Harding et al. 2005)(Chetty et al. 2014[2]). In particular, the top 1 percent of incomes have increased drastically, thus making the privileges of being born into this top income group far more than they were previously.

For the current group of students just starting to enter the labor force, those born in 1993, Chetty et al. 2014[2] found that they may actually realize higher levels of social mobility than their parents. Children who were born into the highest income families in 1984 were 74.5 percent more likely to attend college than those born into the lowest income families, but looking at the cohort who was born in 1993, the gap has fallen to 69.2 percent. While this is still a large gap, and the decrease isn't as drastic as we as a society would like to see, it demonstrates a step in the right direction particularly since the college premium continues to rise. In 2013 Americans with a 4-year degree and no higher education earned on average $21,100 more than those with only a high school degree, and the 2012 unemployment rate for those with a 4-year degree was 7.1 percentage points lower than that for those with only high school degrees (Baum et al. 2013).

The current literature shows low levels of intergenerational income mobility and social mobility in the United States. Sawhill et al. (2012) in particular conducts an in-depth analysis of the current state of social mobility in the United States and they start out

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by defining several *life-stage checkpoints* along the path to becoming middle class by middle age; that is, earning 300 percent of the poverty level by age 40. Figure 2 shows each of the life-stage checkpoints defined by Sawhill et al. (2012) and the minimum requirements for being classified as "successful" at each stage. They then show the percent likelihoods of

succeeding at each life-stage for those born into the bottom and top quintiles, as shown in Figure 3. This figure shows that as early as age 5 there is a disparity in the rates of success between those born into the bottom quintile and those born into the top quintile.

Figure 1: Life-stage Checkpoints to Becoming Middle Class by Middle Age

Source: Sawhill et al. 2012 "Pathways to the Middle Class: Balancing Personal and Public Responsibilities" pg. 4

Figure 2: Likelihood of Meeting Each Life-Stage by Income Quintile

Source: Sawhill et al. 2012 "Pathways to the Middle Class: Balancing Personal and Public Responsibilities" pg. 7

Groves (2005) estimates that there is currently a correlation of 0.40 between parent and child earnings, and she points out that this indicates a high level of persistence in income and a low level of social mobility. The result is that a child born into the bottom fifth of the income distribution has a very low chance of making it to the top of the income distribution during her lifetime, between 6 percent to 8 percent depending on the source, and only a 40 percent chance of making it to the middle class, defined as 300 percent of the poverty level (Reeves and Howard 2013)(Chetty et al. 2014[1])(Sawhill et al. 2012). The current level of social mobility seen in the U.S. has been shown to directly relate to those factors explored earlier, such as parental level of education, environment, and educational attainment. Sawhill et al. (2012) found that overall, 72 percent of children who are born advantaged[19] will enter kindergarten ready for school, but not enough of these children come from the lowest income group. Only 48 percent of children born to parents in the bottom fifth of the income distribution are ready for school by age 5, while 78 percent of children in the top fifth are ready for school on time (ibid). This trend continues and while overall 57 percent of children graduate high school with at least a 2.5 GPA and having never been convicted of a crime nor becoming a parent, only 33 percent of those born into the lowest quintile will achieve this life stage, while 76 percent of those born into the highest quintile will (ibid). In the end, 61 percent of children overall will make it to the middle class by middle age, but only 40 percent of those born into the lowest quintile will make it, while 75 percent of those born into the

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[19] To be advantaged at birth the child must be born with a normal birth weight, to a married mother who has at least a high school education and who isn't poor at the time of the child's birth (Sawhill et al. 2012)

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highest quintile will make it (ibid). Looking only at students who stay on track for all of the life stage, beginning with entering kindergarten ready for school, those who are born less advantaged have almost as high of a chance of making it to the middle class as those who are born advantaged, but only 2 percent of the children from the bottom quintile are able to stay on track for all of the intervening stages[20]. It should be noted that much of the immobility seen in the U.S. is seen in those at the extreme ends of the income distribution (Beller and Hout 2006). Those born into the bottom of the distribution are likely to stay at the bottom and those born into the top are likely to stay at the top, but those who are born into the middle class generally see movement, both up and down, within the middle of the distribution (ibid).

There has been some debate over whether there are gender differences in the level of social mobility within the US. Theoretically, the factors we have explored which affect social mobility, family structure, personality traits, social environment, genetics, the economy, and educational attainment, should impact males and females similarly. Duncan et al. (2005) clumps these factors into the SES[21] hypothesis, which says that these factors, most of which are determined by the child's SES, will impact the child's eventual permanent income and level of social mobility. They then point out that the SES hypothesis implies that the intergenerational correlation of outcomes should be gender neutral since the benefits of higher SES should be realized by both genders (ibid). However, most of the evidence does not support this conclusion. Most studies show that the intergenerational persistence in income is greater for sons than daughters

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[20] See Appendix B for an in-depth analysis of Sawhill et al. (2005) and their findings
[21] Socioeconomic Status (SES)

and that as a result, daughters have a higher level of social mobility (Bowles et al. 2005)(Duncan et al. 2005).

It could be argued, however, that these studies which look at simply the income earned by the adult child herself, and not the daughter's family's income, are misinterpreting the data; because most of these studies were completed using data on adult women from the beginning of the 1960s until the beginning of the 1990s, it is logical that many of the women in the data set would have a negligible personal income. During this time period, women over the age of 30 (the youngest age deemed appropriate to start comparing intergenerational income) were most likely married and married women very rarely worked outside the home, particularly in the higher income groups. For example, in 1960 only 25 percent of women in the top income quartile worked, compared with 42 percent of married women in the lowest income quartile; by 2005 this number had increased to 34 and 77 percent respectively (Greenwood et al. 2014). This means that regardless of what the parental income level was, the daughters would have a very low personal income and thus there was a very low correlation between father-daughter income levels. Other studies, which look at the daughter's family income compared to her family income growing up, show that the intergenerational correlation in income is even higher for women than for men, and that women show an even lower level of social mobility (Harding et al. 2005). This is because women from wealthy families tend to marry men with higher incomes and women from lower income families tend to marry men with lower incomes; Harding et al. (2005) go as far as to say that "parental advantages may exert even more influence on

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a daughter's success in the marriage market than on a son's success in the labor market" (108). This leads them to the conclusion that the economic costs of having grown up in a disadvantaged family are even higher for women than they are for men, because of the effect it has on their potential spouses (ibid). Greenwood et al. (2014) have also found this to be the case, pointing out that Americans are increasingly engaging in positive assortative mating, which means that they marry someone with a similar SES.

Sawhill et al. (2012) also finds gender differences in the percentage of people who succeed at each life stage. They find that for the life stages leading up to the transition to adulthood (age 29), a higher percentage of females succeed than males, but that by age 29 the percentages are equal at 60 percent, and by adulthood, measured at age 40, males have a higher level of success than females. This is interesting because it shows that while women are more successful at younger ages than their male counterparts, by the age of 29 equal percentages live independently and have graduated from college or make at least 250 percent of the poverty level, and by the age of 40 a higher percentage of males than females are middle class and have a family income at least 300 percent of the poverty level. DiPrete and Buchmann (2006) had similar findings, which showed that the large gaps in educational attainment that used to exist between women and men have eliminated, and women today are more likely than men to persist in college, obtain degrees, and enroll in graduate school. Unfortunately, their wages have not bridged this gap, as shown by the findings of Sawhill et al. (2012) and as a result they have a lower representation in the middle class.

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There are also racial differences in the level of social mobility. Chetty et al. (2014)[1] found that areas with larger African American populations have substantially lower rates of upward mobility, and that both African Americans and Caucasians living in these areas shows lower levels of upward mobility. This means that race not only shows individual level effects, but the community level effects that have been previously explored. Reeves and Howard (2013) found that overall, African Americans are 26 percent less likely to move out of the bottom income quartile than Caucasians. Sawhill et al. (2012) also found racial differences in the percentage of children who succeed at each life step. They found that at each life stage, the largest percentages of students who are successful are Caucasians, followed by Hispanics and then African Americans (ibid). The biggest racial gap appears at the transition to adulthood measured at age 29, when they looked at the percentage of each group which lived alone and either had a college degree or an income greater than or equal to 250 percent of the poverty level; 68 percent of Caucasians are successful at this stage compared with 47 percent of Hispanics and only 33 percent of African Americans (ibid).

Another demographic difference that exists is the geographic location in which one lives within the United States. Most studies have approached social mobility from a macro standpoint and looked at the level within the country as a whole, but Chetty et al. (2014)[1] approached their study from a micro standpoint, and looked at the individual levels of mobility within different parts of the United States. They found that there are actually high levels of variation across areas within the U.S., and go as far as to say, "The U.S. is better described as a collection of societies, some of which are 'lands of

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opportunity' with rates of mobility across generations, and other in which few children escape poverty" (1). For example, they found that a child born into the bottom quintiles of the income distribution has a 7.8 percent chance of making it to the top fifth when looking at the U.S. as a whole, but when looking at individual cities it can be as high as 12.9 percent in Salt Lake City and San Jose or as low as 4.4 percent in Charlotte or Indianapolis (ibid). Looking at each state as a whole, some states have very different mobility patterns than other nearby states; for example, Ohio shows much lower rates of upward mobility than Pennsylvania (ibid). They also find that the differences in mobility are mirrored as differences in the factors that affect mobility such as educational attainment and social environment; patterns of college attendance and teenage birth rates are very similar to the patterns they found in terms of intergenerational income mobility, and they noted that children of the parents in the highest income decile are 80 percentage points more likely to attend college than children of parents in the lowest income decile. (ibid). Interestingly, they also found that location matters more for children from low income families more than for children from high income families; regardless of geographic location children from high income families tend to become high income adults, but the future prospects of children from low income families varied greatly by location (ibid)[22].

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[22] A future research endeavor would be to look at policy differences between the different areas within the US to try and pinpoint what causes the differences in levels of social mobility

3.4: CROSS-COUNTRY COMPARISON

As previously mentioned, the level of social mobility differs greatly among different regions across the United States, and while some areas show reasonable levels of mobility, others show very low levels. These low points bring the level of mobility for the country as a whole down to levels which are lower than most developed countries, and some areas within the U.S. are much lower than other developed countries (Chetty et al. 2014[2]). Great Britain is another developed country that shows lower-than-average levels of mobility, but most other developed countries, including Canada, Finland, Sweden, Norway, and Germany consistently show much higher levels of social mobility than those seen in the United States (Beller and Hout 2006)(Corak 2013)(Sorensen 2006). Canada is an interesting country with which to compare the U.S. in terms of social mobility. It is just north of the United States and was settled around the same time period, but it shows drastically lower levels of intergenerational earnings correlations and thus much higher levels of mobility. Corak (2006) found that the intergenerational earnings elasticity for the United States was twice that of Canada, and that as a result more than half of the sons raised by top decile American fathers will fall no lower than to the 8th decile and more than half of the sons raised by bottom decile American fathers will raise no further than the 3rd decile; in Canada the eventual position of the son has a much lower correlation to that of the father.

Much of the difference seen between the US and the other developed countries is due to differences in access to education. The impact education has on future earnings and thus social mobility has already been explored, and it is obvious that education has a

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big part to play. Starting at the very beginning of the child's life, differences in access to education emerge between what is seen in the U.S. and what is seen in other developed countries. For example, in most Scandinavian countries a family's income level is not strongly related to the whether their children will have access to high quality childcare, but in the United States, the family's economic situation is directly related to whether the parents are able to obtain high quality childcare, which can influence the children's cognitive development (Sorensen 2006). This has resulted in drastic socioeconomic differences in whether the child enters kindergarten ready to learn, a difficulty that is passed onto the school system which have higher levels of low income students; only 45 percent of children born into the bottom income quintile are ready for school when they enter kindergarten, compared with 78 percent of those born into the top quintile (Corak 2013)(Sawhill et al. 2012). This difference continues through the child's educational career, coming to a head when the child either does or does not enter college. Graduating from college is increasingly a necessary component of moving up the socioeconomic ladder, and in the United States this correlation is especially strong for tertiary education obtained from a selective institution (Corak 2013). Low income parents have a limited ability to finance their children's education, so countries that have more progressive policies toward public education financing, such as the Scandinavian countries and Canada, show much higher levels of social mobility (Beller and Hout, 2006). It has also been shown higher education is more academically accessible in the United States than in other developed countries; American colleges admit students with poorer secondary school records and they offer more nonacademic instruction, such as 2 year programs at

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community colleges (Harding et al. 2005). This means that lower achieving students in low-income families would have access some form of higher education, if only the institutions were more financially accessible, such as those in the Scandinavian countries. The hurdle in the United States is that there has been significant political resistance to shifting the costs of child rearing from parents to the government, as has been done in most European countries (ibid). In all of these nations the families with the highest incomes pay most of the taxes, while families with the lowest incomes have the most children; redistribution of income in a manner which shifts childrearing and education costs to the government is one way in which the educational differences seen in the United States could be lessened to those seen in other advanced economies (ibid).

As previously mentioned, the attitude and personality of the child plays a role in determining future success, and these are determined in part by both family and community factors. In the same way, differences in social mobility at the national level are partly due to differences in general attitudes among different countries. Groves (2005) explored this topic and measured "externality," the belief that outcomes are the result of fate or luck rather than hard work, and found that in the United States, a one standard deviation increase in externality decreases wages by almost 7 percent, and that in the United Kingdom a one standard deviation increase in aggression or withdrawal decreases wage by 7.6 and 3.3 percent, respectively. Differences in these attitudes among countries play a part in the differences in social mobility. Another community level effect involves the encouragement low-income students get in terms of going to college. Children in low-income families in the United States often have a lack of

guidance and culture from their family and community which encourages college attendance; this leads many children who could be high achievers to not apply to college, nor take the entrance exams such as the ACT and SAT (Corak 2013). In countries where these kinds of tests are offered free of charge to all secondary students, where all students are expected to move on to education, and where higher education is either free or highly subsidized, this barrier to social mobility has disappeared and higher rates of social mobility are common.

CHAPTER 4: MEASURING EDUCATION INEQUALITY

4.1: AN EDUCATION LORENZ CURVE

Income inequality is commonly looked   at
in a Lorenz Curve framework. As shown in
Figure 4, the Lorenz curve plots the
cumulative distribution of income controlled
by cumulative percentages of the population.
As already explored, education is a key
component to the levels of social mobility,
income inequality, and equality of
opportunity seen within a country. I propose

Figure 3: Lorenz Curve

that the Lorenz Curve analysis framework can be applied to analyze the change in the

distribution of college degrees over time, within and among countries. The X-axis stays

the same, as the "Cumulative share of people from lowest to highest incomes", but the Y-

axis becomes the "Cumulative share of college degrees." This method provides a

framework with which to extrapolate both the level of social mobility seen within the

country, as well as the level of social opportunity seen within the country. This is

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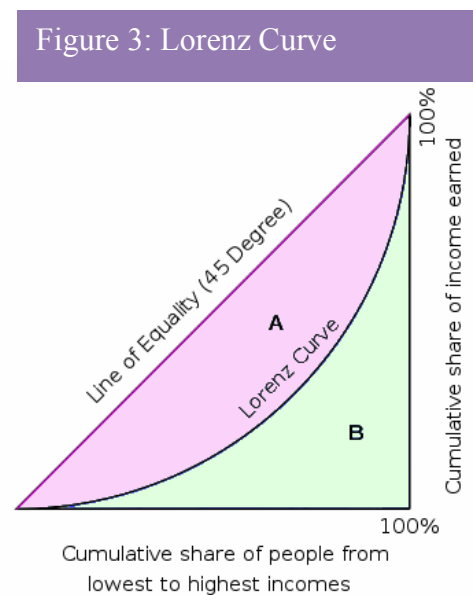
because students who graduate from college generally have higher income levels than those who don't, so

one way to look at the current state of social mobility is to look at the distribution of college degrees among students from different socioeconomic backgrounds (Groves 2005)(Chetty et al. 2014[2]). By comparing the percentage of graduates from each income level with the percentage of the population in that income level, one can see if the distribution of college degrees is equitable, i.e. the percentage of college degrees awarded to income level A is consistent with the percentage of the population that composes income level A.

By creating an Education Lorenz Curve and calculating the equivalent Education Gini Coefficients, one can not only look at the change in the distribution of education, but one can also compare the levels of education inequality to the levels of income inequality seen within a given area. Sorensen (2006) analyzed this comparison, albeit using a completely different method of computation, and found that there has been an increase in the inequality of educational attainment in rich and poor children. He found that on average, a .02 increase in the Gini Coefficient coincides with a reduction of .192 years of schooling for low-income children, and an increase of .372 years of schooling for high-income children.

4.2: APPLYING THE EDUCATION LORENZ CURVE 1993 – 2012

Numerous data sets were explored in an attempt to find one that would be sufficient for completing this analysis. It was determined that the NCES National

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Postsecondary Student Aid Studies (NPSAS) would provide the most complete, accurate data about graduating college seniors, however there are a few caveats that must be attached to this data set[23]. First and foremost, this data is over-representing the percentage of degrees being awarded to low-income students and under-representing the degrees awarded to those from very high income levels. The percentage of degrees awarded to students from different income levels is calculated with the assumption that all graduating college seniors are encompassed in the data set. The NPSAS collects its financial data from the FAFSA that the students and their parents must fill out each year in order to receive government and institutional financial aid (ED Data Inventory 2003-04)(ED Data Inventory 2007-08)(ED Data Inventory 2011-12)(Wine et al. 2005)(Riccobono et al. 2002)(Riccobono et al. 1997). While this method of data collection provides very detailed and accurate financial data about every student who fills it out, there is one segment of the student population that is not included in this sample: very wealthy students. Wealthy students and their families generally do not complete the FAFSA because even if they did, they would not qualify for any kind of need-based aid. Because this group of students has been essentially ignored by these studies, it is important to remember that the distribution of degrees is actually skewed further toward the high-income end of the distribution than what is showed purely by the data.

As aid policies have changed over the years of analysis (1993 – 2012) it is possible that the upper bound of the sample has fluctuated as well. During the time

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[23] Many of the issues with this data set could be have been avoided by obtaining the raw data from NCES as opposed to accessing the data set through NCES PowerStats software. However, gaining access to the raw data requires a lengthy application and approval process that was not deemed necessary for this thesis.

period analyzed, an increasing percentage of the total financial aid awarded was in the form of merit-based aid instead of need-based (Long 2010). For this reason, it is likely that an increasing number of upper-middle class students chose not to fill out the FAFSA, thus making it appear that a higher percentage of total degrees were being awarded to those from lower-income families. Lastly, the survey population changed for the 2012 sample; prior to 2012, all NPSAS data sets included college students in Puerto Rico, but for the 2012 NPSAS Puerto Rican schools and their students were not included (ED Data Inventory 2011-12). Overall, Puerto Rico is a high-poverty territory of the United States; in 2011 the overall poverty level for the U.S. was 15.9 percent, while in Puerto Rico the poverty rate was 45.6 percent (Bishaw 2012). That being said, the territory actually has a higher percentage of students enrolled in higher education than the United States. Looking at the population aged 18 to 24, 33.9 percent of these young adults are enrolled in higher education in the United States, while 34.4 percent of the Puerto Rican population in this age group are enrolled in higher education (Futuro Educación Superior 2011). While it is highly likely that nearly all high-income Puerto Ricans are part of the population enrolled in higher education, their poverty level combined with their enrollment rates suggest that a large percentage of their enrolled students come from families below the U.S. poverty level. Therefore, by removing this group from the sample in 2012 it is likely that a larger percentage of low-income students were removed than high-income students, thus raising the overall income level of the sample. This would lead to an under-estimation of the level of inequality for 2012. Due to the numerous issues identified with the NPSAS data set it is not possible to draw accurate

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conclusions by working with the data. However, this data set is accurate enough to use as a proxy, to demonstrate how the Lorenz Curve analysis can be applied to analyze the change in education inequality over time. I perform this analysis below, explaining how I would work with the data and what kind of conclusions could be drawn.

An analysis of the distribution of college degrees in the United States starts by looking at how the distribution of college degrees compares to the distribution of income in the United States. To simplify matters, I am only looking at the distribution of awarded 4-year degrees from all 4-year institutions, public and private. Table 2 shows these distributions for graduates in 1993, 1996, 2000, 2004, 2008, and 2012 along with the coinciding distributions of income among the population of the United States.[24]

Table 2: Distribution of 4-Year Degrees and Income by Set Income Levels									
	Under $15,000	$15,000-$24,999	$25,000-$34,999	$35,000-$49,999	$50,000-$74,999	$75,000-$99,999	$100,000-$149,999	$150,000-$199,999	Over $200,000	Total
1993 Grad	5.5	6.3	9.2	17.3	37	11.7	7.7	1.8	3.4	100
1991 Pop	14.3	12.1	11.2	15.6	19.4	12.1	10.2	3.1	2	100
1996 Grad	13.6	11.2	11.4	17	25.9	10.5	7.8	1.2	1.5	100
1994 Pop	14.3	12.5	11.2	15	18.7	11.9	10.5	3.3	2.7	100
2000 Grad	5.1	7.6	8.3	14.4	23.9	18.6	16.1	4.1	2	100
1998 Pop	12.4	11.2	10.6	14.3	18.7	12.6	12.5	4.1	3.6	100
2004 Grad	9.1	9	10.1	14.2	22	15.3	14.1	3.6	2.5	100
2002 Pop	12.6	11.3	10.3	14.6	17.7	12.7	12.5	4.3	3.8	100
2008 Grad	16.5	8	8	10.5	15.5	13.9	16.8	7.1	3.8	100
2006 Pop	12.2	11.2	11	14.1	17.7	12.1	12.7	4.9	4.2	100
2012 Grad	11.6	8.7	9.3	10.8	16.5	14.8	17.3	6.1	5	100
2010 Pop	13.7	12	10.9	13.9	17.7	11.4	12.1	4.5	3.9	100
Source: Baccalaureate and Beyond Surveys accessed through NCES Powerstats and DeNavas-Walt et.al.									

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[24] For each year's graduates, their income levels were recorded as their parent's income level 2 years prior. So 1993 Graduates' incomes coincide with the 1991 population's incomes.

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It can be seen from Table 2 that for all the years of analysis, lower income students tend to be underrepresented while higher income students tend to be overrepresented, compared to their distribution among the general population. From a social mobility standpoint, this shows that there is a low level of social mobility in the United States. Since more college degrees are going to students from high-income families, the high-income jobs will also go to these students and the chances of their socioeconomic status changing throughout their lifetime is low. The same analysis applies to the lower income students. The low-income students are receiving a smaller percentage of the college degrees and therefore young adults from these income levels will remain trapped there throughout their lives. A more useful way to look at the data is to look at the cumulative percentages of college degrees and population incomes, distributed by quintile, as shown in Table 2. In an effort to be as accurate as possible, separate income levels were used to determine the upper bounds of the quintiles for each year of reference. These income levels were taken from the U.S. Census Bureau's *Table H-1: Income Limits for Each Fifth and Top 5 Percent of All Households (1967-2012)*[25]. As Table 3 shows, lower income students are drastically underrepresented in the distribution of college degrees. For every single year of analysis, the percentage of total graduates who fall into the lowest income quintile is vastly smaller than the percentage of the population which composes that income quintile. For example, only 4.3 percent of the

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[25] This table of income limits can be accessed via
https://www.census.gov/hhes/www/income/data/historical/household/

total degrees awarded in 1993 went to students from the first quintile, but 46.5 percent of

the population fell within that quintile. In an equal world, a perfectly equitable

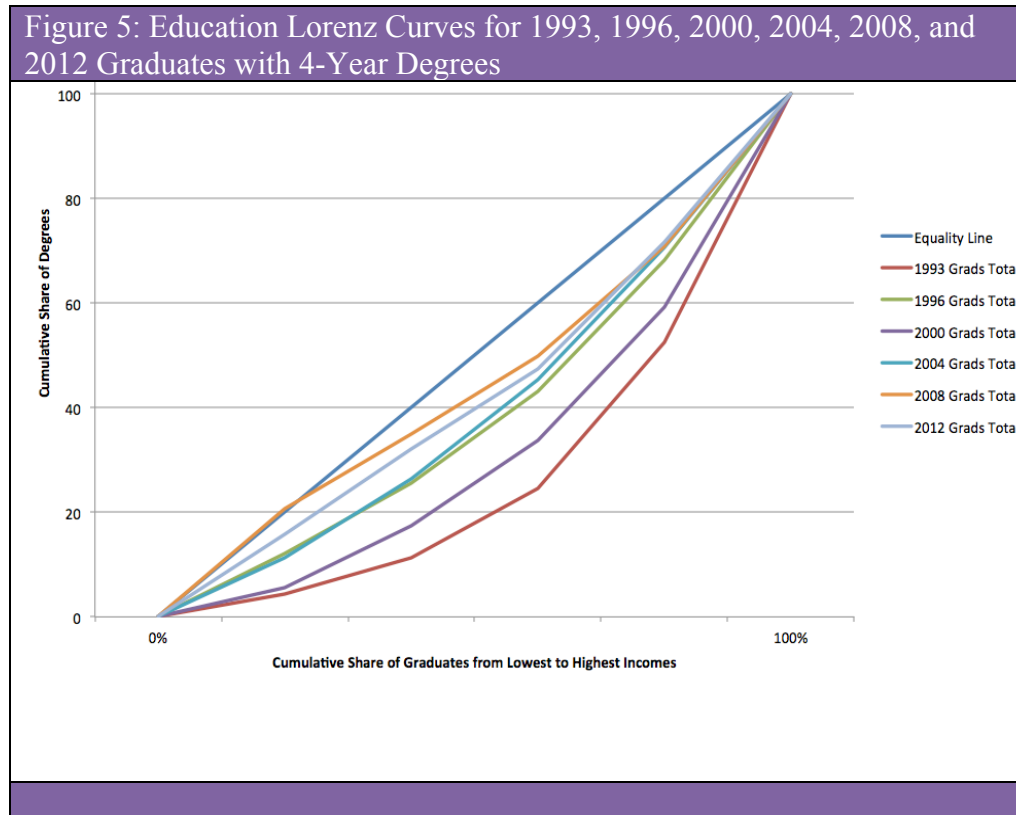| Table 3: Cumulative Distribution of 4-Year Degrees and Population by Income						
	0	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
1993 Grad	0	4.3	11.3	24.6	52.6	100
1991 Pop	0	46.5	70.7	86.6	96.2	100
1996 Grad	0	12.2	25.6	43.2	68.3	100
1994 Pop	0	49.1	72.5	87.5	96.4	100
2000 Grad	0	5.5	17.4	33.8	59.3	100
1998 Pop	0	49.2	72.4	87.4	96.4	100
2004 Grad	0	11.3	26.5	45.4	70.6	100
2002 Pop	0	49.7	73	87.8	96.6	100
2008 Grad	0	20.7	35	49.9	70.8	100
2006 Pop	0	50.5	73.4	87.9	96.5	100
2012 Grad	0	15.9	32.1	47.4	71.8	100
2010 Pop	0	50.3	73.7	88.3	96.8	100
Source: Baccalaureate and Beyond Surveys accessed through NCES Powerstats and DeNavas-Walt et.al. (2010)						

distribution of degrees would have 20 percent obtained by students from the first quintile,

another 20 percent by students from the second quintile, and so on, and given the current

level of income inequality in the United States, almost 50 percent would need to go to

students from the first quintile. To visualize the inequality in the distribution of degrees,

the cumulative distribution of degrees for each year is graphed along with the line of

equality to form the Education Lorenz Curve, as shown for 1993 graduates in figure 5.

One can see that the Education Lorenz Curve is composed of 5 separate line segments,

one for each quintile, and each subsequent line segment has a greater slope than the one

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before; this is because each subsequent quintile is earning a higher percentage of degrees than the one before it. To visually see how the distribution of degrees has changed over

Figure 4: Education Lorenz Curve for 1993 Graduates with 4-Year Degrees
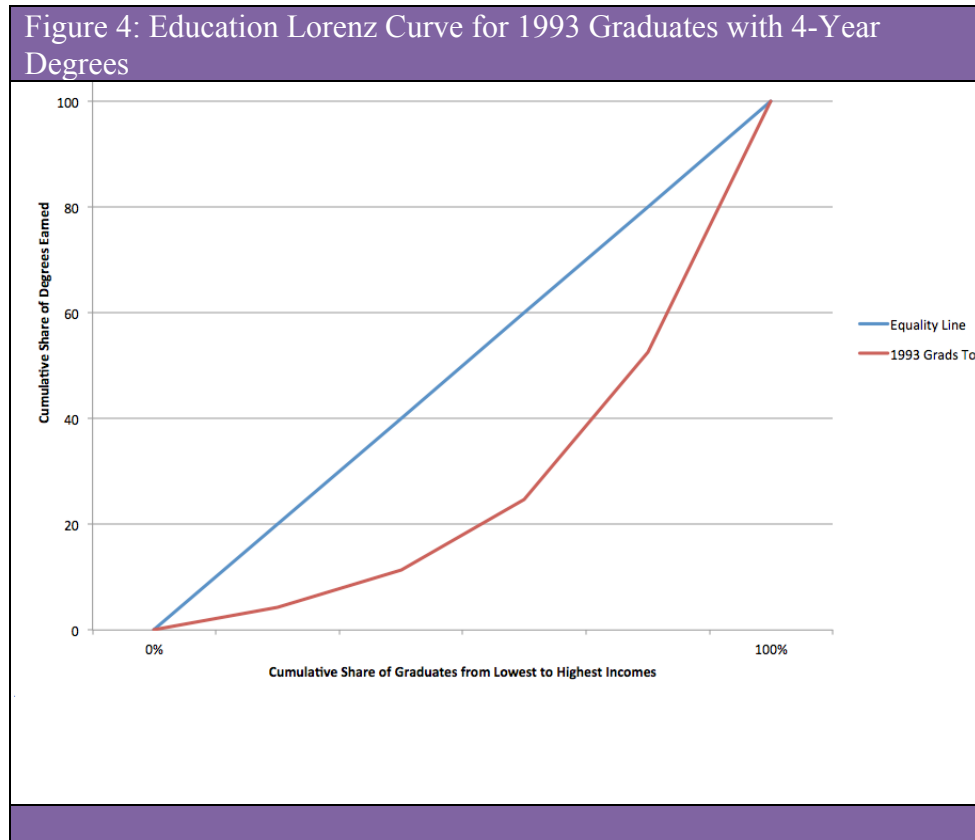
time, it is useful to look at multiple years plotted on the same graph, as in figure 6. From this graph it is easy to visualize which years had the most equal and unequal distributions of degrees. Since the curve for 1993 is the furthest from the equality line that is the year that had the greatest inequality in the distribution of degrees; the distribution jumps around from year to year and 2008 had the least inequality in the distribution of degrees, as is shown by the orange line closest to the line of equality. According to the data, in this year, students from the first quintile actually captured 20.7 percent of the degrees,

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more than what they would have received in a perfectly equal distribution. In this year the highest quintile only obtained 29.2 percent of the degrees. Unfortunately, for

Figure 5: Education Lorenz Curves for 1993, 1996, 2000, 2004, 2008, and 2012 Graduates with 4-Year Degrees

the next year of analysis (2012) the distribution is once again unequal, with students in the first quintile only accounting for 15.9 percent of the total degrees awarded; this is, however, still a great improvement over 1993, when students in the first quintile only accounted for 4.3 percent of the total degrees[26].

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[26] An explanation of the decrease and subsequent increase in inequality will follow, as part of the explanation of the change in gini coefficients.

In order to calculate the Education Gini Coefficient, the area under the Education Lorenz Curve for each year was broken into multiple sections, whose areas totaled to the total area under the curve. Once the total area under the curve is calculated it is then used to calculate the Education Gini Coefficient for each year[27]. Table 4 and Figure 7 show the Education Gini Coefficients for each year, along with their Income Gini Coefficient counterparts.

Table 4: Education and Income Gini Coefficients for Graduation Years 1993-2012			Figure 6: Education and Income Gini Coefficients 1993-2012
Year	Income Gini	Education Gini	
1993	0.428	0.429	
1996	0.456	0.203	
2000	0.456	0.336	
2004	0.462	0.185	
2008	0.47	0.094	
2012	0.47	0.131	

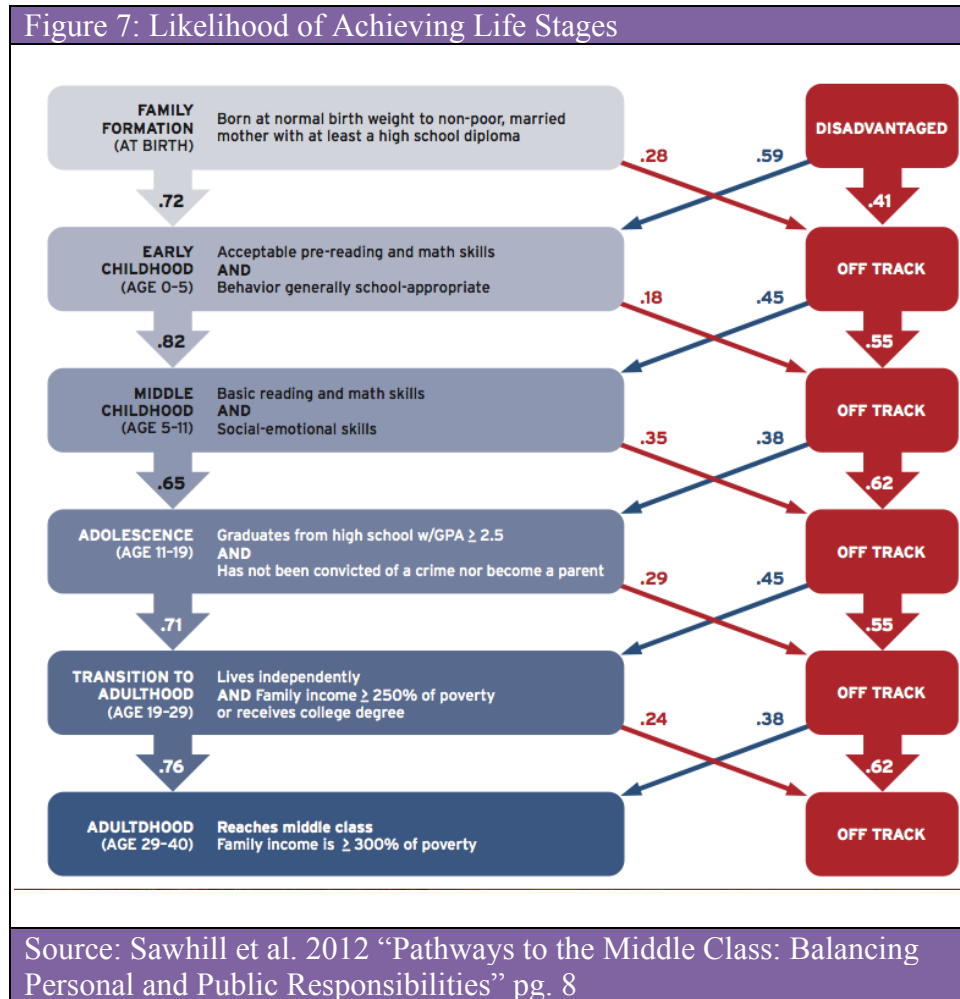Figure 6: Education and Income Gini Coefficients 1993-2012

Interestingly, for the year 1993 the Education and Income Gini Coefficients are nearly the same. From that point, the Income Gini Coefficient steadily increases, while the Education Gini Coefficient both increases and decreases. As already mentioned, the decrease in the Education Gini Coefficient after the year 2000 may be due to an increase in the number of students not filling out the FAFSA. As previously stated, between the

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[27] See Appendix C for an explanation of the actual calculations.

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years 2000 and 2010, spending on merit-based financial aid increased by 203% (Long 2010).

What is obvious from the data is that there is a measurable degree of inequality within the system of higher education and the severity of the inequality may have changed over the past 11 years, but it hasn't disappeared completely and it may be on the rise once again. It is important once again to stress the part that the pre-k through 12 education system plays in the system of higher education. In particular, pre-primary education creates the foundation that the rest of the education system builds upon, and if a student does not arrive in kindergarten ready and prepared to learn at that level then he starts out his educational career already behind the pack. Going back to Sawhill et al. (2012), a student who does not successfully pass the checkpoint, being ready for kindergarten by age 5, is on a path that most likely results in his failing to successfully achieve the following life stages. Figure 8 shows the likelihood of successfully achieving each life stage, depending on whether the previous life stage was achieved or not. One can see that by starting off disadvantaged, a student only has a 59 percent chance of attaining success in early childhood, while for those born advantaged 72 percent are successful at this stage in life. From this point onward, the student has to work harder to catch up and for those who do not succeed in early childhood, only 45 percent will succeed in middle childhood, while 82 percent of those who were already on track will stay on track. If a student continues to be off track throughout childhood, by the time they transition to adulthood, 55 percent will stay off track while only 45 percent will achieve success. This places a large responsibility on the early childhood education

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system, particularly on the publicly funded early childhood education system. Equal

access to higher education actually starts when the child does or does not enter pre-

primary education. However, it is important always remember that it is never too late to

Figure 7: Likelihood of Achieving Life Stages

Source: Sawhill et al. 2012 "Pathways to the Middle Class: Balancing Personal and Public Responsibilities" pg. 8

intervene and help some students succeed even if they were previously unsuccessful.

Yes, 55 percent of young adults who were unsuccessful in adolescence will also be

unsuccessful in the transition to adulthood, but that means that 45 percent of them will

<u>still</u> succeed, given their previously unsuccessful status. Sawhill et al. (2012) include this in their findings, pointing out that "people who succeed in their twenties, despite earlier struggles, still have a good chance of making it to the middle class" (2).

CHAPTER 5: CONCLUSIONS

It is undeniable that a level of income inequality exists within the American society that makes it essential for those who are born into poverty to have the potential for upward mobility throughout their lifetimes. In particular, over the past 30 years the United States has come to show the highest levels of income inequality among all of the OECD countries (Neckerman and Torche 2007). It is also obvious that a large component of the differences in income among the lower 90 percent of the income distribution are the direct result of differences in higher education attainment. This difference in educational attainment stems from unequal educational opportunities starting at the pre-k level and compounding through subsequent levels of the education system, coming to a head in the system of higher education. If a low-income student who works hard and achieves throughout high school is unable to pay for college with the maximum loans available from the federal government, how could one argue that there isn't unequal access to higher education in the current system? It is almost guaranteed that a high-income student with the same grades and motivation would obtain a Bachelor's degree or higher and thus reap the income rewards associated with that level of education. It is obvious why the United States ranked 27th out of 31 developed countries in measures of equal opportunity (Sawhill et al. 2012). This measureable degree of unequal opportunity is one of the contributing factors to the low levels of social mobility seen within the United States. Education itself accounts for 10 percent of the intergenerational correlation of earnings; more than any other factor measured (Bowles et

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al 2005). Until there is completely equal educational opportunity in the United States, at

all levels of the education system, the state of meritocracy and upward mobility through

hard work and dedication that has perpetuated through the years will not actually exist.

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APPENDIX A: DATA SETS USED TO CREATE THE EDUCATION LORENZ

CURVE

Each year of analysis was completed using a separate data set, each of which was

accessed through the NCES Powerstats software. Here is a brief overview of the data

sets used for each year.

1993 Grads	
Data Set Name:	BB:03
Summary:	The 1993/03 Baccalaureate and Beyond Longitudinal Study (B&B:93/03), sponsored by the National Center for Education Statistics (NCES), U.S. Department of Education, followed a cohort of students who earned bachelor's degrees during the 1992–93 academic year. These students were first interviewed in 1993, as part of the 1993 National Postsecondary Student Aid Study (NPSAS:93). NPSAS is a cross-sectional survey that is designed to compile a comprehensive research dataset, based on student-level records, on financial aid provided by the federal government, the states, postsecondary institutions, employers, and private agencies along with student demographic and enrollment data. The study was conducted using multiple sources, including institutional records, government databases, and student interviews.
Date of Data Collection:	7/1/1992 – 6/30/1996
Study Population:	The target population for the B&B:93 study consisted of those individuals who were eligible to participate in NPSAS:93 and were awarded the bachelor's degree by a postsecondary institution in the United States, the District of Columbia, or Puerto Rico. The B&B:93 cohort consisted of both students who completed the NPSAS:93 interview and were identified to be baccalaureate recipients and those NPSAS:93 nonrespondents who were potentially eligible for B&B who had at least some data (from either the institutional records or interviewing).
Source: Wine et al. 2005	

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1996 Grads	
Data Set Name:	NPSAS:06
Summary:	Data are collected from a very large and diverse set of respondents; over 950 postsecondary institutions, 50,000 students, and 8,800 parents were selected for participation in NPSAS:96. A major methodological concern underlying NPSAS is designing a data collection system that has the flexibility to gather comprehensive financial data from the most appropriate source and concurrently provide some assurance of comparability in data collection for each element. Of the potential sources for NPSAS data--government data files, institutions, students, or parents--none alone can provide a complete and accurate summary of postsecondary education financing.
Date of Data Collection:	7/1/1995 – 6/30/1996
Study Population:	The target population for NPSAS:96 consists of all students who were enrolled in postsecondary institutions in the United States or Puerto Rico between July 1, 1995 and June 30, 1996.
Source: Riccobono et al. 1997	

2000 Grads	
Data Set Name:	NPSAS:2000
Summary:	NPSAS:2000 involved a multistage effort to collect information related to student aid. All student sample members were first matched to the U.S. Department of Education's Central Processing System (CPS) to collect an electronic student aid report (Institutional Student Information Report, or ISIR) for each federal financial aid applicant. The second stage involved abstracting information from the student's records at the sampled postsecondary institution, using a Web-based computer-assisted data entry (CADE) system. Interviews were then conducted with sampled students, primarily using a computer-assisted telephone interviewing (CATI) procedure. To help reduce the level of nonresponse to CATI, computer-assisted personal interviewing (CAPI) procedures, using field interviewers, were also used for the first time on a NPSAS study. Approximately 1,100 institutions were initially selected for NPSAS:2000, and all but 10 of these institutions were found to be eligible. These sampling procedures

	resulted in the selection of about 70,200 students for NPSAS:2000, including 16,600 potential baccalaureate recipients. Almost 6,000 of these sample members were determined to be ineligible for NPSAS:2000 during various phases of data collection, resulting in a final eligible sample of about 64,500 students.
Date of Data Collection:	7/1/1999 – 6/30/2000
Study Population:	The target population for NPSAS:2000 consisted of all students who were enrolled in postsecondary institutions in the United States or Puerto Rico that had Title IV Program Participation Agreements with the U.S. Department of Education at any time between July 1, 1999, and June 30, 2000 (defined as the NPSAS:2000 year).
Source: Riccobono (2002)	

2004 Grads	
Data Set Name:	NPSAS:04
Summary:	The 2003–04 National Postsecondary Student Aid Study (NPSAS:04) is a study that is part of the National Postsecondary Student Aid Study (NPSAS) program. NPSAS:04 (http://nces.ed.gov/surveys/npsas/about.asp) is a cross-sectional survey that is designed to compile a comprehensive research dataset, based on student-level records, on financial aid provided by the federal government, the states, postsecondary institutions, employers, and private agencies along with student demographic and enrollment data. The study was conducted using multiple sources, including institutional records, government databases, and student interviews. NPSAS:04 contains the data on a sample of about 109,210 postsecondary students who were enrolled at any time between July 1, 2003 and June 30, 2004 in about 1,670 postsecondary institutions. The data are representative of all undergraduate and graduate students enrolled in postsecondary institutions in the 50 United States, the District of Columbia, and Puerto Rico that were eligible to participate in the federal financial aid programs in Title IV of the Higher Education Act. Statistics produced from the NPSAS:04 provide reliable national estimates of characteristics related to financial aid for postsecondary students.

Date of Data Collection:	1/21/2004 – 9/9/2004
Study Population:	Eligible students enrolled at any time during the federal financial aid award year in postsecondary institutions in the United States, the District of Columbia, or Puerto Rico that had a signed Title IV participation agreement with the U.S. Department of Education.
Source: ED Data Inventory. "2003-04 National Postsecondary Student Aid Study."	

2008 Grads	
Data Set Name:	NPSAS:08
Summary:	The 2007–08 National Postsecondary Student Aid Study (NPSAS:08) is a study that is part of the National Postsecondary Student Aid Study (NPSAS) program. NPSAS:08 [http://nces.ed.gov/surveys/npsas/about.asp]is a cross-sectional survey that is designed to compile a comprehensive research dataset, based on student-level records, on financial aid provided by the federal government, the states, postsecondary institutions, employers, and private agencies, along with student demographic and enrollment data. The study was conducted using multiple sources, including institutional records, government databases, and student interviews. NPSAS:08 contains the data on a sample of 114,000 undergraduate students and 14,000 graduate students. These students were enrolled between July 1, 2007 and June 30, 2008 in about 1,730 postsecondary institutions. The data are representative of all undergraduate and graduate students enrolled in postsecondary institutions in the 50 United States, the District of Columbia, and Puerto Rico that were eligible to participate in the federal financial aid programs in Title IV of the Higher Education Act. Statistics produced from the NPSAS:08 provide reliable national estimates of characteristics related to financial aid for postsecondary students.
Date of Data Collection:	1/16/2008 – 9/29/2008
Study Population:	Eligible students enrolled at any time during the federal financial aid award year in postsecondary institutions in the United States that had a signed Title IV participation agreement with the U.S. Department of Education.

Source: ED Data Inventory. "2007-08 National Postsecondary Student Aid Study."

2012 Grads	
Data Set Name:	NPSAS:12
Summary:	The 2011–12 National Postsecondary Student Aid Study (NPSAS:12) is a study that is part of the National Postsecondary Student Aid Study (NPSAS) program. NPSAS:12 (http://nces.ed.gov/surveys/npsas/about.asp) is a cross-sectional survey that is designed to compile a comprehensive research dataset, based on student-level records, on financial aid provided by the federal government, the states, postsecondary institutions, employers, and private agencies, along with student demographic and enrollment data. The study was conducted using multiple sources, including institutional records, government databases, and student interviews. To be eligible to participate in the study, students have to be enrolled in a postsecondary institution. The data are representative of all undergraduate and graduate students enrolled in postsecondary institutions in the 50 United States and the District of Columbia that were eligible to participate in the federal financial aid programs in Title IV of the Higher Education Act. Statistics produced from NPSAS:12 provide reliable national estimates of characteristics related to financial aid for postsecondary students.
Date of Data Collection:	2/7/2013 – 10/7/2012
Study Population:	Eligible students enrolled at any time during the federal financial aid award year in postsecondary institutions in the 50 United States or the District of Columbia that had a signed Title IV participation agreement with the U.S. Department of Education. Prior cycles of NPSAS sampled institutions from Puerto Rico.
Source: ED Data Inventory. "2011-12 National Postsecondary Student Aid Study."	

The article "Pathways to the Middle Class: Balancing Personal and Public Responsibilities" by Sawhill et al. of the Brookings Institute was pivotal to the creation of this project, from the very beginning of the process, including brainstorming ideas to research. In this article Sawhill et al. uses data from the National Longitudinal Survey of Youth, which follows children from 1986 through 2010. They set out to answer the questions "Why do some children do so much better than others? And what will it take to create more opportunity?" (2). The following tables show their findings and recommendations:

FINDINGS

- The majority (61%) of Americans achieve the American dream by reaching the middle class by middle age, but there are large gaps by race, gender, and children's circumstances at birth.

- Success begets further success. Children who are successful at each life stage from early childhood to young adulthood are much more likely to achieve the American Dream.

- Children from less advantaged families tend to fall behind at every stage. They are less likely to be ready for school at age 5 (59% vs 72%), to achieve core academic and social competencies at the end of elementary school (60% vs 77%), to graduate from high school with decent grades and no involvement with crime or teen pregnancy (41% vs 70%), and to graduate from college or achieve the equivalent income in their twenties (48% vs 70%).

- Racial gaps are large from the start and never narrow significantly, especially for African Americans, who trail by an average of 25 percentage points for the identified benchmarks.

- Girls travel through childhood doing better than boys only to find their prospects diminished during the adult years.

- The proportion of children who successfully navigate through adolescence is strikingly low: only 57%.

- For the small proportion of disadvantaged children who do succeed throughout school and early adulthood (17%), their chances of being middle class by middle age are almost as great as for their more advantaged peers (75% vs 83%).

- Keeping less advantaged children on track at each and every life stage is the right strategy for building a stronger middle class. Early interventions may prevent the need for later ones. As the data provided in this paper make abundantly clear, success is a cumulative process. One-time interventions may not be enough to keep less advantaged children on track.

- It's never too late to intervene—people who succeed in their twenties, despite earlier struggles, still have a good chance of making it to the middle class.
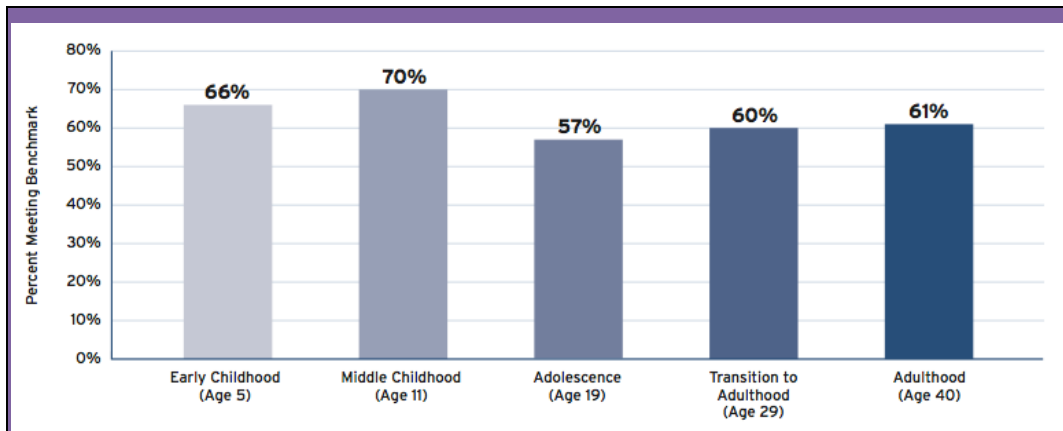
Source: Source: Sawhill et al. 2012 "Pathways to the Middle Class: Balancing Personal and Public Responsibilities" pg. 2

RECOMMENDATIONS

- Creating more opportunity will require a combination of greater personal responsibility and societal interventions that have proven effective at helping people climb the ladder. Neither alone is sufficient. Government does not raise children, parents do. But government can lend a helping hand.

- If one believes that good behavior and good policy must go hand in hand, programs should be designed to encourage personal responsibility and opportunity-enhancing behaviors.

- There are not just large, but widening gaps by socioeconomic status in family formation patterns, test scores, college-going, and adult earnings. These gaps should be addressed or the nation risks becoming increasingly divided over time.

- Budget cuts necessitated by the nation's fiscal condition should discriminate between more and less effective programs. The evidence now exists to make these discriminations. Some programs actually save taxpayer money.

- Too little attention has been given to ensuring that more children are born to parents who are ready to raise a child. Unplanned pregnancies, abortions, and unwed births are way too high and childbearing within marriage is no longer the norm for women in their twenties, except among the college-educated. Government has a role to play here, but culture is at least as important.

- As many have noted, a high-quality preschool experience for less advantaged children and reform of K-12 schooling could not be more important.

- Increasing the number of young people who enroll in college is important, but increasing the proportion who actually graduate is critical. Graduation rates have lagged enrollment. A major problem is poor earlier preparation. In addition, disparities in ability to afford the cost of college mean that even equally qualified students from low- and high-income families do not have the same college-going opportunities.

Source: Source: Sawhill et al. 2012 "Pathways to the Middle Class: Balancing Personal and Public Responsibilities" pg. 3
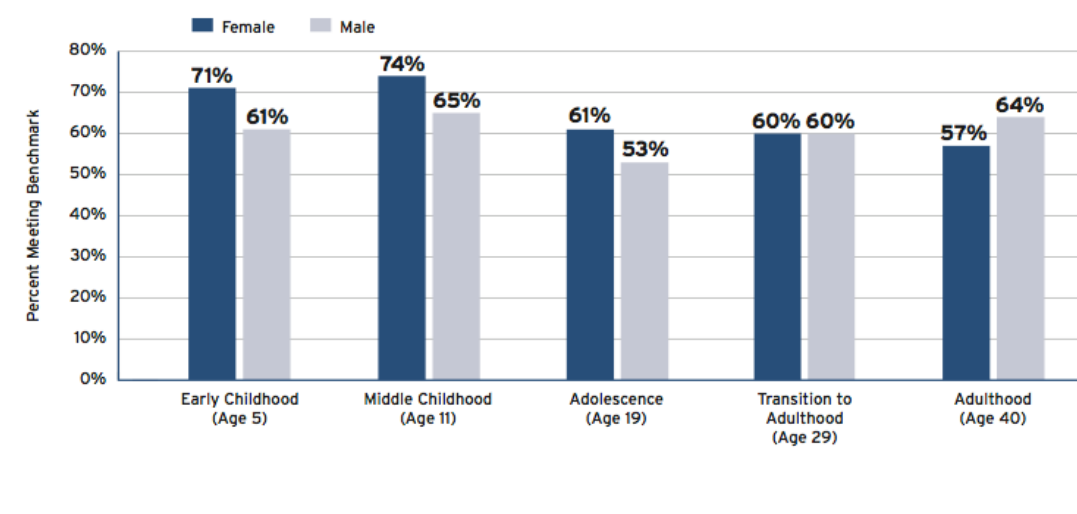
Additional figures from the article:

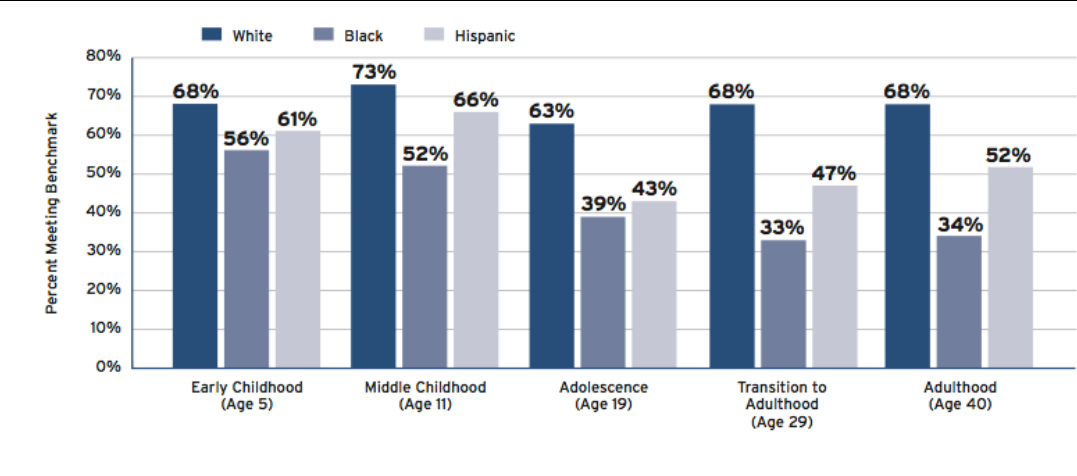Percent of Children Succeeding at Each Life Stage

Source: Source: Sawhill et al. 2012 "Pathways to the Middle Class: Balancing Personal and Public Responsibilities" pg. 5

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APPENDIX C: CALCULATIONS OF DATA

The Education Lorenz Curves for each year of data were created in the same way as the 1993 Education Lorenz Curve shown in Chapter 4. The following are the tables that were used for the creation of the curves:

Data for 1993 Grads Chart						
	0%					100%
Equality Line	0	20	40	60	80	100
1993 Grads Total	0	4.3	11.3	24.6	52.6	100

Data for 1996 Grads Chart						
	0%					100%
Equality Line	0	20	40	60	80	100
1996 Grads Total	0	12.2	25.6	43.2	68.3	100

Data for 2000 Grads Chart						
	0%					100%
Equality Line	0	20	40	60	80	100
2000 Grads Total	0	5.5	17.4	33.8	59.3	100

Data for 2004 Grads Chart						
	0%					100%
Equality Line	0	20	40	60	80	100
2004 Grads Total	0	11.3	26.5	45.4	70.6	100

Data for 2008 Grads Chart						
	0%					100%
Equality Line	0	20	40	60	80	100
2008 Grads Total	0	20.7	35	49.9	70.8	100

Data for 2012 Grads Chart						
	0%					100%
Equality Line	0	20	40	60	80	100
2012 Grads Total	0	15.9	32.1	47.4	71.8	100

These tables were then used to create one separate Education Lorenz Curve for each year of analysis and one graph that shows all of the curves together:

83

84
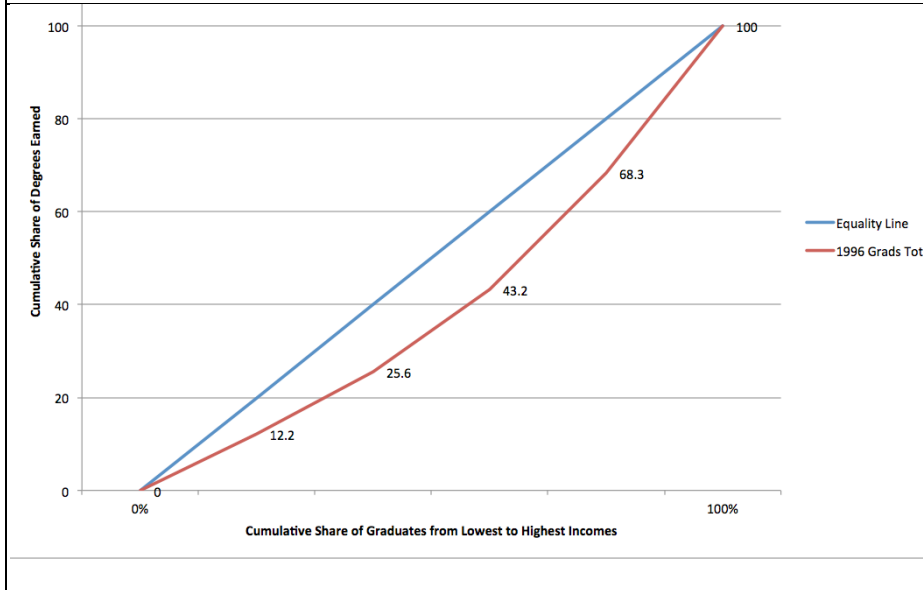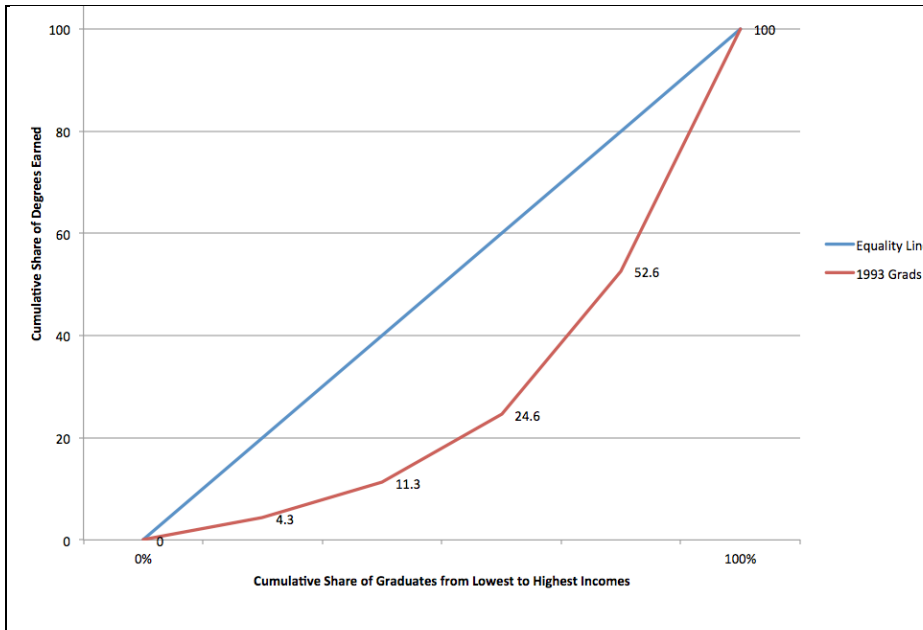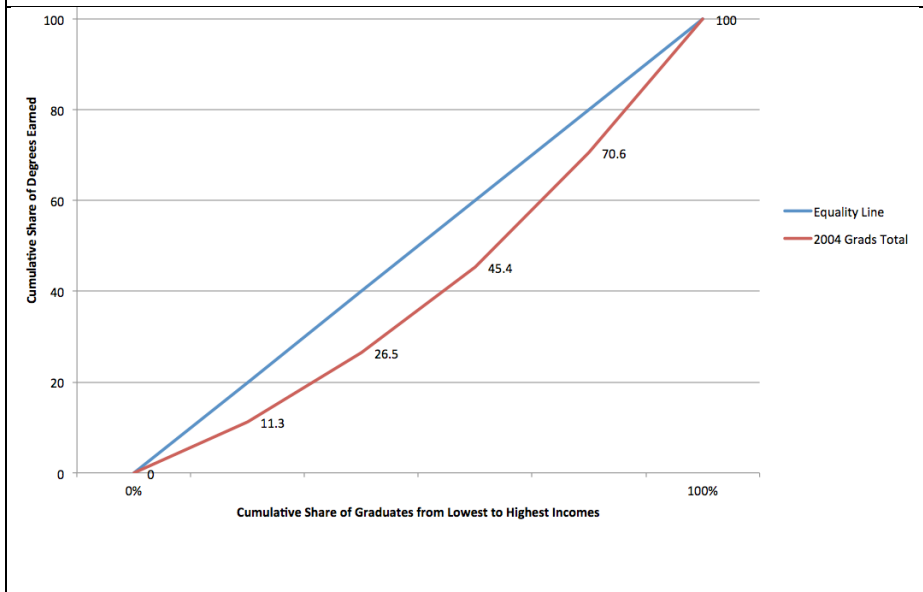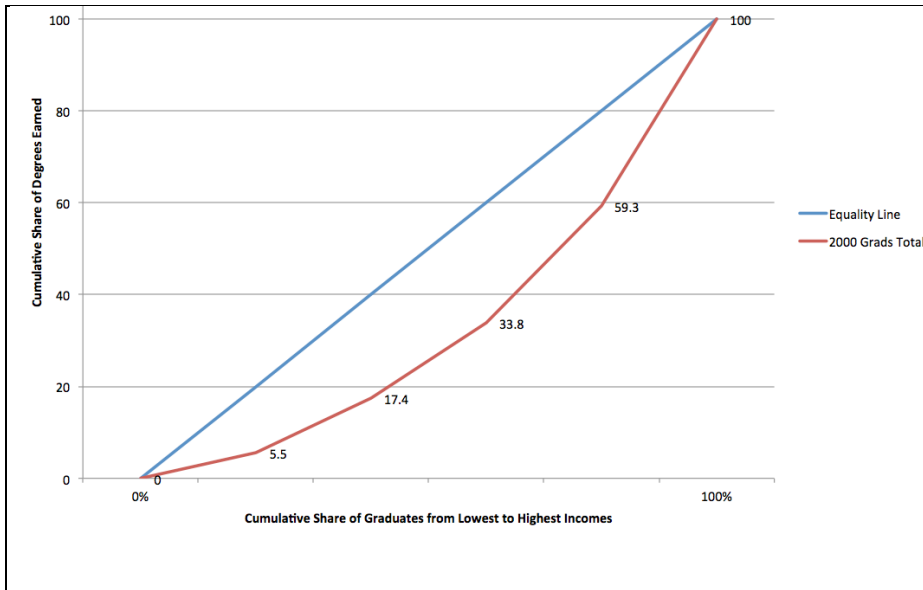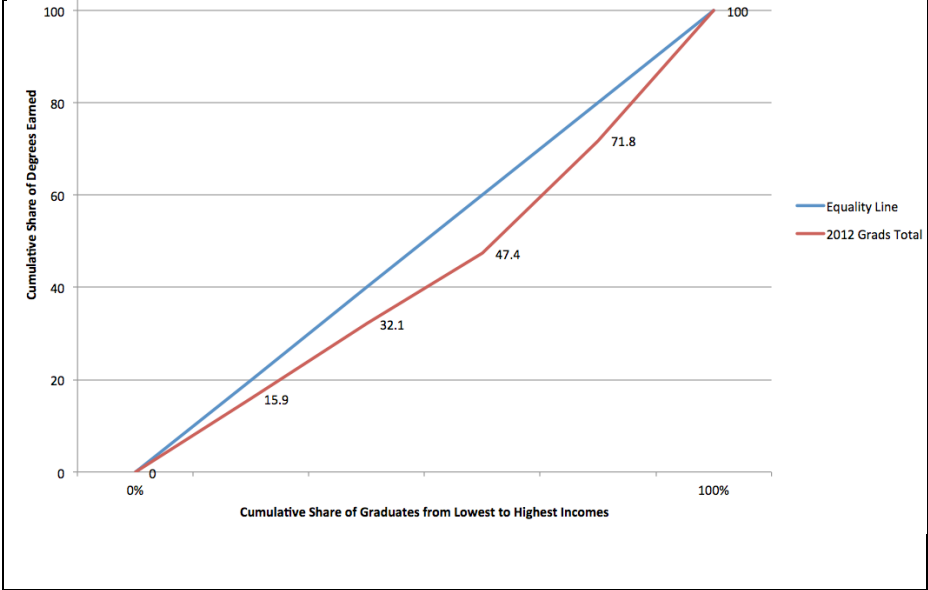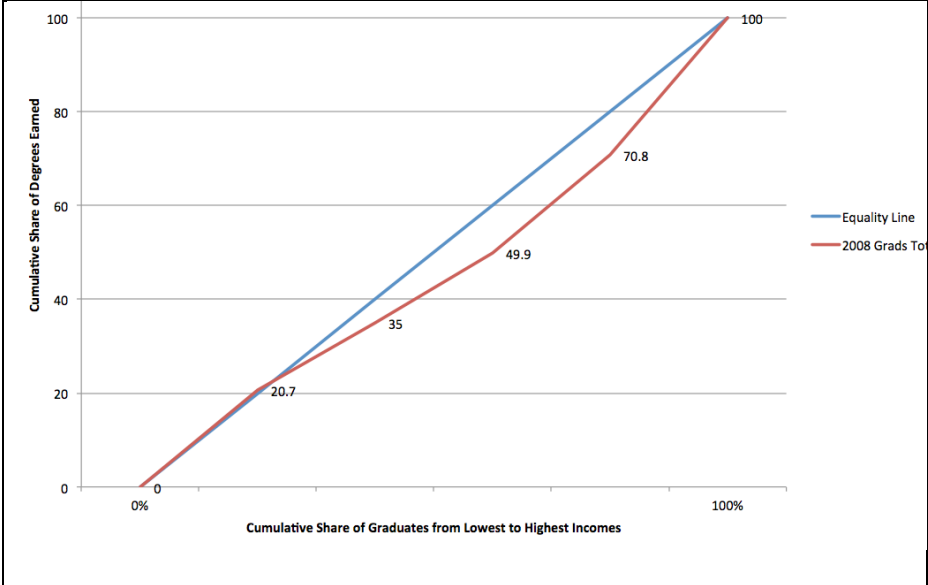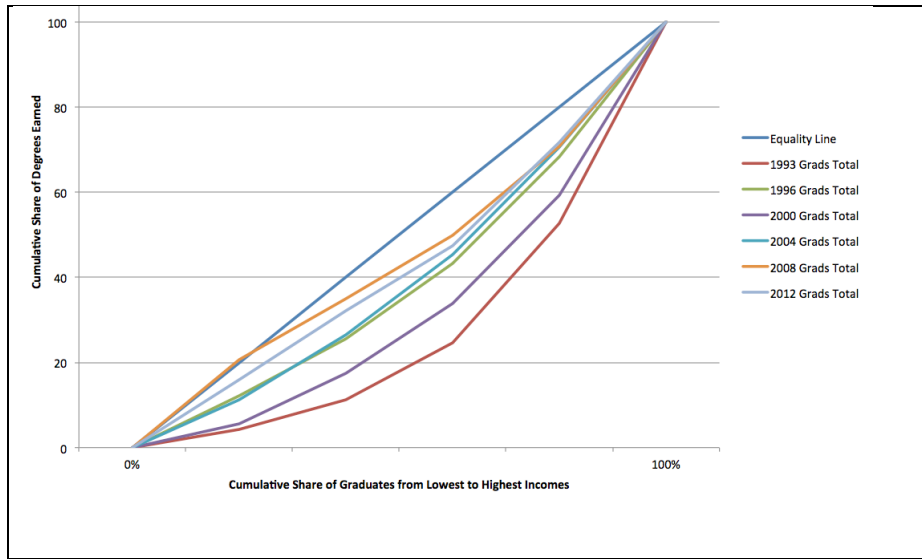
In order to calculate the area under the curve, this space was divided into 5 triangles

and 4 rectangles, as shown below.

It was observed that each curve is constructed of 5 line segmens, $\{L_1, L_2, \ldots, L_5\}$ along with 6 x-values $\{x_1, x_2, \ldots, x_6\}$ and 6 y-values $\{y_1, y_2, \ldots y_6\}$. These sets of values were used to calculate the area of each section (1-5 and a-d), all of which were then added together to get the total area under the curve, as shown below. The full Excel file with all of the data used is available upon request.
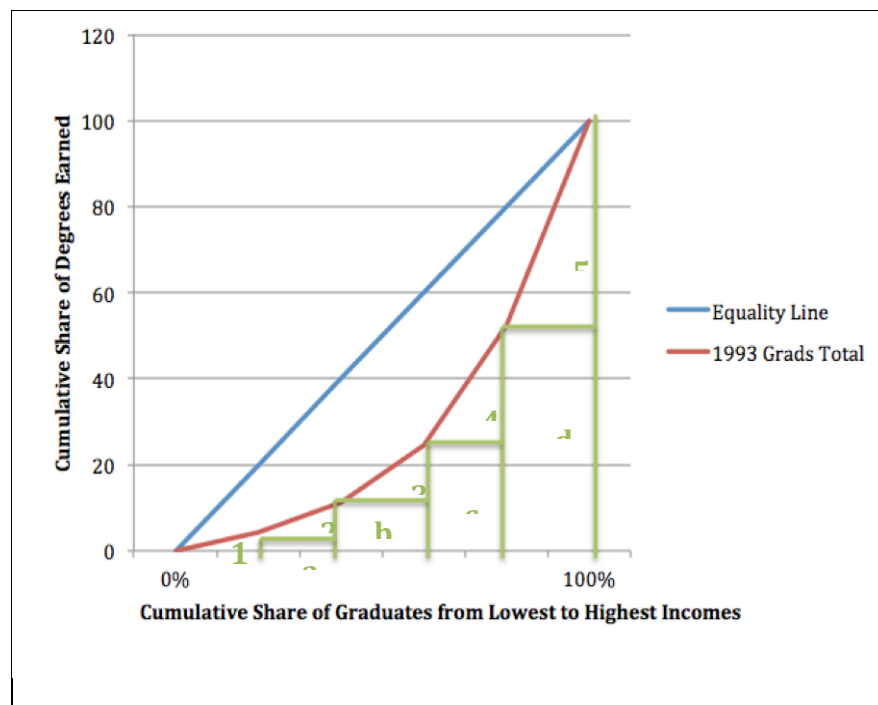
1993

X1	0	Y1	0
X2	0.2	Y2	0.043
X3	0.4	Y3	0.113
X4	0.6	Y4	0.246
X5	0.8	Y5	0.526
X6	1	Y6	1

Segment 1: (0.5*w*h1), w= 0.2, h1= 0.043
Area 1= 0.0043

Segment 2/a: 2: (0.5*w*h2), a: (w*ha), w= 0.2, h2= 0.07, ha= 0.043
Area 2= 0.007
Area a= 0.0086

Segment 3/b: 3: (0.5*w*h3), b: (w*hb), w= 0.2, h3= 0.133, hb= 0.113
Area 3= 0.0133
Area b= 0.0226

Segment 4/c: 4: (0.5*w*h4), c: (w*hc), w= 0.2, h4= 0.28, hc= 0.246
Area 4= 0.028
Area c= 0.0492

Segment 5/d: 5: (0.5*w*h5), c: (w*hd), w= 0.2, h5= 0.474, hd= 0.526
Area 5= 0.0474
Area d= 0.1052

Total Area (B): 0.2856
Area (A) = .5 - (B)
Area (A) = 0.2144
Gini Coefficient = 2*A
Gini Coefficient = 0.4288

1996

X1	0	Y1	0
X2	0.2	Y2	0.122
X3	0.4	Y3	0.256
X4	0.6	Y4	0.432
X5	0.8	Y5	0.683
X6	1	Y6	1

Segment 1: (0.5*w*h1), w= 0.2, h1= 0.122
Area 1= 0.0122

Segment 2/a: 2: (0.5*w*h2), a: (w*ha), w= 0.2, h2= 0.134, ha= 0.122
Area 2= 0.0134
Area a= 0.0244

Segment 3/b: 3: (0.5*w*h3), b: (w*hb), w= 0.2, h3= 0.176, hb= 0.256
Area 3= 0.0176
Area b= 0.0512

Segment 4/c: 4: (0.5*w*h4), c: (w*hc), w= 0.2, h4= 0.251, hc= 0.432
Area 4= 0.0251
Area c= 0.0864

Segment 5/d: 5: (0.5*w*h5), c: (w*hd), w= 0.2, h5= 0.317, hd= 0.683
Area 5= 0.0317
Area d= 0.1366

Total Area (B): 0.3986
Area (A) = .5 - (B)
Area (A) = 0.1014
Gini Coefficient = 2*A
Gini Coefficient = 0.2028

2000

X1	0	Y1	0
X2	0.2	Y2	0.055
X3	0.4	Y3	0.174
X4	0.6	Y4	0.338
X5	0.8	Y5	0.593
X6	1	Y6	1

Segment 1: (0.5*w*h1), w= 0.2, h1= 0.055
Area 1= 0.0055

Segment 2/a: 2: (0.5*w*h2), a: (w*ha), w= 0.2, h2= 0.119, ha= 0.055
Area 2= 0.0119
Area a= 0.011

Segment 3/b: 3: (0.5*w*h3), b: (w*hb), w= 0.2, h3= 0.164, hb= 0.174
Area 3= 0.0164
Area b= 0.0348

Segment 4/c: 4: (0.5*w*h4), c: (w*hc), w= 0.2, h4= 0.255, hc= 0.338
Area 4= 0.0255
Area c= 0.0676

Segment 5/d: 5: (0.5*w*h5), c: (w*hd), w= 0.2, h5= 0.407, hd= 0.593
Area 5= 0.0407
Area d= 0.1186

Total Area (B): 0.332
Area (A) = .5 - (B)
Area (A) = 0.168
Gini Coefficient = 2*A
Gini Coefficient = 0.336

2004

X1	0	Y1	0
X2	0.2	Y2	0.113
X3	0.4	Y3	0.265
X4	0.6	Y4	0.454
X5	0.8	Y5	0.706
X6	1	Y6	1

Segment 1: (0.5*w*h1)		w= 0.2
		h1= 0.113
Area 1= 0.0113		

Segment 2/a:	2: (0.5*w*h2)	w= 0.2
	a: (w*ha)	h2= 0.152
		ha= 0.113
Area 2=	0.0152	
Area a=	0.0226	

Segment 3/b:	3: (0.5*w*h3)	w= 0.2
	b: (w*hb)	h3= 0.189
		hb= 0.265
Area 3=	0.0189	
Area b=	0.053	

Segment 4/c:	4: (0.5*w*h4)	w= 0.2
	c: (w*hc)	h4= 0.252
		hc= 0.454
Area 4:	0.0252	
Area c:	0.0908	

Segment 5/d:	5: (0.5*w*h5)	w= 0.2
	c: (w*hd)	h5= 0.294
		hd= 0.706
Area 5=	0.0294	
Area d=	0.1412	

Total Area (B):	0.4076
Area (A) = .5 - (B)	
Area (A) =	0.0924
Gini Coefficient = 2*A	
Gini Coefficient =	**0.1848**

2008

X1	0	Y1	0
X2	0.2	Y2	0.207
X3	0.4	Y3	0.35
X4	0.6	Y4	0.499
X5	0.8	Y5	0.708
X6	1	Y6	1

Segment 1: (0.5*w*h1)		w= 0.2
		h1= 0.207
Area 1= 0.0207		

Segment 2/a:	2: (0.5*w*h2)	w= 0.2
	a: (w*ha)	h2= 0.143
		ha= 0.207
Area 2=	0.0143	
Area a=	0.0414	

Segment 3/b:	3: (0.5*w*h3)	w= 0.2
	b: (w*hb)	h3= 0.149
		hb= 0.35
Area 3=	0.0149	
Area b=	0.07	

Segment 4/c:	4: (0.5*w*h4)	w= 0.2
	c: (w*hc)	h4= 0.209
		hc= 0.499
Area 4:	0.0209	
Area c:	0.0998	

Segment 5/d:	5: (0.5*w*h5)	w= 0.2
	c: (w*hd)	h5= 0.292
		hd= 0.708
Area 5=	0.0292	
Area d=	0.1416	

Total Area (B):	0.4528
Area (A) = .5 - (B)	
Area (A) =	0.0472
Gini Coefficient = 2*A	
Gini Coefficient =	**0.0944**

2012

X1	0	Y1	0
X2	0.2	Y2	0.159
X3	0.4	Y3	0.321
X4	0.6	Y4	0.474
X5	0.8	Y5	0.718
X6	1	Y6	1

Segment 1: (0.5*w*h1)		w= 0.2
		h1= 0.159
Area 1= 0.0159		

Segment 2/a:	2: (0.5*w*h2)	w= 0.2
	a: (w*ha)	h2= 0.162
		ha= 0.159
Area 2=	0.0162	
Area a=	0.0318	

Segment 3/b:	3: (0.5*w*h3)	w= 0.2
	b: (w*hb)	h3= 0.153
		hb= 0.321
Area 3=	0.0153	
Area b=	0.0642	

Segment 4/c:	4: (0.5*w*h4)	w= 0.2
	c: (w*hc)	h4= 0.244
		hc= 0.474
Area 4:	0.0244	
Area c:	0.0948	

Segment 5/d:	5: (0.5*w*h5)	w= 0.2
	c: (w*hd)	h5= 0.282
		hd= 0.718
Area 5=	0.0282	
Area d=	0.1436	

Total Area (B):	0.4344
Area (A) = .5 - (B)	
Area (A) =	0.0656
Gini Coefficient = 2*A	
Gini Coefficient =	**0.1312**