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An Empirical Analysis of Economic Inequality on Economic Growth

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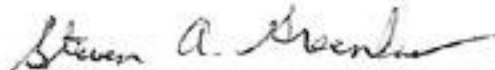
BY

Brandon M. Williams

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR
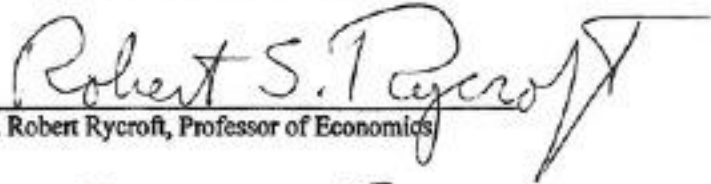HONORS IN ECONOMICS

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Abstract

For the United States, one of the most important trends of concern is the growing level of inequality. It is widely accepted that the United States is currently experiencing historically high levels of economic inequality. There are numerous reasons for policymakers and citizens to be concerned about the rising level of inequality, such as its impact on the basic American social contract that says that hard work pays off and the diminishing of opportunity. It has been well established that inequality negatively impacts educational opportunities, social mobility, skills development, and labor inputs. Most research has studied the extent to which higher inequality is associated with less opportunity and mobility. This research studies if there is a causal link between higher inequality and slower macroeconomic growth. The main hypothesis is that inequality limits human capital accumulation primarily through the channel of educational attainment, which then dampens labor quality. Reductions in labor quality led to slower economic growth. This research attempts to measure this relationship by incorporating income inequality in the composition of labor quality. The results do not support the hypothesis that as the United States has seen a rise in inequality, economic growth decreases. One suggestion is to use disaggregate data rather than aggregate data as some of the variations are lost when analyzing aggregate data.

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INTRODUCTION

For most advanced and developed countries, specifically the United States, one of the most important trends of concern is the growth of economic inequality. It is widely accepted that the United States is currently experiencing historically high levels of economic inequality. Currently, the distributions of income and wealth have widened in the United States (Stone et al. 2020). More importantly, the rising economic inequality has become relevant after the economic and social fallout from the global financial crisis, which subsequently led to an increase in attention towards global growth and employment (Tsounta et al. 2015).

Economic inequality is the unequal distribution of income, wealth, consumption, or wages. This inequality is associated with an unequal distribution of opportunities between different groups in society. Inequality signals a lack of income mobility or opportunity within the society, which in return reflects a persistent disadvantage for particular groups. Economists measure these distributions through the context of the Lorenz curve, the Gini coefficient, or the Inequality-adjusted Human Development Index (IHDI).

For the United States, economic inequality is problematic because inequality violates the fundamental principles in which the country was established. As Jared Bernstein (2013, page 4) states,

> Inequality puts at risk fundamental American precepts: the belief that hard work and fair play pays off, the conviction that the opportunities for upward mobility are available to all, and the trust in the basic fairness of American society.

Bernstein states that while there is insufficient empirical evidence in support, economic theory suggest that the presence of economic inequality still creates problems within the United States. More specifically, it can concentrate political and decision-making power in the hands of a few, lead to a suboptimal use of human resources, cause investment-reducing political and economic instability, and raise crisis risk, all of which could dampen economic growth (Tsounta et al. 2015).

There are three different theories for the relationship between economic inequality and economic growth: supply-side, demand-side, and the political economy. Most often, supply-side theories argue that economic growth decreases because of the presence of inequality in the economy, which significantly influences the amount and quality of inputs of goods and services. By contrast, demand-side theories state there is a negative relationship between inequality and growth because of differences in marginal propensity to consume across the income scale. This channel is based on the assumption that the law of diminishing marginal utility of money, that is, individuals will receive less utility as more money is earned. Lastly, political economy theories suggest that wealth influences policy outcomes in ways that can heighten inequality and prevent policies that encourage more equitable outcomes for society. As inequality widens, this concentration of income and wealth concentration towards the upper part of the distribution can influence the political and decision-making power to the hands of a few individuals. In a sense, as income or wealth becomes concentrated towards the top, these individuals can "buy" political power, which can result in more growth upwards.

PREVIOUS LITERATURE

In their seminal analysis, Jorgenson & Griliches (1967) hypothesize that if the quantities of output and input are measured accurately, then the growth in total output may be largely explained by growth in total input. In fact, the authors find support for their hypothesis. Their research highlights the importance of human capital accumulation on economic growth. Moreover, labor productivity is composed of the growth in human and physical capital as well as technological advancements, all of which are influential characteristics to economic growth. The growth in human capital influences economic growth by an increase in labor inputs. In other words, as workers amass knowledge, skills, and experience, their human capital accumulation increases. This investment towards human capital corresponds to a growth in labor inputs, where labor input is generally defined as the product of the number of hours worked and the labor quality. Generally, labor quality reflects the level of labor skills per worker and includes characteristics such as education, experience, industry, and occupation with education and experience being the main contributors (Chou and San 2015 and Fernald 2012). As mentioned, increases in labor quality translate to increases in labor productivity. In fact, since the 1970's, Fernald (2012) states that labor quality has been a constant contributor to the growth in productivity with estimates of 0.4 percent per year. Jorgenson et al (2011) estimate that by the end of 2020, labor quality will plateau. According to the authors, this plateau suggest that the new cohorts have stopped gaining educational attainment relative to retiring cohorts. To appropriately capture the trends in labor quality, it is important to capture the demographic trends associated with labor quality, all of which have changed the composition of the workforce in ways that affect the productivity of an hour of labor.

One of the most important demographics of labor quality is educational attainment, as education allows for individuals to grow their skills and increase their opportunities. Equally as important, experience (or sometimes proxied by age) can also increase human capital. Chou and San (2015) and Fernald (2012) found that educational attainment and work experience are the two most key factors of a country's labor productivity and labor quality. Human capital is determined by one's knowledge (accumulated from education and experience), skills, and "expertise" of a worker within the economy. Human capital theory states that one's earnings are determined by one's human capital, ceteris paribus, and one's level of human capital depends on one's actions towards investing in themselves. These actions include skills, which can be attained through education, job training programs, or experience. To that end, there have been numerous studies which claim that educational attainment and worker experience are important to labor quality. Specifically, Vandenberghe (2017) concludes that the quality of inputs matter for total factor productivity growth, specifically finding evidence to support the notion that better-educated and older/more experienced workers are more productive than their less-educated, younger/less experienced counterparts. Furthermore, Chou and San (2015) investigate the growth of labor quality on Taiwan's economic growth and conclude that the growth of labor quality impacts economic growth more than capital investment. In addition, the researchers also find that the main demographic trends are the growth in educational attainment and age/experience.

Another important aspect of labor quality is the role of gender. During the second half of the twentieth century, the composition of the labor force saw an increase in the number of female workers. More importantly, during this same time period, educational attainment for women also increased; however, Seguino et al. (2019) find that this educational equality did not translate to employment. Using panel data from 1991-2005, the authors measure the determinants of gender job

segregation and the effects of gender job segregation on labor share of income. Seguino et al. (2019) conclude that two of the most important determinants of gender job segregation are the rising capital/labor ratio and the ratio of female/male labor force participation rates. Lastly, the authors find a negative relationship between gender job segregation on labor share of income. Thus, the results suggest that the crowding of women into lower quality jobs has a negative effect on workers as a whole by dampening the labor share of income. In other words, despite an increase in employment participation by women, often women are relatively rare in high-skilled jobs compared to males. Because there is a discrepancy between high and low- skilled jobs between male and females, inequality further dampens the income of labor, which in return influences aggregate demand and economic growth. Similarly, the role of ethnicity also plays a significant role in the labor markets. Weinberger (1998) finds that there is strong evidence to suggest that within the market for recent college graduates, there is discrimination among different ethnic groups and females when compared to white males. Despite controlling for same type and quality of college education, market discrimination still persists. Labor market discrimination can be classified as a mechanism that causes individuals with the same productive characteristics but different descriptive characteristics to be valued differently by the labor market.

Lastly, fluctuations in the business cycles can bring about more transient changes. For example, the workforce tends to become more experienced in recessions because older and more experienced workers are less likely to lose their jobs than younger and less experienced workers. Devereux (2004) supports this notation that employers retain more experienced workers than less experienced workers during recessions. In fact, low-skill workers disproportionately experience unemployment in recessions. For example, labor composition (or quality) fluctuates a fair amount at high frequency, that is, in recessions, labor quality systematically rises, since workers with lower skills and education are more likely to lose their jobs.

Although the literature review on economic growth and inequality is very limited, this paper aims to provide more in-depth analysis of the relationship. By considering the factors that influence labor quality, this paper does a more appropriate job at the controlling for labor quality.

Two papers, John Fernald's *Productivity and Potential Output before, during, and after the Great Recession* (2012) and Daniel Aaronson and Daniel Sullivan's *Growth in Worker Quality* (2001) are important for building the relationship for inequality and labor quality. Each of these studies aim to examine the economy's potential rate of growth. The former provides historical and recent observation of the dynamics of productivity and potential output, whereas the latter provides insights on the improvements in worker quality due to changes in the distribution of education and worker experience. In addition, the latter suggest that future research extend their analysis to other data sources that can provide richer characterization of the determinants of worker's wages. More specifically, Fernald examines labor productivity and potential output and finds four major trends. First, he finds that after a period of acceleration in the mid-1990s, labor and total-factor productivity growth slowed starting in the early 2000s. Next, he claims that during the Great Recession and the early phase of the recovery, productivity performance was roughly in line with previous experience during deep recessions. Then, Fernald claims that the steady-state potential output is likely to rise at about a 2.1 percent pace, which appears to be relatively low compared to recent estimates. Lastly, during the Great Recession and the recovery, potential output growth was well below that pace. Furthermore, Aaronson and Sullivan examine worker quality and provide new estimates and

forecasts of the rate of improvement in worker quality. These authors study education, experience, gender, and business cycles to better measure labor quality. Specifically, these authors pay close attention to the rate of educational attainment and the Baby Boom generation. The authors note that as the Baby Boom generation begins to retire, the change in experience levels will turn from a positive to a negative factor for worker quality growth.

Bernstein (2013) addresses the supply-side theory as mentioned earlier and claims that there is not sufficient empirical evidence to support the linkage of inequality and growth. Specifically, he states that there is, "compelling evidence that inequality has a negative impact on educational opportunity;" and "strong economic logic relates diminished educational opportunity to growth." Although, economic growth is widely agreed to be negatively affected by less-educated and less-productive inputs, the empirical evidence is missing to support the relationship between inequality and economic growth. The lack of empirical evidence for these linkages leads to the research question: to what extent does inequality affect labor quality in the United States?

ECONOMIC THEORY
This section develops the theorical model that is used in this paper.

Supply-side theories argue that inequality affects economic growth because inequality significantly reduces the labor quality. Specifically, Cingano (2014) finds that inequality undermines educational opportunities for children from poor socio-economic backgrounds and impedes skills development. As workers increase their educational opportunities and skills development, the workers improve their human capital development and labor quality. To measure inequality in the United States, economists often use the Gini coefficient. The Gini coefficient is a desirable measure of inequality because it is easy to calculate, allows changes in inequality to be tracked over time, and enables cross-region and cross-country comparisons. In *Figure 1*, the Gini coefficient is depicted from 1947 – 2019. As can be seen in *Figure 1*, the United States is currently experiencing an historically high level of income inequality.

Figure 1: Visualization of Gini Coefficient from 1947 – 2019
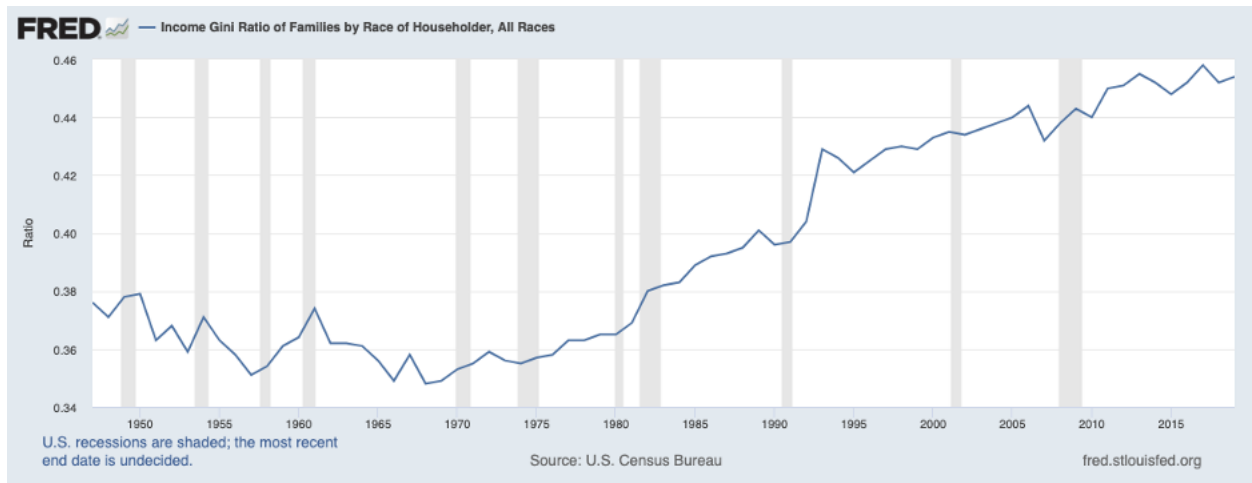

Note: This graph shows the Income Gini Ratio of Families by Race of Household, All Races from 1947 to 2019. It is apparent that the United States is currently experiencing historical levels of income inequality.

It is evident that within the United States, income inequality is at a historical level, with the greatest rise after 1968 and very little decreasing since then. This historic level of income inequality decreases labor quality through educational opportunities for children from poor socio-economic backgrounds and skills development. In *Figure 2*, educational attainment is measured as the percent of people 25 years and over, who have completed four or more years of college from 1964 to 2019. The blue dots represent the percentage of 25 years and over who have completed some college for that year whereas the orange dots represent the percentage change for each year. Since 1964, it is evident that the level of educational attainment is decreasing. This negative relationship suggests that, over time, less people 25 years and older have completed college; however, it is important to note that the relative change is rather small. The rate of increase in educational attainment is declining, thus the human capital accumulation is not rising as fast as in previous years within the United States.

**Figure 2: Visualization of Educational Attainment from 1965 – 2019**
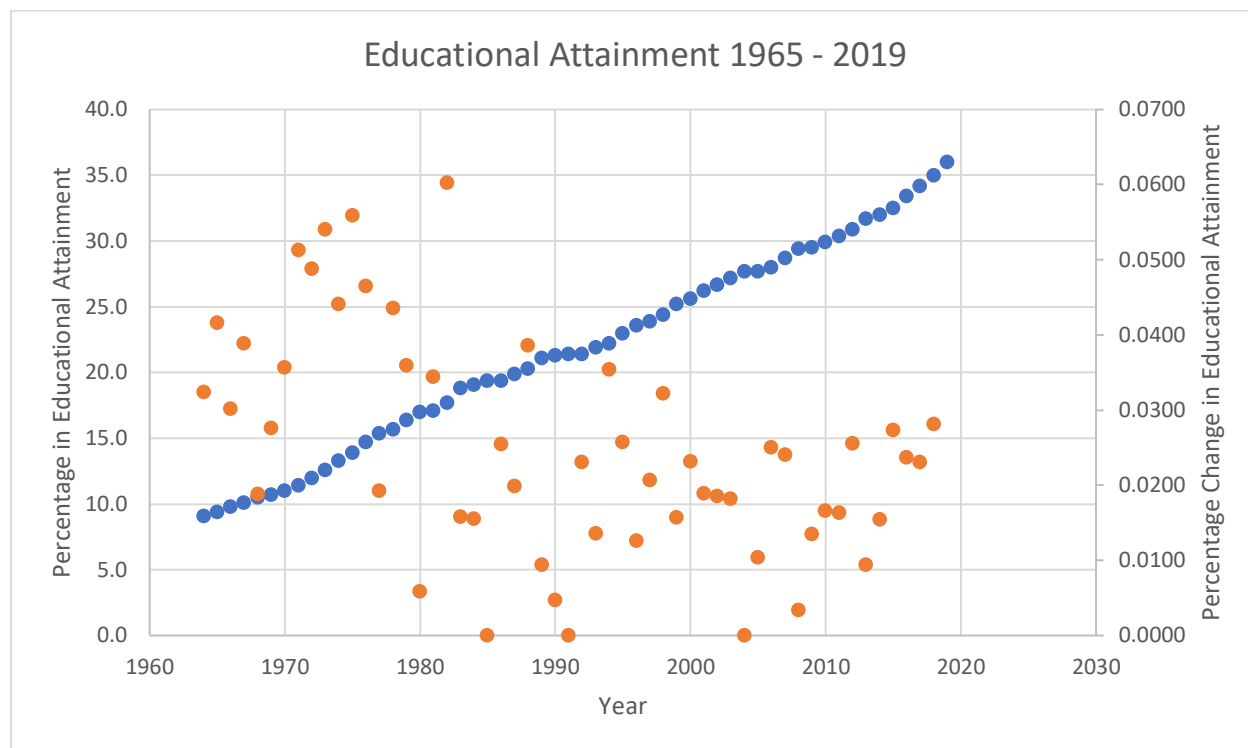
Note: This graph shows the percent and percentage change of People 25 Years and Over Who Have Completed Some College from 1965 to 2019. It shows how there has been an increase in competition in college; however, it appears that the rate of change is decreasing slowly over time in the United States. Furthermore, it shows a negative trend in the rate of those who graduated college; however, the magnitude is small.

As the United States has seen increases, at a decreasing rate, in educational attainment, the United States has also been experiencing a decrease in the absolute number of workers by young and middle age workers; however, there have been increases in the employment of older age employees in absolute terms. Worker's wage rate and productivity is influenced by their age and tends to increase as the worker ages. Since the late 1980's, the employment level for the youth and middle age group has been decreasing. Typically, these workers have less experience than those of the older demographic. As a result, it is important to capture this difference in experience; this paper uses age as a proxy for the experience within the economy. In *Figure 3*, it is apparent that the younger and middle age employment follows a different trend than the older demographic. It is important to note that this paper defines young as 16 – 24 years old, middle age as 25 – 34 years old, and old age as 55 years and over. After gathering each employment level from 1948 to 2020, the age employment level was divided by the total employment level for that year. The total employment level is determined as the employment level for 16 years and over.

Figure 3: Age of Employment as Proxy for Work Experience from 1948 – 2020
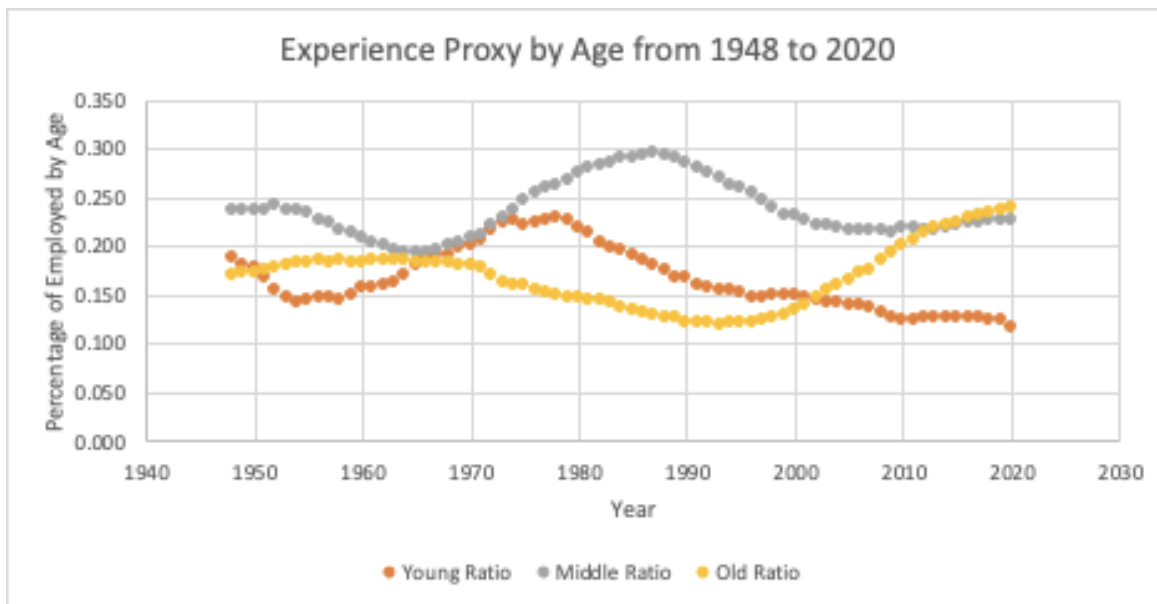

Note: This graph shows the difference in employment levels by age, where Young Ratio is considered from 16 to 24, Middle Ratio is from 25 – 34, and Old Ratio is from 55 and over.

       To measure the empirical relationship between inequality and labor force, the role of gender must be captured. Equally as important as the age or experience gap, the gender gap is an important trait that must be captured to approximate the relationship between inequality and labor quality. In *Figure 4,* the labor force participation rate for each gender is depicted from 1948 to 2020. Since 1948, the labor force participation rate for women has been increasing; however, in the last couple of decades, it is evident that the rate has been slowing down. After 1948, the United States saw more women attending college and entering the labor force. In recent years, it appears that this increase has slowed. Meanwhile, there has been a reduction in the labor force participation rate for males. The gap has been narrowing; however, women tend to earn lower wages than men of the same age and educational level. Women tend to have less actual experience. It is not that women are intrinsically less productive than men, but rather that they have less actual labor market experience than men of the same age and educational level. Finally, an increasing share of women in the labor force lowers the growth of labor quality below that expected on the basis of age/experience and education.

Figure 4: Gender Labor Force Participation Rate from 1948 – 2020
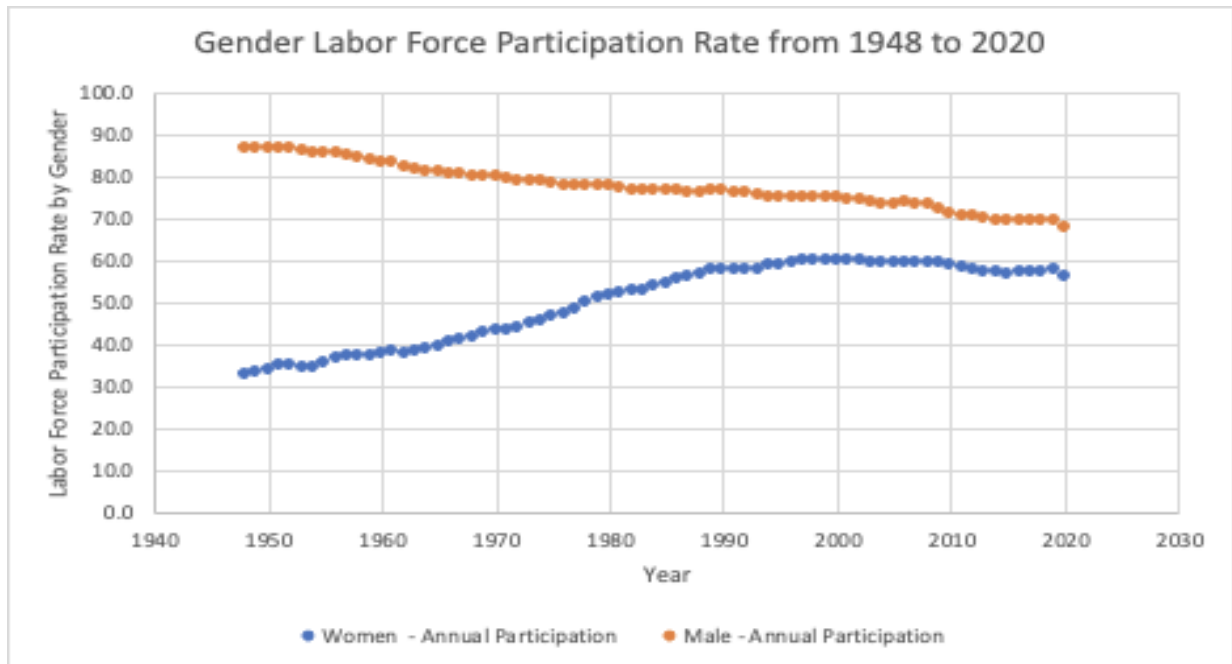
Note: This graph shows the labor force participation rates by gender from 1948 to 2020.

Fluctuations in labor quality decrease labor productivity as labor quality is an input to productivity. Labor productivity consists of the growth in human and physical capital as well as technological advancements. Specifically, the growth in human capital corresponds to a growth in labor inputs, where labor input is the product of the number of hours worked and the quality of labor. Through the growing disparity of income inequality in the United States, educational attainment and skills development decreases causing the labor input by workers and future workers to decrease. As workers' labor input and human capital reduces, labor quality reduces as well. Furthermore, the United States has also seen a steady decline in real GDP. *Figure 6* shows the stagnant growth in economic growth. It is hypothesized that economic inequality causes a decrease in educational attainment, thus decreasing the labor quality in the United States. As labor quality decreases, economic growth also decreases.

Figure 5: Real GDP from 1948 – 2019
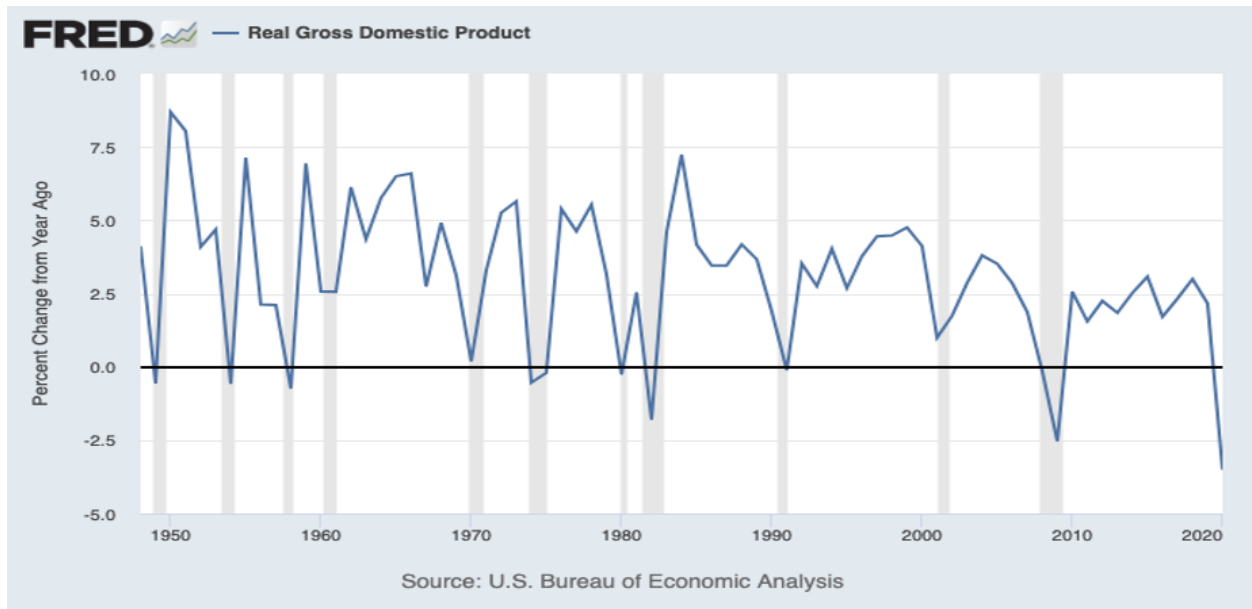
Note: This graph shows the economic growth for the United States from 1948 to 2020. As seen in the figure, it is apparent how economic growth has slightly decreased and been stable around 2.5% in the last decade.

To evaluate the overall claim that inequality dampens growth, this paper first establishes a channel in which inequality influences labor quality. This paper attempts to explain the relationship between inequality and growth in the United States by including the Gini coefficient in the labor quality equation to account for the rise of income inequality. Traditionally, labor quality is defined as function of demographics such as educational attainment, gender, race, age, and businesses cycles. This paper claims that to estimate the relationship between inequality and growth researchers must include a variable for inequality in the labor quality function. Once this variable is incorporated into the regression equation, this paper hypothesizes that these variables will explain the dynamics of inequality and growth. After estimating the determinants of labor quality, this paper proceeds to incorporate inequality, labor quality, and unemployment into a regression equation to measure the relationship with economic growth.

RESEARCH HYPOTHESIS

To assess the claim that inequality dampens economic growth, first, this paper claims that inequality decreases labor quality by undermining educational opportunities for children from poor socio-economic backgrounds and impeding skills development. Second, because labor quality is a determinant of labor productivity, decreases in labor quality translate to decreases in labor productivity. Lastly, as there is a reduction in labor productivity, economic growth diminishes. To evaluate this claim, this paper uses a time-series regression analysis and regresses two equations: inequality on labor quality and labor quality on economic growth.

EMPIRICAL MODEL & METHODOLOGY

The labor quality variable is derived of changes the composition of the workforce, such as demographic and business cycles. More importantly, the growth in labor quality captures the productive benefits of changes in composition of hours worked. From the work of Aaronson and Sullivan (2002), Chou and San (2015), and Vandenberghe (2017), the regression equation must capture the level of experience and educational attainment in the economy. Furthermore, Aaronson and Sullivan (2002) discuss the importance of measuring gender in the composition of labor quality and Seguino et al (2019) find evidence of gender job segregation. Thus, it is important to capture gender in the regression equation. In sum, the first equation is derived from Chou and San (2015), Vandenberghe (2017), Seguino et al (2019), and Aaronson and Sullivan (2002).

First, this paper attempts to explain the relationship between growth and inequality in the United States by establishing the empirical relationship between inequality and labor quality. Below is the theoretical model for the relationship between labor quality and inequality.

Equation 1: Labor Quality and Inequality

$$LQ = \beta_0 + \beta_{1t}GINI_{1t} + \beta_{2t}EDUCATION_{2t} + \beta_{3t}GENDER_{3t} + \beta_{4t}AGE_{4t} + \varepsilon_t$$

where LQ is labor quality in the United States, GINI measures economic inequality, and EDUCATION represents educational attainment, GENDER indicates gender, and AGE is the average age of the work force population.

The sign of GINI is expected to be negative because an increase in economic inequality is hypothesized to cause a decrease in labor quality. In addition, the sign for the EDUCATION is expected to be positive because an increase in the years of schooling leads a worker to have more knowledge. In return, this knowledge causes the worker to be more productive, leading to better paying jobs. Next, the sign of GENDER is expected to be negative for females and positive for males. As more females enter the labor force, these females have less experience and education; thus an increase in the female labor force participation rate should decrease labor quality. In addition, Aaronson and Sullivan (2001) and Seguino et al (2019) conclude that female workers earn less than their male counterparts. As more males enter the labor force, these males are typically more educated and have greater experience, thus an increase in the male labor force participation rate should increase labor quality. Lastly, the sign for AGE should be positive for older workers and negative for younger workers. This is because better-educated and older/more experienced workers are more productive than their less-educated, younger/less experienced counterparts.

Finally, once this empirical relationship is established, this paper hypothesizes that the inequality can dampen economic growth through labor quality, which is a key determinant to labor productivity. Below is the theoretical model such a relationship.

Equation 2: Economic Growth and Inequality

$$GROWTH = \beta_0 + \beta_{1t}LQ + \beta_{3t}CYCLES + \varepsilon_t$$

where GROWTH is the percent change in real GDP in the United States, LQ represents labor quality and CYCLES is a measurement of unemployment.

The sign for LQ is expected to be positive because as workers become more productive, economic growth should increase. Lastly, CYCLES is expected to be negative since with as greater unemployment, there will be less workers able to produce goods and services for the economy.

DATA COLLECTION

To measure labor quality, this paper uses the measurement provided by John Fernald. Fernald measures labor quality from the Bureau of Labor Statistics (BLS) and the Aaronson-Sullivan approximation. Using John Fernald's estimates of labor quality, in *Figure 6*, it is apparent that from 1948 – 1978, labor quality decreased; however, from 1978 – 1993, labor quality increased. Following this increase, from 1993 – present, labor quality began to decrease again. Furthermore, *Figure 6* shows the comparison between the BLS measure of labor quality and Aaronson-Sullivan's estimation of labor quality. From 1947 to 1978, labor quality is "interpolated annual BLS MFP estimate of labor composition (interpolated using Denton (1971) relative to a constant quarterly "indicator" series." After 1978, labor quality is measured as follows from Aaronson and Sullivan (2001). *Figure 6* shows the combination of the BLS and Aaronson-Sullivan's measurement to approximate labor quality in the United States. The combination of the data series is labor quality that is used as provided by John Fernald.

Figure 6: Labor Quality from 1948 – 2019
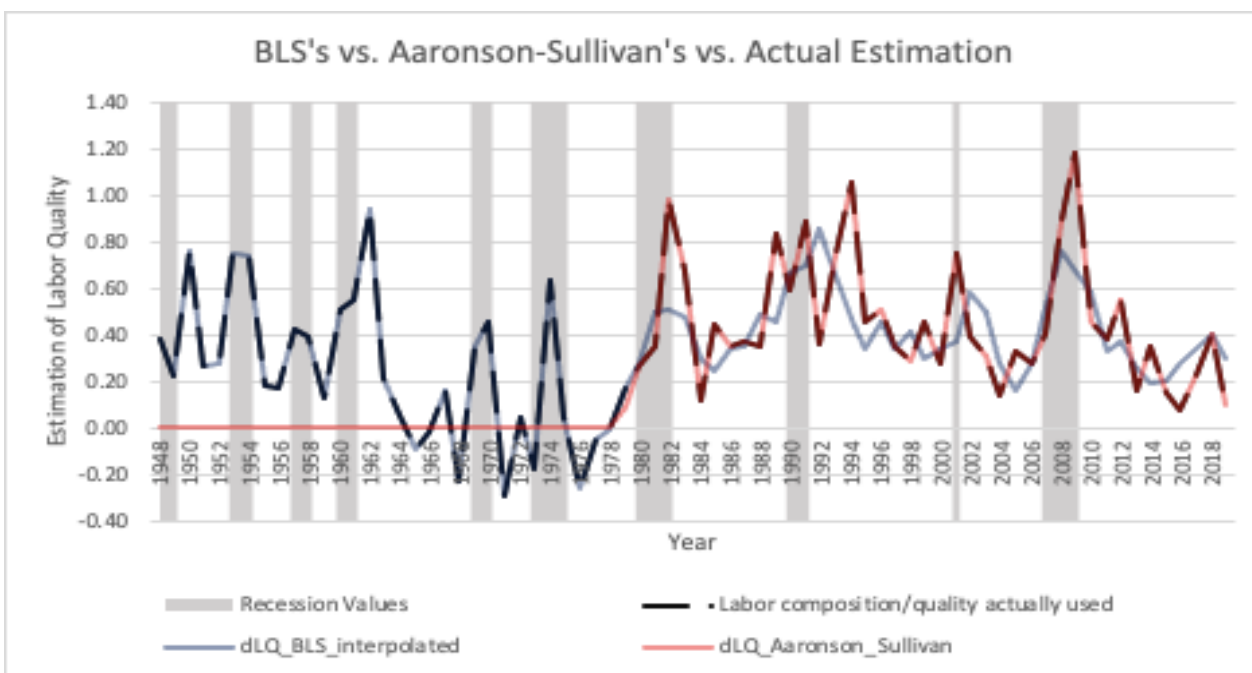
Note: This graph shows the difference between the BLS interpolated and the measurement by Aaronson and Sullivan (2001), as extended by Bart Hobijn and Joyce Kwok (FRBSF[BW(5)) from 1948 to 2019. This graph shows actual labor quality used from 1964 to 2019. The labor quality used is simply a combination of the BLS interpolated and the labor quality measured by Aaronson and Sullivan (2001), as extended by Bart Hobijn and Joyce Kwok (FRBSF).

Meanwhile, to control for factors affecting labor quality, this paper includes educational attainment, experience, gender, and a measure for the business cycle into the regression equation. The data for educational attainment and income inequality are obtained from the U.S. Census Bureau, whereas the data for experience, gender, and unemployment are collected from the Bureau of Labor Statistics. The Gini coefficient is measured as the income Gini ratio of families by race of household for all races. The educational attainment variable is defined as the percent of people 25 years and over, who have completed four years of college or more. The experience variables are ratios between the employment level of 16-24 years old and 55 years and older against the employment level of 16 years and older. These two ratios serve as a proxy for low and high. Lastly, the gender variable is defined as the ratio of labor force participation by females and by males.

To control for factors affecting economic growth, this paper includes labor quality and unemployment into the regression equation. Economic growth is measured as the annual percentage change in real GDP and the cycles variable is the unemployment rate. The data for labor quality and unemployment are collected from the Bureau of Labor Statistics, whereas the data for economic growth is collected from the Bureau of Economic Analysis.

MODEL ESTIMATION PROCESS

For the first and second regression equations, the sample period is 1964 to 2019, whereas the third regression equation, the sample period is 1948 to 2019. The following regression equations are as follows:

Gini Coefficient and Educational Attainment:

$$y = \beta_0 + \beta_{1t} x_{1t} + \varepsilon_t$$

where y is the percent of people 25 years and over who have completed four or more years of college and x_1 is the Gini income ratio in the United States. This regression is useful in order to determine if economic inequality decreases the number of students who graduate from college.

Labor Quality and Inequality Equation:

$$y = \beta_0 + \beta_{1t} x_{1t} + \beta_{2t} x_{2t} + \beta_{3t} x_{3t} + \beta_{4t} x_{4t} + \beta_{5t} x_{5t} + \varepsilon_t$$

where y is the labor quality as measured as an annual percentage change in the United States, x_1 is the Gini income ratio, and x_2 is the percent of people 25 years and over who have completed four or more years of college, x_3 is the annual percentage change in the gender labor force participation rates, x_4 is the ratio of young and old ages with total employment level, and x_5 is the unemployment rate.

Economic Growth and Inequality Equation:

$$y = \beta_0 + \beta_{1t} x_{1t} + \beta_{2t} x_{2t} + \varepsilon_t$$

where y is the growth rate of real GDP in the United States, x_1 is the labor quality as measured as an annual percentage change in the United States, and x_3 is the unemployment rate.

Notably, every regression is tested and corrected for multicollinearity, serial correlation, and heteroskedasticity. The detection for multicollinearity uses the simple correlation tables and the high variance inflation factors. For the correlation tables, values that are above or below 0.80/-0.80 are cause for concern in regards to multicollinearity. In addition, this paper also uses high variance inflation factors with the general rule that if the VIF is greater than 5 then the multicollinearity is severe. When multicollinearity is detected, this paper either dropped a redundant variable or did nothing. The paper also tests for serial correlation. The detection method for serial correlation is the Lagrange Multiplier test. With time-series data, each regression is tested for 1 or 2 lags due to the loss of degrees of freedom with more lags. If serial correlation is detected, the remedy for this issue is the Newey-West Standard Errors. Lasty, to detect heteroskedasticity, this paper uses the White Test. If heteroskedasticity is detected, the remedy for this issue is the Heteroskedasticity- consistent standard errors.

INTERPRETATION OF RESULTS

To estimate the relationship between economic inequality and educational attainment, this paper uses an ordinary least squares regression with a sample size of 55 from 1964 to 2019. The first regression results are presented below:

T A B L E 1 . R E G R E S S I O N R E S U L T S : E D U C A T I O N A L

A T T A I N M E N T

Intercept	-57.40
	(0.00)
Gini Coefficient	196.64
	(0.00)
R^2	0.9326
N	55

Note: P-value in parentheses

The relationship between the Gini coefficient and Educational Attainment is positive and statistically significant. For the relationship between economic inequality and education, 93.26% of the variation in labor quality can be explained through the model. The R^2 suggests that economic inequality can explain roughly 93% of the variation in educational attainment. Nonetheless, the relationship between the Gini coefficient and Educational Attainment is positive and statistically significant. for a one percentage point increase in the income Gini ratio, educational attainment increases by 1.96%. This is contradictory to the literature review and economic theory. An explanation is that the model is too simple and the annual the time series does not provide enough variation in order to capture the true effects of the relationship.

The results of the regression analysis are stated in *Table 1*, which explains the dynamics of labor quality from 1964 to 2019, whereas *Table 2* explains the economic growth dynamics with the focus on labor quality and inequality from 1948 to 2019.

TABLE 2. REGRESSION RESULTS: LABOR QUALITY

Intercept	5.48
	(0.01)
Gini Coefficient	-12.32
	(0.04)
Gender - Woman	13.60
	(0.07)
Gender – Male	-35.50
	(0.00)
Age - Young	-9.62
	(0.01)
Age – Old	-6.58
	(0.00)
Educational Attainment	0.06
	(0.01)
R^2	0.4742
N	56

Note: P-value in parentheses

For the relationship between labor quality and economic inequality, 47.42% of the variation in labor quality can be explained through the model when holding other parameters constant. In addition, in regards to the F-test, the F-statistic is 7.37 and the p-value is 0.00, thus the null hypothesis that all of the coefficients are equal to 0 is rejected. This result suggests that at least one of the predictors is important in predicting the labor quality in the United States. In particular, Educational Attainment and Gender – Women are statistically significant and the coefficients are positive, whereas Age – Young, Age – Old, Gender – Male, and Gini Coefficient are statistically significant and the coefficients are negative.

There is neither serial correlation nor heteroskedasticity detected within the regression; however, the issue of multicollinearity does arise. In Table 3, the Variance Inflation Factors (VIF) are reported. This paper follows the general rule that any VIF greater than 5 is considered to be problematic. Thus, it is evident that the following variables are causing multicollinearity in the regression: Gini Coefficient, Educational Attainment, and Age– Young.

Table 3: VIF Table

Variable	VIF	1/VIF
Gini Coefficient	44.29	0.022577
Educational Attainment	22.00	0.045464
Age - Young	12.74	0.078495
Gender - Woman	4.61	0.216786
Gender – Male	1.67	0.597130
Age – Old	1.54	0.648426
Mean VIF	14.88	

To investigate further, Table 4 reports the correlation matrix for each variable. The simple correlation coefficient, r, is a measure of the strength and direction for the linear relationship between two variables. R ranges from -1 to 1, where the sign indicates the direction of the relationship, either positive or negative. Although the exact value of r to indicate multicollinearity varies, this paper uses the absolute value of 0.8 and above to suggest multicollinearity. These variables are denoted in red in the table below.

Table 4: Correlation Matrix

	Gini Coefficient	Gender– Woman	Gender– Male	Age– Young	Age– Old	Educational Attainment
Gini Coefficient	1					
Gender – Woman	-0.7953	1				
Gender – Male	-0.0651	0.4167	1			
Age – Young	-0.9369	0.8019	0.1312	1		
Age – Old	0.3234	-0.2692	-0.1981	-0.3855	1	
Educational Attainment	0.9657	-0.7556	-0.0470	-0.8678	0.3792	1

There are three potential remedies for multicollinearity: do nothing, drop a redundant variable, and increase the sample size. Because increasing the sample size is not possible, this paper argues to do nothing. In addition, when multicollinearity is present, the estimates remain unbiased, the variances and standard errors increase, and the computed t-scores fall. Since, the variables, Gini Coefficient, Educational Attainment, and Age– Young, are statistically significant, any remedies do not change their estimate coefficients and their t-scores will lower. Thus, this paper chooses not to address the collinearity in the regression estimate.

The most important regression result is that the Gini coefficient is statistically significant and negative. This paper seeks to establish a negative relationship between labor quality and economic inequality, which the regression analysis supports. It is important to note that for a one percentage point increase in the income Gini ratio, labor quality decreases by 12.32%. The magnitude of the

value is very significant and large. Thus, to provide evidence that inequality dampens economic growth, a following regression equation is necessary.

For the control variables, all of the variables have their expected signs except the sign for the Age – Old, Gender-Female, and Gender-Male variables. Age-Old has a negative sign, suggesting that an additional increase in an older worker decreases the labor quality by 3.46%. Intuitively, this result does not make sense as an older worker has more experience and knowledge, so it is expected this worker has a larger human capital accumulation. A potential explanation is that experience increases with age but at a decreasing rate. Furthermore, Aaronson and Sullivan (2002) expect to find a change in experience levels that turn from a positive to a negative factor for labor quality growth. As explained in their paper, as the Baby Boom generation begins to age and retire, these workers will move beyond the highest earnings years that most workers experience in their early 50s. Furthermore, the age ranges associated with maximum wages and productivity have become populated with a smaller number of workers, specifically, populated by workers born in the late 1960s and early 1970s. Furthermore, Gender-Woman and Gender-Male are statistically significant and have positive and negative signs, respectfully. Intuitively, these signs do not make sense as Aaronson and Sullivan (2002) and Seguino et al (2019) have established that women tend to earn lower wages despite having the same level of education and experience as their male counterparts. In fact, Seguino et al (2019) finds that women tend to be rare in higher skill jobs than males and that the crowding of women into lower quality jobs has a negative effect on the labor share of income. Nonetheless, Aaronson and Sullivan (2002) mention that this negative effect on labor quality is diminishing overtime as the share of women workers grows; however, the size of coefficient estimates as well as the difference between the coefficient estimates seem to be rather large.

Nonetheless, since the Gini Coefficient is negative and statistically significant, this paper turns its attention to the relationship between economic growth and inequality. The regression results are reported in Table 5.

TABLE 5. REGRESSION RESULTS: ECONOMIC

GROWTH

Intercept	6.34 (0.00)
Labor Quality	-2.35 (0.01)
Unemployment	-0.40 (0.01)
R^2	0.2261
N	72

Note: P-value in parentheses

22.61% of the variation in labor quality can be explained through the model. In addition, in regards to the F-test, the F-statistic is 10.08 and the p-value is 0.00, thus the null hypothesis that all of the coefficients are equal to 0 is rejected. This result suggests that at least one of the predictors is important in predicting the labor quality in the United States. In particular, Labor quality and Unemployment are statistically significant and the coefficients are negative. Lastly, there is neither serial correlation, multicollinearity, nor heteroskedasticity detected within the regression.

In the final regression analysis, labor quality is statistically significant and negative. This result does not have its expected sign and does not provide support to the hypothesis that inequality dampens economic growth through labor quality. It is important to note that for an additional annual percentage point increase in the labor quality, economic growth decreases by 2.36%. This result is contradictory. Lastly, the unemployment has its expected sign and is statistically significant.

CONCLUSION

There are numerous reasons for policymakers and citizens to be concerned about the rise of inequality, not the least of which are its impact on the basic American social contract that says that work pays off; the diminishing of opportunity; the rise in societal unrest; and its impact on political functionality. The supply-side theories state that inequality causes less-productive labor inputs. This paper does find evidence that inequality decreases labor quality; however, this paper does not find evidence to support the idea that decreases in labor quality led to decreases in economic growth. To address this result, policymakers need to focus their attention on labor quality. Specifically, policymakers must improve the labor force participation of males, continue to education its citizens, encourage the young members of its society to growth their human capital, and address the ongoing crisis with the disparity of inequality in the United States.

Ultimately, the results do not support that economic inequality dampens economic growth. The main issue that arises is that economic inequality does not have a negative relationship between educational attainment. Although, the third equation shows a decrease with economic growth and labor quality, the economic theory behind this relationship does not hold. It is important to note that the other controls had their intended signs expect for Age-Old, Gender-Male, and Gender-Female.

Suggestions for Future Development

Further research should focus on addressing economic inequality and labor quality. This paper fails to provide evidence to support that inequality decreases edcuational attainment, which is very suprising considering the large research showing evidence of a negative relationship. As a result, future research show explore the dynamics of inequality and education. In addition, it appears that labor quality and economic growth does not have its intended relationship, thus future research show attempt to establish a better theory explain this linkage. One suggestion is to use disaggregate data rather than aggregate data as some of the variation between the relationships are lost when conducting analysis in the aggregate.

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