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Measurement of Working Experience and Education Level in Earning Models Among African-American and Whites

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MEASUREMENT OF WORKING EXPERIENCE AND EDUCATION LEVEL IN
EARNING MODELS AMONG AFRICAN-AMERICAN AND WHITES

A Thesis
Presented to
The Graduate School of
Clemson University

In Partial Fulfillment
of the Requirements for the Degree
Master of Arts
Economics

By
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ABSTRACT

Labor market attachment differs significantly between African-American males and white males; there are various reasons that account for the wage differential. It has long been agreed that the Mincer equation method, which analyzes earnings by using experience and education levels, is very reliable. Is it only these two variables that account for the wage inequality? For instance, does discrimination exist in the labor market? And is there any improvement in the measurement of experience variables that will affect the result? In this paper, I will generate accumulated experience variables in order to compare them to potential experience variables. I will find out whether racial wage differential still exists after using adjusted accumulated models.

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CHAPTER ONE

INTRODUCTION

This paper examines an alternative method to generate “experience” variables in earning models by observing African-American males and white males. Some researchers analyzed the racial wage differential (Altonji and Blank) focused on conditional wage differential. Meanwhile, there’s unconditional wage differential, which simply measures the difference in average wages between all African-American males and white males. As we know, in the long run, the unconditional differential will show no differences when related to race, experience, or education. The conditional wage differential is the difference in wages estimated after differences in “relevant” factors have been accounted for. So, by using conditional wage differential we need to discover why African-American males get paid less. Some research shows that discrimination takes place in forms other than pay, such as reduced access to schooling compared to Whites or through employers having a racial bias on decisions such as layoffs and promotions (Jared Michael Huff 2012.) It has long been established that African-American males earn lower wages compared to their white counterparts. Reasons for this include education, discrimination, and geography. In this paper, I discuss the main influence of wage differential: the “experience effect.” I used accumulated experience instead of potential experience (age minus education years minus 6). Then I adjusted accumulated experience by age, age square, education years square, and age times education year variables to fix the variance caused by the simple accumulated experience model. This method approximates the real-experience result in the earning model. In

many previous studies, most researchers seem content using potential experience, which may be a good approximation of the real experience for those who work consistently, but this will vary among different individuals and will make potential experience less accurate (Antecol and Bedard 2002,2004), and it is unreasonable to assume that people have been in the labor force continuously since leaving school. Some research shows that the Mincer model for work experience has become standard practice, and the error will affect females more than males. However, male workers will also suffer employment laps. Therefore, potential work experience measurements overstate the effects of schooling and experience coefficients (Regan and Oaxaca 2009). Jared Michael Huff (2012) countered that the use of reported education and potential experience make them seem considerably less important factors than they actually are. Therefore, I examined accumulated experience and the approximation of the real experience in explaining wage difference between African-American males and white males. In this paper, I use CPS (IPUMS-current population survey) data from 1980 to 2010 to generate my accumulated experience data, combined with 2010ACS (IPUMS-American community survey) data to regress earning models. And I use three ways to adjust the measurement of accumulated experience variable's square term, which will cause a huge variance. Furthermore, I will use education years as dummy variables to compare racial differential in both the accumulated experience and the Mincer model.

CHAPTER TWO

METHOD AND MODEL

I used the basic Mincer regression model to estimate the African-American and white wage differential by comparing potential experience and accumulated experience.

For the potential experience model:

$$\ln(\text{income}) = \alpha_0 + \alpha_1 \text{EXP}_i + \alpha_2 \text{EXP}_i^2 + \alpha_3 \text{EDUC}_i + \alpha_4 \text{Black}_i + e_i$$

In this equation, income is measured as the total annual income; EXP and EXP square are the individual's potential experience (age minus education years minus 6) and EDUC is the education year.

For the accumulated experience model:

$$\ln(\text{income}) = \alpha_0 + \alpha_1 \text{AEXP}_i + \alpha_2 \text{AEXP}_i^2 + \alpha_3 \text{EDUC}_i + \alpha_4 \text{Black}_i + e_i$$

Income is measured as total annual income; AEXP and AEXP square are accumulated experience; EDUC is the education year.

Method of Accumulated Experience Calculation

Firstly, I used WKSWORK (number of weeks that each individual worked last year) and UHRSWORK (the number of hours per week that individuals worked last year.)

$$\text{Total Hours Worked} = \text{WKSWORK} * \text{UHRSWORK}$$

All of the above variables have a one-year lag, so I adjusted the year lag by minus one year to the year variable.

Next, I divided all my observations into 4 education groups by education year: less than high school; high school; some college; college or more. For each individual in every education group, I assumed they all worked to the age of 39; for those in the less

than high school education group, they started to work at 18 years old; the high school group started to work at 19 years old; those in the some-college category started to work at 21 years old; and for college or more they started to work at 23 years old. In my 2010ACS data, I only focus on ages 18 to 40, thus birth year from 1970 to 1992. In my paper, age 18 is the earliest working age. So I will narrow my ACS data from 1988 to 2010; then I will calculate different races' accumulated experience variable by using the education-group, age, and birth-year cohort. For example, for African-American males in the less-than-high-school-education group, I included – in one group – those that were born in the same year but are at different ages in the survey year summed the mean value of total hours in each age and year in that group. Example: calculate the mean value of total hours worked for those at age 18 years old in 1988; then sum with the mean value of total hours worked for those at 19 years old in 1989; then sum with the mean value of total hours worked for “20 years olds in 1990” until “39 years old in 2010” to get the accumulated experience by hours for high school drop outs of the Africa-American males group who were born in 1970 who started work at age 18 and worked until age 40. Using the same method, I get the accumulated experience for the same group born in 1971 until those who born in 1992. Then I assumed that each full-time working employee will work 2080 hours per year (40 hours per week*52 weeks per year), so I will have

Accumulated Experience for each education birth year group = Total Hours Worked/2080.

Error Adjustment for Accumulated Experience Square

In the basic Mincer equation, there is an EXP^2 that changes with experience over the working life-cycle. And EXP^2 is negatively sloped by time; it explains when a person is young or at the beginning of his/her career, the return of experience to wage is increased (first 10 to 15 years), and the quadratic specification predicts a spurious decline return in wage among the older time of workers.

Therefore:

$$EXP^2 = (\text{age-education year} - 6)^2$$

the quartic function in years of experience captures very well the main feature of the empirical experience-earnings profiles. But in my method to generate quadratic accumulated experience,

$$[E(\text{accumulated experience})]^2 \neq E(\text{accumulated experience}^2)$$

A) Adjustment one

For every observation, true experience is equal to accumulated experience plus some variance. (AEXP stands for accumulated experience)

$$exp_i^T = AEXP + V_i$$

Therefore:

$$(exp_i^T)^2 = AEXP^2 + V_i^2 + 2V_iAEXP_i$$

Because the variance and AEXP are uncorrelated, then $2V_iAEXP_i=0$, so I need to focus on adjusting the variance influence in my accumulated experience wage regressions in order to make sure my estimation of accumulated experience would approximate the true experience.

Therefore, for observation i:

$$T_i^* = \sum_{t=1}^k T_{ti} \quad t = \text{years of working}$$

$$AEXP = E(T_i^*) = \sum_{t=1}^k E(T_{ti})$$

$$T_i^{*2} = \sum_{t=1}^k T_{ti} + 2 \sum_{t=1}^k \sum_{t'=t+1}^k T_{ti} T_{t'i}$$

$$AEXP^2 = E(T_i^{*2}) =$$

$$E\left(\sum_{t=1}^k T_{ti}^2\right) + 2E\left(\sum_{t=1}^k \sum_{t'=t+1}^k T_{ti} T_{t'i}\right) = \sum_{t=1}^k E(T_{ti}^2) + 2E\left(\sum_{t=1}^k \sum_{t'=t+1}^k T_{ti} T_{t'i}\right)$$

For the first part on the right-hand side, $E\left(\sum_{t=1}^k T_{ti}^2\right)$, I can adjust it by using the mean of square of working experience of each individual in a given year. This is the same as the method I used to generate accumulated experience. I also used the education-group, age, and birth-year cohort to generate my mean of square of working experience. I then sum all the mean value of square of each individual's total hours worked.

B) Adjustment two.

Assume that true value of experience,

$$T_{ti}^* = AEXP_t + \varepsilon_{ti}$$

Suppose

$$\varepsilon_{ti} = V_i + u_{it}$$

Therefore,

$$T_{ti}^* = AEXP_t + V_i + u_{it}$$

Where V_i varies among personal specific, and u_{it} is a intercept of $AEXP_t$ and V_i

$$T_{ti} T_{t'i} = (AEXP_t + V_i + u_{it})(AEXP_{t'} + V_i + u_{it'})$$

$$E(T_{ti} T_{t'i}) = AEXP_t * AEXP_{t'} + \sigma_V^2$$

For

$$E(\sum_{t=1}^k \sum_{t'=t+1}^k T_{ti} T_{t'i}) = [\sum_{t=1}^k \sum_{t'=t+1}^k (AEXP_t * AEXP_{t'} + \sigma_{V^2})]$$

$$= k(k-1) \sigma_{V^2} + \sum_{t=1}^i \sum_{\substack{t'=1 \\ t' \neq t}}^i (AEXP_t * AEXP_{t'})$$

Thinking of σ_{V^2} as a coefficient and $k(k-1)$ as explainable variables, depends on age and education in 2010.

Therefore,

$$k(k-1) = (\text{age} - \text{educyear} - 6)(\text{age} - \text{educyear} - 7)$$

$$= \text{age}^2 + \text{educyear}^2 + 2\text{educyearage} - 13\text{age} + 13\text{educyear} + 42$$

Therefore, I need to put age^2 ; educyear^2 ; educyearage ; age ; educyear in my further adjustment.

C) Adjustment One+Two

I put all the adjustment variables back to regression, to approximate the true experience more accurately.

Regressions by Using the Education Year As Dummy Variables

In order to observe the education effect more precisely, I put the education year as dummy variables into the basic Mincer model, the simple-accumulated experience model, and the entire three-ways accumulated-experience adjustment model. In adjustment models, I dropped educyear^2 when regress adjustment2 and adjustment 1+2 model because of the collinearity of “education year” and “education year square.”

CHAPTER THREE

DATA

I focus on young African-American and white males (18-39) by using IPUMS-CPS and 2010ACS data. Summary of statistics of relevant variables are shown in Table 1. In average, white males are slightly older than African-American males, but their potential experience has similar years. Their accumulated experience and total hours worked varies a lot, with white males 27% higher than their counterparts. Surprisingly, both of these two race groups don't have a big gap in education years. I generated my accumulated variable by using CPS data and dropped all the missing values and divided the education level for four groups: less than high school (assuming those have fewer than 12 years of education equals 11 years); high school (12 years of education); some college (those with more than 12 years and less than 16 years of education equal to 14 years); college or more (those who have 16 or more years of education equal to 16.) In some sense, this is a rough method to generate my education dummy variables. I could have divided the total into 9 or 11 groups, but the four groups sufficiently cover the discussion I will talk about next. From Table 2, for the African-American race group, 13.4% have less than 12 years of education (less than high school degree), while for white males, they have only 10.9%. And 29% of the white group has a bachelor's, master's, or PhD degree. The other group has only 17%. Most of the African-American males (33.95%) are in the high school education group, but white males have only 28.23% scattered in the high school group. From this fact, I noticed that even though

there is not a big difference in the mean value of the education year, the 4 education groups do explain the race groups' education-level difference.

From the mean fact of potential and accumulated experience, it is obvious that accumulated experience has better demonstrated the experience gap between these two race groups. And I will use the accumulated experience adjustment to approach more accurate results, which approximate to actual experience

CHAPTER FOUR

RESULT

Figure 1 tells the differences among 4 education groups between potential experience and accumulated experience. Also, it shows the white and African-American's education gap. First of all, it is obvious that potential experience reported higher education levels for both race groups compared to accumulated experience. In the graph, for example, potential experience equals 10 years, males who have less than high school and whites' accumulated experience equals only 5 years, and African Americans' accumulated experience equals nearly 2.5 years. If potential experience equals 20, for this same education group, white males have almost 15 years of education and African-American males have 7 years of education. What I observed was the large accumulated experience gap between these two race groups. Moreover, this gap diminishes with the growth of education level, and it leads to almost the same accumulated experience line when observations have college or more than college degrees. I will talk about this fact more precisely in the next figure. The biggest change to this education-experience effect happens among those in the "less than high school" and "high school" groups. In my opinion, my method reveals that white males have less possibility or fewer times to be laid off in the labor market, which I think is caused not only by experience and education level but discrimination.

Figure 2 explains the differences between potential experience and accumulated experience for different ages in the year 2010. Not surprisingly, potential experience still is more generous than accumulated experience and gives everyone higher working

experiences. The reverse tendency of the experience gap and increasing education level happens not only between whites and African-Americans but also between accumulated experience and potential experience for both race groups. For each education group, the experience gap grows with age. For 25-year-old males in 2010 who have less than a high school education level, potential experience is 4 years more than that of white males' accumulated experience and 6 years more than that of African-Americans. While, in the same group for 30-year-olds, potential experience has 8 years more than African-Americans and 4 years more than white males. For 40-year-olds, potential experience has doubled the African-Americans' accumulated experience, and for whites has 6 years less than potential experience. For more educated people in this data, the experience gap is less observable compared to the less-than-high-school group. Still, for 40-year-old male graduates from high school, potential experience is 4 years more than African-Americans' accumulated experience, and the experience gap between races is 3 years. For those 40 years of age who have some college education, experience differences do not change much, only 3 years more compared to the potential experience of the African-Americans' accumulated experience. Finally, for those in the college or more educated group, the experience gap is not that identical. From this fact, it is my opinion that under the existing unavoidable discrimination, more education will smooth the experience gap between African-American and white males, which makes sense because in this paper I assume people have a high education background (bachelor's, master's , or doctoral degree) and they started working at age 23. In order to avoid facing pressure from the job

market, investing in education is an option that may lead to more education but less experience for this education group.

Table 3 demonstrates all my regressions for the Mincer equation, the simple accumulated experience model, and three ways of the accumulated model adjustment. In this table's first two columns is the basic Mincer equation with the potential experience variable and the simple accumulated experience model. The African-American coefficient goes up from -0.391 to -0.306 by using accumulated experience. Compared to the Mincer equation, the return of education effect to wage model goes down from 0.185 to 0.171, which is not quite reliable. By comparing experience return to wage model in Figure 3, it shows that potential experience has overestimated the effect of experience. In columns 3, 4 and 5, I use the method I talked about above to adjust my accumulated experience measurement. Column 3 is the model for adjustment 1, which replaced the summation of mean of accumulated experience's square into mean value of the summation of accumulated experience's square. The relationship of African-American and white wage gap decreases in the Mincer equation and simple accumulated experience (-0.391 to -0.306 to -0.304). In Column 4 is my adjustment two model. As I mentioned before, I put age^2 , $educyear^2$, $educyearage$, age , and $educyear$ into my adjustment two model to adjust the variance gotten from the square level variable. The wage differential between race groups grows from -0.391 to -0.519 basic Mincer equation. Then in Column 5, I put all the adjustments together into my simple accumulated experience model. The race wage gap became bigger compared to the potential experience as a lower coefficient (-0.401 to -0.391) by using Adjustment 1+2. In my regression result, after adjusting

accumulated experience, Africa-American males still have a lower wage compared to their counterparts. So when talking about wage differential between white and Africa-American males, racial bias is influenced significantly.

In Table 4, I am attempting to demonstrate the effect of each education year's return for the log wage model by using each education year as dummy variables instead of the education-year variable. From table 4 in Columns 1 and 2, when using the simple accumulated experience model compared to the basic Mincer equation, the "black" coefficient went up, and wage differential with their counterparts decreased. After I used all the three adjustments, the "black" coefficient went down from simple accumulated experience model (-0.304 to -0.338) and finally stayed at -0.380, as shown in the last two columns, which is lower than the Mincer equation model. That means the Africa-Americans' discrimination grew.

CHAPTER FIVE

CONCLUSION

In the Mincer equation, the measurement of both experience variables and education variables inflated the wage differential between African-American and white males. Meanwhile, it also underestimated the real return to wage from education and experience. By using potential experience, the magnitude error increases over time, and it is most present by “less than college education levels.” The bias of experience variables in the Mincer equation narrows down the actual effect of experience and education levels to the wage equation. Because of the measurement error caused by potential experience, I explained the accumulated experience method to analyze the wage differential between these two race groups.

“Knowledge is power” said by Roger Bacon, which is famous in every corner of the earth. “Knowledge changes destiny” said by Li Ka-shi(“The RICHEST PERSON IN ASINA” by Bloomberg Billionaires Index---Oct.2013), which is the most cliché “first lesson” in Chinese elementary school. How powerful that education and knowledge can change our life, fate or destiny! I want to say, it is the first choice and basic element to build up your world, but I don’t think it is power enough to get through discrimination. Unfortunately, in the labor market there is always discrimination, which skews study results. Therefore, I still can improve my paper by using more levels of education groups to generate more accurate accumulated experience variables.

TABLES AND FIGURES

TABLE 1

Statistics Summary For Relevant Variables

variable	Mean	
	Black	White
	(N= 29351)	(N= 236250)
Potential experience	10.44 (6.19)	10.52 (6.09)
Accumulated experience	6.81 (5.13)	8.63 (5.99)
Log(income)	9.64 (1.31)	10.11 (1.19)
age	29.70 (6.35)	30.21 (6.22)
Education years	12.54 (1.65)	12.85 (2.03)
Total hours worked	15125.5 (10336.9)	19206.26 (11906.92)

TABLE 2

Black and White Education Level Comparison

EductionYear	Black (N= 29351)/White(N= 236250)			
	lessthanhs	HS	Somecollege	College or more
4	256 /1,952	0	0	0
5	19 /365	0	0	0
6	70/ 2,298	0	0	0
7	45/536	0	0	0
8	127/1,723	0	0	0
9	337 /3,461	0	0	0
10	774/3,981	0	0	0
11	2,311/ 11,526	0	0	0
12	0	9,966/66,693	0	0
13	0	0	10,442/74,867	0
14	0	0	0	3,726 /49,132
16	0	0	0	980/13,466
19	0	0	0	193/4,214
20	0	0	0	105/2,036
Total	3,939/25,842	9,966/66,693	10,442/74,867	5,004/ 68,848

TABLE 3

Results of Basic Mincer equation, accumulated experience, Adjustment 1, Adjustment 2

and Adjustment 1+2

	Basic Mincer Equation	Simple Accumulated Experience	Accumulated Experience Adjustment		
			Adjustment 1 ¹	Adjustment 2 ²	Adjustment 1 + 2 ³
Black	-0.391 (0.006)	-0.306 (0.006)	-0.304 (0.006)	-0.519 (0.007)	-0.401 (0.008)
Education year	0.185 (0.001)	0.171 (0.001)	0.197 (0.0013)	-0.239 (0.007)	-0.153 (0.007)
Potential Exp	0.225 (0.0013)				
Potential Exp^2	-0.0069 (0.00006)				
Accumulated Exp		0.221 (0.0012)	0.226 (0.0061)	-0.158 (0.004)	-0.453 (0.008)
(\sum Mean value of AEXP)²		-0.0079 (0.00006)		0.002 (0.0006)	0.001 (0.0002)
Mean of (\sum AEXP²)			-0.00006 (2.63e-06)		0.00015 (3.47e-06)
AGE				0.488 (0.0071)	0.56 (0.0073)
AGE^2				-0.007 (0.0001)	-0.008 (0.0001)
EducationYear^2				0.0007 (0.0002)	0.0025 (0.0002)
EDUCATION*AGE				0.0103 (0.0002)	0.0050 (0.0002)
Constant	6.380 (0.014)	6.872 (0.013)	6.859 (0.018)	2.155 (0.098)	0.883 (0.102)

TABLE 4

Result of the Regressions by Education Year as Dummy of Basic Mincer Equation,

Accumulated Experience, Adjustment 1, Adjustment 2 and Adjustment 1+2

	Basic Mincer Equation	Simple Accumulated Experience	Accumulated Experience Adjustment		
			Adjustment 1	Adjustment 2	Adjustment 1+2
Black	-0.338 (0.006)	-0.25 (0.006)	-0.304 (0.006)	-0.380 (0.008)	-.380 (0.008)
Potential Exp	0.204 (0.0013)				
Potential Exp^2	-0.006 (0.00005)				
Accumulated Exp		0.204 (0.0012)	0.226 (0.0061)	-0.039 (0.005)	-0.009 (0.017)
(\sum Mean value of AEXP)²		-0.007 (0.00006)		0.0004 (0.0002)	0.0004 (0.0002)
Mean of(\sum AEXP²)			-0.00006 (2.63e-06)		-0.00001 (6.18e-06)
5Year	0.136 (0.054)	0.125 (0.054)	0.116 (0.007)	-0.112 (0.054)	-0.121 (0.054)
6Year	0.1064 (0.029)	0.086 (0.029)	0.950 (0.008)	-0.391 (0.031)	-0.408 (0.033)
7Year	0.0199 (0.045)	0.003 (0.046)	-1.734 (0.009)	-0.750 (0.050)	-0.775 (0.052)
8Year	0.137 (0.031)	0.139 (0.031)	8.365 (0.008)	-0.903 (0.042)	-0.937 (0.046)
9Year	-0.0031 (0.026)	-0.0006 (0.026)	0.027 (0.0265)	-1.29 (0.028)	-1.33 (0.050)
10Year	-0.037 (0.0250)	-0.0197 (0.025)	0.035 (0.0256)	-1.56 (0.049)	-1.61 (0.056)
11Year	-0.115 (0.0224)	0.359 (0.023)	-0.062 (0.0229)	-1.84 (0.053)	-1.891 (0.062)
12Year	0.415 (0.021)	0.359 (0.021)	0.529 (0.022)	-1.653 (0.058)	-1.711 (0.067)
13Year	0.723 (0.021)	0.617 (0.021)	0.952 (0.022)	-1.787 (0.067)	-1.841 (0.081)
14Year	1.30 (0.021)	1.168 (0.021)	1.665 (0.022)	-1.67 (0.076)	-1.721 (0.023)
16Year	1.41 (0.022)	1.28 (0.022)	1.851 (0.023)	-2.078 (0.091)	-2.144 (0.098)
19Year	1.68 (0.025)	1.558 (0.0256)	2.139 (0.027)	-2.653 (0.114)	-2.747 (0.125)
20Year	1.493 (0.030)	1.370 (0.03)	1.968 (0.031)	-3.147 (0.124)	-3.251 (0.136)
AGE				0.363 (0.0075)	0.352 (0.0094)
AGE^2				-0.0060 (0.0001)	-0.0060 (0.0001)
EDUCYEAR*AGE				0.0084 (0.00022)	0.0087 (0.00027)
Constant	6.380 (0.014)	6.872 (0.013)	6.859 (0.018)	3.720 (0.104)	3.900 (0.143)

FIGURE 1

Difference between Accumulated Experience and Potential Experience by Different Race

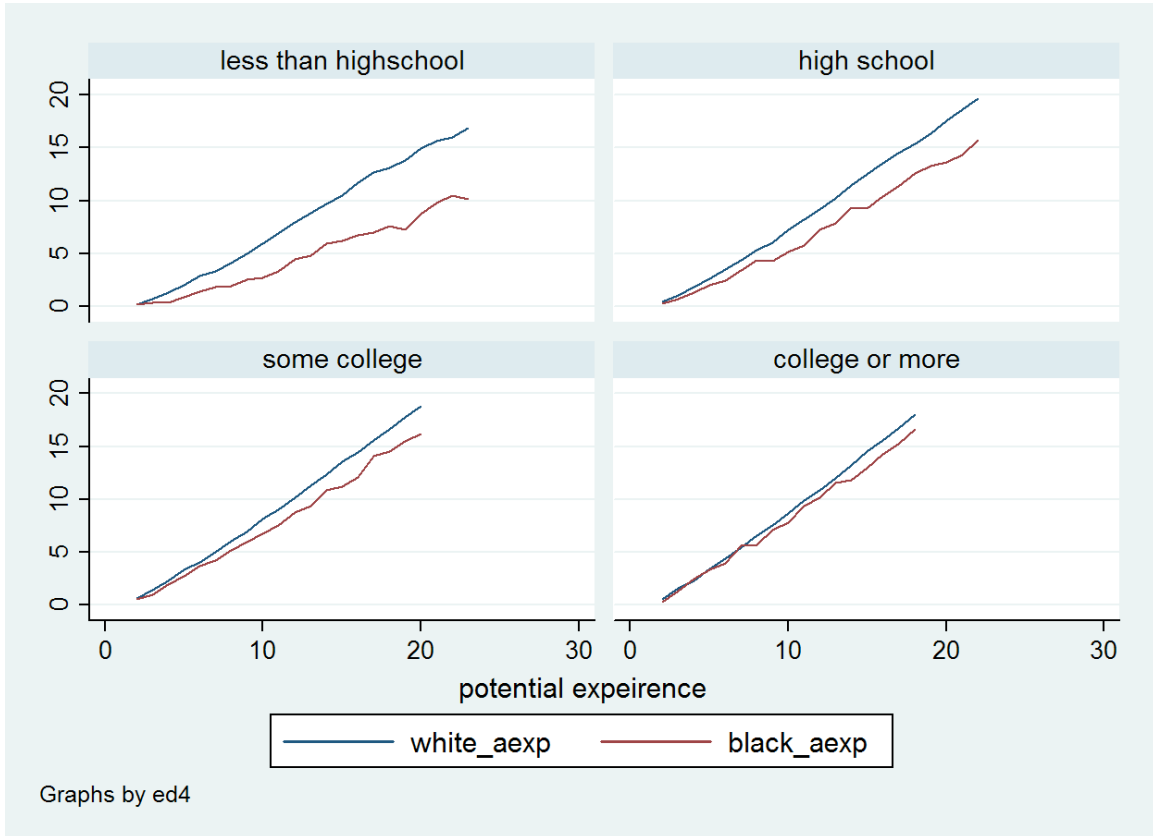


FIGURE 2

Difference between Accumulated Experience and Potential Experience by Different Race

by All Ages

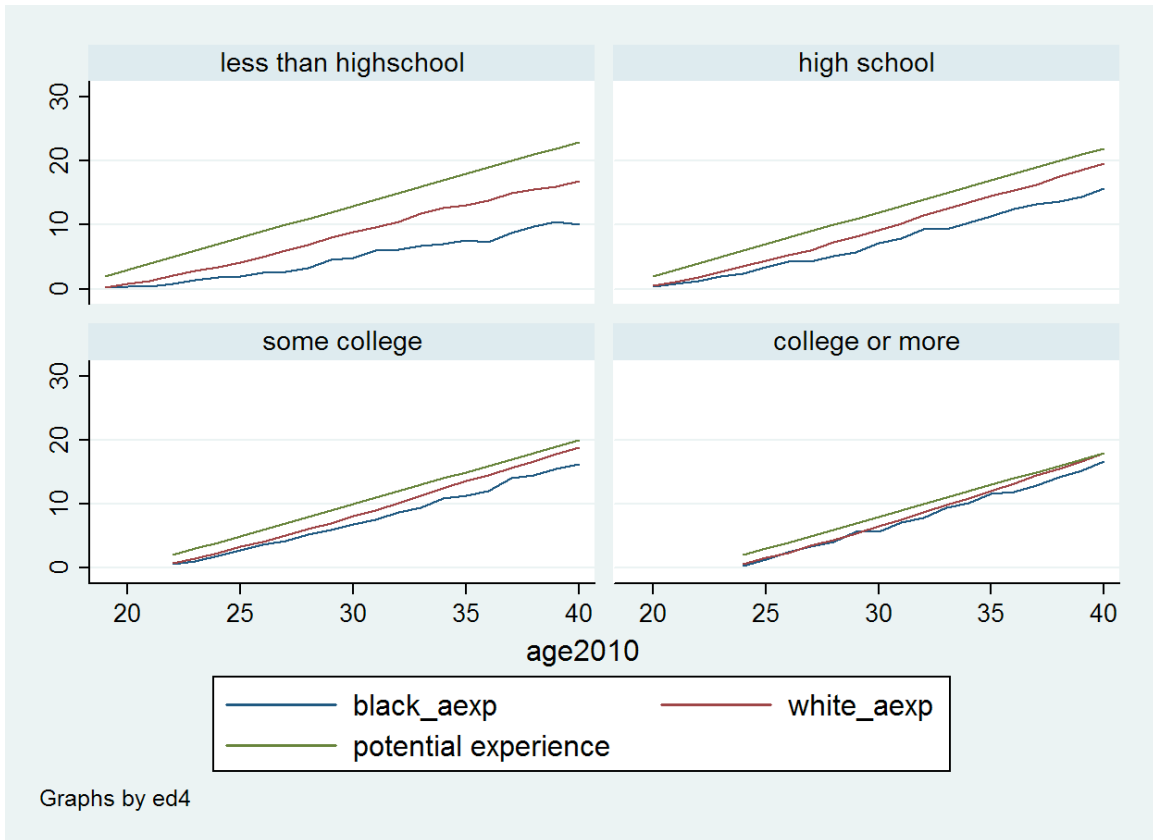
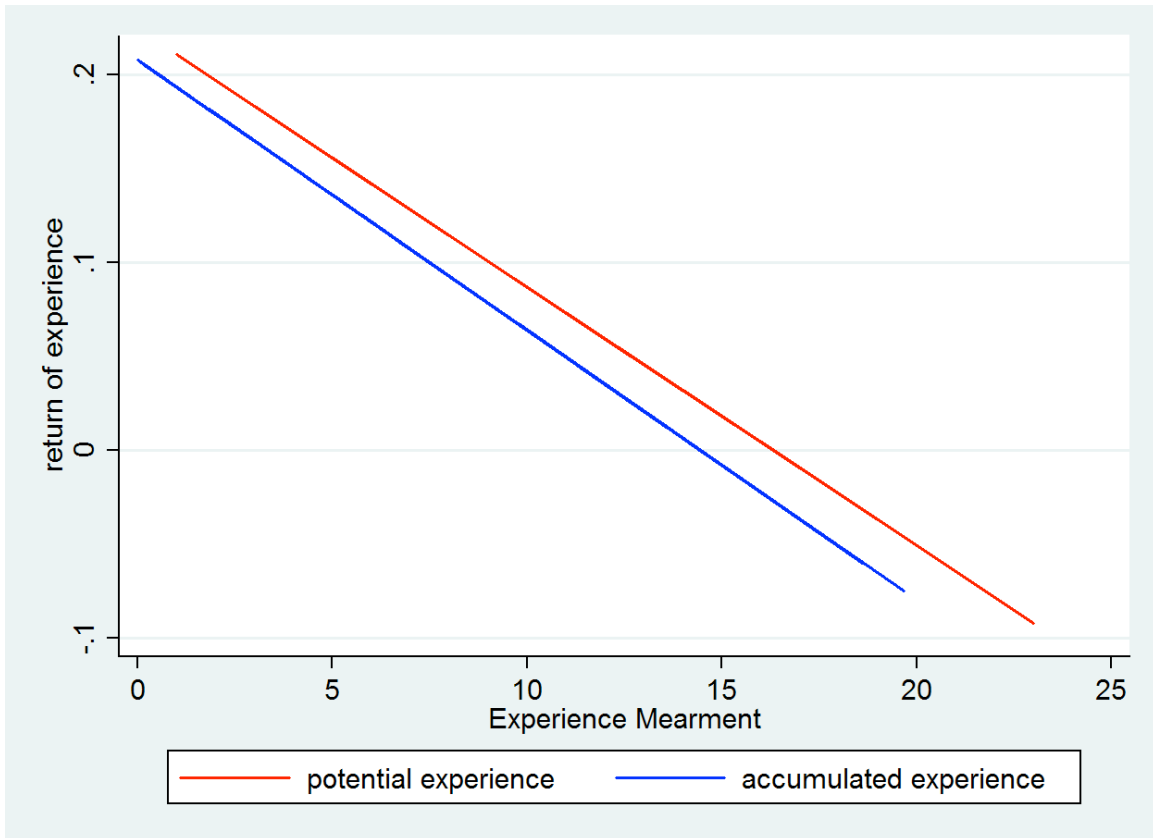


FIGURE 4

The Return of Experience to Wage in Basic Mincer Equation and Simple Accumulated Experience Model



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