Education and Wage Differential by Race: Convergence or Divergence?*

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Abstract

This paper investigates the changes in households' investment in higher education and wage differential between racial groups. Using the Consumer Expenditure Survey collected by the U.S. Census Bureau for the Bureau of Labor Statistics, educational spending, in the years 1980 through 2003, has risen significantly for Asians relative to Whites, while the opposite is observed for Blacks. Higher educational attainment follows a similar trend, as well as household income, however wage differentials conditional on education level and individual characteristics is still a concern for certain groups, while for other groups, wage differential is reversed. In these years, the wage differential that favored males has decreased, but still largely significant. Minority groups and females are generally disfavored, as suggested by the residual wage differential, however the wage differential is gradually and completely reversed for Black females and Asian Males with higher education in recent years. In fact, these two groups earn on average 14% and 13% more, respectively, than Whites with the same education level and individual characteristics. However, Asian females and Black males across all education levels still have a substantial wage differential that disfavors them, and this gap does not appear to be decreasing over these years.

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[†] The author thanks thesis advisor Professor Andrea Weber for her continued support and guidance. All errors are the author's.

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I. INTRODUCTION

Influenced by Confucian ethics, it is well known that Asians tend to have a greater desire for education, as education is associated with prestige. As for other racial groups, this may not be the case. Higher education is generally associated with higher wages, however, the returns to education may be different for different racial groups, partly due to individual characteristics and partly due to discrimination. Previous literature show a variety of results on whether the wage differential is converging or diverging before the 1980s, but none have examined the trend of this difference with separate levels of higher education in the more recent years. This paper examines the nuances and provides more updated results, which may have important policy implications.

This paper is organized as follows. Section II provides the background and previous research. Section III explains the dataset. Section IV explores the data and provides unconditional income differences and trends. Section V analyzes total, higher, and lower educational spending and attainment differences and trends. Section VI analyzes the returns to education and the wage differential between groups. And finally, Section VII summarizes the results and concludes. Each section starts with a brief summary of the findings in that section, followed by graphs of trends, then model specifications, and finally detailed tables and graphs of results. Table 17 of Section VII gives a brief summary of all results.

II. BACKGROUND & PREVIOUS RESEARCH

The vast amount of literature on education and wage differential between racial groups provides both evidence for convergence and divergence in the years 1940s through 1970s.

Race and Gender

From the 1950 Census data, Oaxaca estimates the extent of discrimination against female workers in the US and provides the sources of this wage differential in his 1973 paper, "Male-

Female Wage Differentials in Urban Labor Markets". His results suggest that a substantial proportion of the male-female wage differential is attributed to the effects of discrimination. He finds that 58% and 56% of wage differential for whites and blacks, respectively, is accounted by discrimination. He indicates that the concentration of women in lower paying jobs produce the large wage differentials.

Divergence of wage differential of Black men

Using the Current Population Survey, Bound et al., in their 1992 article, "What Went Wrong? The Erosion of Relative Earnings and Employment among Young Black Men in the 1980s", found evidence that while there had been relative black economic advance before the mid-1970s, the relative earnings and employment of young black men declined from the mid-1970s through the 1980s. They show that different economic forces affected different groups of young blacks.

Convergence of wage differential of Black women

In Cunningham and Zalokar's 1992 article, "The Economic Progress of Black Women, 1940-1980: Occupational Distribution and Relative Wages", they examined the long-term trends of black women's relative wages. Using 1940-80 Census data, they find that there had been a significant increase in relative wages and occupational status, but little evidence of convergence in the characteristics of black and white women, such as similarity in education. This suggests that the convergence of relative wages was due to the decrease in racial discrimination.

Education level differences

In general, previous research shows that the differences in the levels of investment in education explain some of the wage differentials. Asians tend to investment more in education, while Blacks invest less compared to Whites.

In Gwartney's 1978 paper, "The Relative Earnings of Blacks and Other Minorities", he finds that the relative earnings of urban minorities in 1969 varied considerably among different racial groups and by sex. Japanese and Chinese fared better in the labor market while Blacks, Mexican Americans females, and Puerto Rican Males did poorly. Gwarthney indicated that the high relative earnings of Japanese males and females are due to their higher level of investments in human capital (formal education), while Mexican Americans were consistent with their lower levels of schooling.

In their 1984 article, "Socioeconomic gains of Asian Americans, Blacks, and Hispanics: 1960–1976", Hirschman and Wong uses Census data for 1960 and 1970 and the Survey of Income and Education in 1976 to examine the socioeconomic inequality of various minority groups compared to whites. They found that Asian American's over achievement in educational attainment helped them achieve socioeconomic parity with whites. Hispanic and Black men have also made progress but the gaps between them and White men are substantial. About half of Black men's occupational disadvantage and a third of their lower earnings can be explained by lower educational levels.

In Freedman's 1983 article, he finds evidence that by 1970, virtually all of the blackwhite female income differential can be attributed to education and personal characteristics rather than labor market discrimination. Black female college graduates and professionals have

higher income, primarily due to more hours worked. He also finds that equality of starting wages for college men was attained by 1970.

Reimers separates the wage differential between racial groups into differing characteristics and differential due to discrimination in his 1983 paper, "Labor Market Discrimination against Hispanic and Black Men". He finds that there is a 23% wage-offer difference between Black and White males, 10% of which explained by the two year educational difference and 14% is due to discrimination.

Returns to education: divergent view

Some previous literatures indicate that the wage differential worsens with increasing education.

In Siegel's 1964 article, "On the Cost of Being a Negro", he finds that a black man doing the same work as a white man get paid on average about a thousand dollars less a year. Siegel also argues that Blacks may not have the same access to certain occupations. He finds that the white-nonwhite wage differential increases with increasing education, even within the same occupations.

In his 1966 paper, "The Effect of Low Educational Attainment on Incomes: A Comparative Study of Selected Ethnic Groups", Fogel uses 1960 Census data and shows that a given educational attainment has less income value for disadvantaged minority groups than for the majority (Whites). His objective is to examine the effects of educational attainment levels on the economic welfare of selected minority groups. He finds evidence in support for the proposition that market discrimination is directly related to the observable physical dissimilarity between the ethnic group and the majority population.

Using data from 1980 census, Barringer, Takeuchi, and Xenos finds that Asian Americans do not receive income returns from education that are equal to those of Whites in his 1990 paper, "Education, occupation prestige, and income of Asian Americans".

Returns to education: convergent view

Other previous literatures indicate that the wage differential converges with increasing education.

Gwartney, in his 1970 paper, "Discrimination and Income Differentials", uses 1960 Census data and finds that the white-nonwhite wage differential decreases with higher education. He also finds that even after adjusting for productivity factors, the unexplained income differential still remains and is larger in the South than in the North.

In Ashraf's paper, "Differences in Returns to Education: An Analysis by Race" (1994), he finds that in the years 1967 through 1986, the returns to college education for Blacks were substantially higher than for Whites, while the return to high school education is about the same. In these years, the earnings gap is much smaller in unionized environments than environments without collective bargaining. He also finds that the gender earnings differential for Blacks dropped from 32% to 13% in these years.

III. DATA

The primary dataset I use for this study is the Consumer Expenditure Survey (CEX) collected for the Bureau of Labor Statistics by the U.S. Census Bureau. This survey provides information on buying habits and characteristics of households and individuals. Family level and member level extracts of this survey from years 1980 to 2003 are made available by Ed Harris and John Sabelhaus and posed online by the National Bureau of Economic Research (NBER). In these extracts, quarterly records for each household are matched to form one annual record, and

more than 500 detailed spending, income, and wealth categories are aggregated into 109 categories. This paper uses individual and family characteristics, as well as spending variables such as educational spending, including higher, lower, and other educational spending. The sum of all expenditures for each household is also used when calculating the proportion of educational spending relative to total expenditures. See Section IV, Data Appendix, for additional details.

In addition to the detailed household and member level data, I also collected aggregate yearly data from the Bureau of Labor Statistics website for years 2003 to 2007, separated by race. These aggregate data include educational spending, family income, and total expenditures. Various individual and family characteristics are also used in the analysis.

IV. EXPLORATORY DATA ANALYSIS

In the years 1980-2003, Black households on average earn \$13,000 less income (33% less) than White households (Table 18), while Asian households on average earn \$10,000 more (25% more) than White households. For educational spending, Black households on average spend \$240 less (44% less) than White households, while Asian households on average spend \$440 more (80% more) than White households. It appears that the differences in educational spending between races are proportionally greater than the differences in household income. Note that these differences are unconditional on other factors such as family structure, educational level, etc. Family size and the number of earners for each household are 0.4 and -0.2 persons greater, respectively, for Blacks than Whites, and 0.7 and 0.2 persons greater for Asians. The distribution of education level appears to be highest for Asians, followed by Whites, then Blacks. The average number of hours worked for Blacks appear to be lower than that of Whites, while Asians on average appear to be comparable to Whites.

As shown in Graph 1, average income increases with increasing education level. For each level of education, Asians on average have higher income than Whites, who have higher average income than Blacks.



Graph 1. Family Income by Race and Education

As shown in Graph 2, family income has been consistently increasing from years 1980 to 2008. Average Black household income is consistently lower than average White household income, while Average Asian household income is for the most part higher than average White household income. From 1930 to 2003, quarterly household level data is used. From 2003-2008, annual aggregate data is used.





Note: A local polynomial smoother using biweight kernel function with polynomial degrees 6, 6, and 4, for Whites, Blacks, and Asians, respectively, is used for years 1980-2003, and polynomial degrees 2, 2, and 2 for years 2003-2008.

Sumple Siz	le jor C	тарп 1	unu O	rupn 2									
YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	
White	3,724	3,399	3,614	3,970	3,969	2,054	4,578	2,218	2,008	4,022	3,999	4,052	
Black	486	416	450	511	512	241	575	265	234	504	516	538	
Asian	114	33	19	30	27	15	33	40	71	124	147	113	
TOTAL	4,324	3,848	4,083	4,511	4,508	2,310	5,186	2,523	2,313	4,650	4,662	4,703	
YEAR	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	TOTAL
White	4,017	4,089	3,840	1,780	3,977	4,031	5,049	5,320	5,338	5,515	5,825	3,001	93,389
Black	541	553	523	249	545	549	603	757	803	750	757	409	12,287
Asian	147	159	137	66	163	176	222	238	261	266	328	136	3,065
TOTAL	4,705	4,801	4,500	2,095	4,685	4,756	5,874	6,315	6,402	6,531	6,910	3,546	108,741
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Sample size for Graph 1 and Graph 2

Notes: Quarters with observations less than 10 are removed from this graph.

V. **EDUCATION**

A. EDUCATIONAL EXPENDITURE

Summary of results: average educational spending for Blacks have always been lower

and Asians higher than for Whites. This differential is increasing for both groups.

As mentioned previously, household educational spending (averaged over years from

1980-2003) is much greater for Asians than for White, while Blacks spend much less. This

section examines this difference visually and quantitatively.

Graph 3, Graph 4, Graph 5, and Graph 6 show the trend of educational spending from

years 1980 to 2008. In general, educational spending has been steadily increasing across all

racial groups. It appears that the educational spending gap has increased significantly over these

years. Average spending for Asians has increased more than for Whites, while spending by

Blacks has increased slower than for Whites. This is especially the case for higher educational spending than lower educational spending.



Graph 3. Total Educational Spending by Race and Year

Note: A local polynomial smoother using biweight kernel function with polynomial degrees 6, 6, and 4, for Whites, Blacks, and Asians, respectively, is used for years 1980-2003, and polynomial degrees 2, 2, and 2 for years 2003-2008.

Graph 4. Total Educational Spending as a proportion of Total Expenditures, by Race and Year



Note: A local polynomial smoother using biweight kernel function with polynomial degrees 6, 6, and 4, for Whites, Blacks, and Asians, respectively, is used for years 1980-2003, and polynomial degrees 2, 2, and 2 for years 2003-2008.

It appears from Graph 5 that higher educational spending accounts for most of the educational

spending differences between racial groups.

Graph 5. Higher Educational Spending by Race and Year



Note: This graph uses a local polynomial smoother using biweight kernel function with polynomial degrees 6, 6, and 4, for Whites, Blacks, and Asians, respectively.

Graph 6. Lower Educational Spending by Race and Year



Note: This graph uses a local polynomial smoother using biweight kernel function with polynomial degrees 6, 6, and 4, for Whites, Blacks, and Asians, respectively. *Sample size for Graph 3, Graph 4, Graph 5, and Graph 6*

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YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	
White	5,760	5,478	5,123	5,568	5,691	2,932	6,412	3,264	2,734	5,562	5,483	5,488	
Black	695	673	659	717	752	356	825	414	327	712	748	740	
Asian	179	76	27	38	47	22	42	54	105	187	211	172	
TOTAL	6,634	6,227	5,809	6,323	6,490	3,310	7,279	3,732	3,166	6,461	6,442	6,400	
YEAR	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	TOTAL
White	5,482	5,552	5,343	2,685	5,668	5,936	7,387	8,191	8,100	7,978	8,367	4,342	134,526
Black	764	770	778	390	830	837	996	1,207	1,247	1,152	1,202	630	18,421
Asian	229	219	205	121	270	280	342	419	410	423	489	207	4,774
TOTAL	6,475	6,541	6,326	3,196	6,768	7,053	8,725	9,817	9,757	9,553	10,058	5,179	157,721

Notes: Quarters with observations less than 15 are removed from these graphs.

From these graphs, it appears that for both higher educational spending and lower educational spending, Asians spend more than Whites, and Blacks spend less than Whites. The next section quantifies this difference.

a. TOTAL EDUCATIONAL SPENDING

Empirical Specification

Previously, I have graphically shown the differences in educational spending between racial groups unconditional on any controls. I now model and quantify this difference with additional controls. I start with the following models:

- (1a) $educ_i = \beta_0 + \beta_1 Black_i + \beta_2 Asian_i + X\gamma_1 + \varepsilon_i$
- (1b) $educp_i = \beta_0 + \beta_1 Black_i + \beta_2 Asian_i + X\gamma_1 + \varepsilon_i$

Where $educ_i$ is the total educational spending of household *i*, and $educp_i$ is the total educational spending of household *i* as a percent of their total expenditures. $X\gamma_1$ is a vector of year and regional controls. Each year except for year 1980, is an indicator (1 in the observation is in that year, 0 if not) for a total of 23 year indicators (first year is dropped to avoid collinearity). Each region except for urban is an indicator, or a total of 4 region indicators. Year fixed effects are added in order to take out and account for the baseline educational spending differences between years. Region fixed effects are added in order to take out and account for the totake out and account for the baseline educational spending differences between different regions.

I now add family structure controls to the previous models:

(2a) $educ_i = \beta_0 + \beta_1 Black_i + \beta_2 Asian_i + X\gamma_1 + X\gamma_2 + \varepsilon_i$

(2b)
$$educp_i = \beta_0 + \beta_1 Black_i + \beta_2 Asian_i + X\gamma_1 + X\gamma_2 + \varepsilon_i$$

 $X\gamma_2$ is a vector of family structure controls including income, age structures, and family size. Age is divided into 8 categories: 0-9, 10-19, ..., 60-69, 70+. Each category, except the first, is an indicator for whether an individual is in that age category. Income control is included because families with different incomes have different abilities to spend. Age structure is included because age of members and the number of children directly affects whether they would need spending in this area. Family size is included for a similar reason as age structure. Adding employment of head controls to the previous models:

(3a)
$$educ_i = \beta_0 + \beta_1 Black_i + \beta_2 Asian_i + X\gamma_1 + X\gamma_2 + X\gamma_3 + \varepsilon_i$$

(3b) $educp_i = \beta_0 + \beta_1 Black_i + \beta_2 Asian_i + X\gamma_1 + X\gamma_2 + X\gamma_3 + \varepsilon_i$

 $X\gamma_3$ is a vector of employment of head of household controls, including occupation, employment type, average hours worked per week, and weeks worked in the past year. Occupation is divided into 11 categories, from white collar to blue collar occupations to other types. Indicators for each category except the first are added to the regression. Employment type includes 5 categories: private company, government employee, self-employed, working without pay, or not indicated, each as an indicator except for the first. These controls are added to differentiate those with different types of jobs and hours worked. This controls for if certain racial groups tend to select into certain types of occupation and if they tend to work more than other groups.

Adding educational level of head controls to the previous models:

(4a)
$$educ_i = \beta_0 + \beta_1 Black_i + \beta_2 Asian_i + X\gamma_1 + X\gamma_2 + X\gamma_3 + X\gamma_4 + \varepsilon_i$$

(4b)
$$educp_i = \beta_0 + \beta_1 Black_i + \beta_2 Asian_i + X\gamma_1 + X\gamma_2 + X\gamma_3 + X\gamma_4 + \varepsilon_i$$

 $X\gamma_4$ is a vector of education level controls for the head of the household. Education level includes 5 categories, from no High school degree to Masters or Doctorate degree, each as an indicator except for the first. This controls for differences in education level between individuals, especially between racial groups.

Finally, I add marital status controls to the previous models:

(5a)
$$educ_i = \beta_0 + \beta_1 Black_i + \beta_2 Asian_i + X\gamma_1 + X\gamma_2 + X\gamma_3 + X\gamma_4 + X\gamma_5 + \varepsilon_i$$

(5b) $educp_i = \beta_0 + \beta_1 Black_i + \beta_2 Asian_i + X\gamma_1 + X\gamma_2 + X\gamma_3 + X\gamma_4 + X\gamma_5 + \varepsilon_i$

 $X\gamma_5$ is a vector of marital status controls. Marital status includes 3 categories: 1) married, 2) widowed divorced, or separated, and 3) never married, each as an indicator except for the first.

This controls for the effect of marital status on educational spending, and that different racial groups may have a different composition of marriage status.

See Section IV, Data Appendix, for more details on variables. Results are shown in Table 1.

Results

As shown in Table 1, Blacks have significantly less educational expenditure than comparable Whites, while Asians have much more. After each control is added, the coefficients on both Black and Asian become closer to 0. In other words, the differences between educational spending between Whites and Blacks or Whites and Asians becomes less as we control for year, region, family structure, employment, education, and marital status. Even after adding these controls, Black households on average still spend \$53 less on education than comparable Whites, while Asian households on average spend \$271 more. As a percent of total expenditures, Blacks spend 0.27% less, and Asians spend 1.49% more. These results are all highly significant.

	(1a)	(2a)	(3a)	(4a)	(5a)						
Total educational expenditure											
Number of observations: 131,0	087										
Black	-171 (-15.02)***	-114 (-9.99)***	-105 (-9.12)***	-62 (-5.55)***	-53 (-4.61)***						
Asian	407 (-15.02)***	335 (-9.99)***	329 (-9.12)***	271 (-5.55)***	271 (-4.61)***						
	(1b)	(2b)	(3b)	(4b)	(5b)						
Total educational expenditure as a proportion of total expenditure Number of observations: 131,052											
Black	-0.27% (-6.02)***	-0.34% (-7.33)***	-0.34% (-7.27)***	-0.19% (-4.20)***	-0.27% (-5.63)***						
Asian	1.78% (11.62)***	1.76% (11.58)***	1.73% (11.39)***	1.60% (10.64)***	1.49% (9.97)***						
Year & regional indicators	Yes	Yes	Yes	Yes	Yes						
Family structure controls: income, age, and size	No	Yes	Yes	Yes	Yes						
Employment of head controls	No	No	Yes	Yes	Yes						
Education level of head control	No	No	No	Yes	Yes						
Marital status of head control	No	No	No	No	Yes						

Table 1. Racial differences in total educational spending

Notes: Heteroskedasticity robust standard errors are used. t-statistics are shown in parentheses. *significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level. Employment controls includes occupation, employment type, hours worked, and weeks worked.

This section quantified the total education spending differences, and found significant differences in total education spending. The next section separates the spending into higher and lower educational spending.

b. HIGHER AND LOWER EDUCATIONAL SPENDING

Empirical Specification

Similar to specification (5), I now model higher and lower educational spending.

- (6a) $higheduc_i = \beta_0 + \beta_1 Black_i + \beta_2 Asian_i + X\gamma_1 + X\gamma_2 + X\gamma_3 + X\gamma_4 + X\gamma_5 + \varepsilon_i$
- (6b) $higheducp_i = \beta_0 + \beta_1 Black_i + \beta_2 Asian_i + X\gamma_1 + X\gamma_2 + X\gamma_3 + X\gamma_4 + X\gamma_5 + \varepsilon_i$
- (7a) $loweduc_i = \beta_0 + \beta_1 Black_i + \beta_2 Asian_i + X\gamma_1 + X\gamma_2 + X\gamma_3 + X\gamma_4 + X\gamma_5 + \varepsilon_i$
- (7b) $loweducp_i = \beta_0 + \beta_1 Black_i + \beta_2 Asian_i + X\gamma_1 + X\gamma_2 + X\gamma_3 + X\gamma_4 + X\gamma_5 + \varepsilon_i$

Where *higheduc_i* and *loweduc_i* are the higher educational and lower educational spending of household *i*, respectively, and *higheducp_i* and *loweducp_i* are the higher educational and lower educational spending of household *i*, respectively, as a percent of their total expenditures. All of the controls are the same as in specification (5). Results are shown in Table 2.

Next, I add an interaction term of race and marital status to see whether certain racial and marital status groups have significant deviations from average. Results are shown in Table 3.

(8)
$$\begin{aligned} higheduc_i &= \beta_0 + \beta_1 Black_i + \beta_2 Asian_i + \beta_3 DWS_i + \beta_4 Single_i + \\ &\beta_3 (Black_i * DWS_i) + \beta_4 (Black_i * single_i) + \beta_3 (Asian_i * DWS_i) + \\ &\beta_4 (Asian_i * single_i) + X\gamma_1 + X\gamma_2 + X\gamma_3 + X\gamma_4 + \varepsilon_i \end{aligned}$$

I have modeled and quantified the differences in educational spending between racial groups. The next models are similar to specification (6a) (6b) except that I analyze the differences in 5 year intervals to determine the trend.

(9a)
$$higheduc_i = \beta_0 + \beta_1(Black_i) + \beta_2(Asian_i) + X\gamma_{1b} + X\gamma_2 + X\gamma_3 + X\gamma_4 + X\gamma_5 + \varepsilon_i$$

(9b) $higheducp_i = \beta_0 + \beta_1(Black_i) + \beta_2(Asian_i) + X\gamma_{1b} + X\gamma_2 + X\gamma_3 + X\gamma_4 + X\gamma_5 + \varepsilon_i$

Where *higheduc_i* is the higher educational spending of household *i* for the corresponding years. $X\gamma_{1b}$ is a vector of region controls. Results are shown in Table 4.

Results

As shown in Table 2, conditional on all controls, Black households on average spend \$40 less on higher education, while Asians spend \$253 more. Although Blacks also spend less on lower education and Asians more, the difference is insignificant compared to Whites.

0				
	High educ (6a)	High educ (6b)	Low educ (7a)	Low educ (7b)
Black	-40 (-4.54)***	-0.34% (-8.65)***	-4 (-0.64)	0.11% (4.67)***
Asian	253 (7.41)***	1.38% (9.86)***	19 (0.92)	0.07% (1.60)
Observations	131,087	131,052	131,087	131,052

Table 2. Higher educational and lower educational expenditures

Notes: Heteroskedasticity Robust standard errors are used. t-statistics are shown in

parentheses. All with same controls as in specification (5). *significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

As shown in Table 3, Blacks who are divorced, widowed, or separated spend on average

\$47 more than comparable Whites. Asians who are single spend \$383 more on average than

comparable Whites.

Table 3. Racial and marital status differences in higher educational spending using specification(5) plus race and marital status of head of household interactions

	High educ (8)
Black	-51 (-3.07)***
Asian	147 (3.54)***
Divorced, widowed, separated (DWS)	-63 (-6.85)***
Single	31 (2.59)***
Black DWS	47 (2.53)**
Black single	-13 (-0.57)
Asian DWS	2 (0.03)
Asian single	383 (4.12)***

Notes: Robust standard errors are used. t-statistics are shown in parentheses. *significant at the 10% level; ** significant at the 1% level

As shown in Table 4, conditional on all controls, educational spending by Black

households is consistently less than White households, while Asian households spend

consistently more. This educational spending racial gap is generally increasing for both Blacks

and Asians. In the late 1980s, it appears that higher educational spending by Asians have increased significantly (also shown in Graph 5).

Tuble 4. Trena of highe	euncunonui	spenuing				
	1980-1984	1985-1989	1990-1994	1995-1999	2000-2003	
Higher educational expe	enditure (9a)					
Black	-24.8	-13.5	-54.5	-49.0	-40.7	
	(-2.40)**	(-0.60)	(-4.20)***	(-3.52)***	(-1.61)	
Asian	-38.4	235.6	207.6	301.0	241.0	
	(-1.42)	(2.13)*	(3.62)***	(5.16)***	(3.45)***	
Observations	20,264	12,677	28,561	35,245	34,340	
Higher educational expe	enditure as a p	roportion of to	otal expenditur	re (9b)		
Black	-0.22%	-0.38%	-0.37%	-0.34%	-0.33%	
	(-1.84)*	(-3.26)***	(-5.04)***	(-4.46)***	(-4.04)***	
Asian	-0.26%	1.66%	1.44%	1.65%	1.30%	
	(-0.74)	(2.64)***	(5.01)***	(6.55)***	(5.29)***	
Observations	20,234	12,677	28,561	35,244	34,336	

 Table 4. Trend of higher educational spending

Notes: t-statistics are shown in parentheses. *significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level

This section and the previous sections show that for both higher and lower educational spending, Blacks spend less and Asians spend more compared to Whites. Higher educational spending makes up most of the total educational spending and the higher educational spending differences between races is significant. The next section shows the differences in educational attainment. We would expect that this follows closely with educational spending.

B. EDUCATIONAL ATTAINMENT

Summary of results: On average, Blacks have always had a lower percent of higher educational attainment and Asians higher percent compared to Whites. This difference does not appear to be changing over these years for Blacks, but is diverging for Asians.

As shown in Graph 7 the percent of individuals with High school degree or lower is generally decreasing from years 1980 to 2003 for all racial groups. The percent of Blacks with

High school degree or lower is consistently over 10% higher than Whites, while Asians are over

10% lower except in the 1980s.



Graph 7. Percent with high school degree or lower

Note: This graph uses a local polynomial smoother using biweight kernel function with polynomial degrees 6, 6, and 3, for Whites, Blacks, and Asians, respectively.

Graph 8 shows that the trend of percent of individuals attending some college is generally

increasing over the years for all races. The percent of individuals in each racial group who

attended some college appears to be about the same.

Graph 8. Percent with some college degree



Note: This graph uses a local polynomial smoother using biweight kernel function with polynomial degrees 6, 6, and 4, for Whites, Blacks, and Asians, respectively.

From Graph 9, it appears that the percent of individuals with Bachelors degree or higher is increasing over the years. The Percent of Blacks with Bachelors degree or higher is consistently about 10% lower than Whites. The percent of Asians with Bachelors degree or higher is for the most part more than 10% higher than Whites. Due to low sample size for Asians in the 1980s, the averages in these years may not accurately reflect the population for this racial group.



Graph 9. Percent with Bachelors degree or higher

From Graph 10, it appears that the percent of individuals with Masters or Ph.D is increasing over the years. The Percent of Blacks with Masters or Doctorate is consistently about 3-4% lower than Whites. The percent of Asians with Masters or Doctorate is for the most part about 5% higher than Whites. Due to low sample size for Asians in the 1980s, the averages in these years may not accurately reflect the population for this racial group.

Graph 10. Percent with Masters or Doctorate



Note: This graph uses a local polynomial smoother using biweight kernel function with polynomial degrees 6, 6, and 4, for Whites, Blacks, and Asians, respectively.

Note: This graph uses a local polynomial smoother using biweight kernel function with polynomial degrees 6, 6, and 4, for Whites, Blacks, and Asians, respectively.

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YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	
White	10,634	10,037	9,288	10,086	10,262	5,227	11,581	5,805	5,047	10,057	9,937	9,826	
Black	1,275	1,210	1,168	1,266	1,403	638	1,440	756	563	1,239	1,258	1,289	
Asian	410	158	43	76	79	44	82	132	239	411	464	344	
TOTAL	12,319	11,405	10,499	11,428	11,744	5,909	13,103	6,693	5,849	11,707	11,659	11,459	
YEAR	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	TOTAL
White	9,756	9,847	9,520	4,761	9,934	10,262	12,841	14,534	14,575	14,191	14,877	7,645	240,530
Black	1,271	1,275	1,346	671	1,364	1,401	1,656	1,996	2,097	1,989	1,988	1,016	31,575
Asian	474	466	429	235	563	566	705	867	880	916	1,024	419	10,026
TOTAL	11,501	11,588	11,295	5,667	11,861	12,229	15,202	17,397	17,552	17,096	17,889	9,080	282,131

Sample size for Graph 7, Graph 8, Graph 9, and Graph 10

Notes: Quarters with observations less than 20 are removed from this graph.

Table 5 gives a numerical presentation of the educational attainment differences in 5-year intervals. It appears that Blacks have consistently more lower education and less higher education and Asians less lower education and more higher education compared to Whites. This difference does not appear to be changing throughout the years for Blacks. For Asians, the percent of Bachelors or higher is increasing, which is in line with the increase in higher educational spending.

	1980-1984	1985-1989	1990-1994	1995-1999	2000-2003
HS or lower					
Black	11.2%	11.3%	12.8%	11.7%	10.1%
Asian	-16.9%	-14.5%	-20.7%	-20.6%	-18.5%
Some College					
Black	-1.7%	-2.0%	-1.4%	-1.2%	-0.8%
Asian	2.5%	-0.2%	-1.2%	-2.4%	-3.4%
Bachelors or higher					
Black	-9.5%	-9.3%	-11.4%	-10.4%	-9.3%
Asian	14.4%	14.7%	21.9%	23.1%	21.9%
Masters or Doctorat	te				
Black	-3.1%	-3.7%	-4.5%	-3.9%	-3.4%
Asian	6.0%	5.3%	6.9%	7.8%	6.8%

Table 5. Educational Attainment differences relative to Whites

Overall, it appears that a significantly greater percent of Asians attained higher education than Whites, while a significantly lower percent of Blacks attained higher education than Whites. This result is consistent with the previous findings that Asians have higher and Blacks have lower educational spending than Whites. Whether this educational difference explains the wage difference between racial groups and whether higher education helps with the wage differential is analyzed in the next section.

VI. RETURNS TO EDUCATION & WAGE DIFFERENTIAL

Summary of results: The conditional Black-White wage differential appears to be converging especially with educational differences controls as shown in Table 9 and Table 10, however the Asian-White wage differential does not appear to be converging and controlling for educational differences exacerbates this differential. At a closer look, it appears that Black females with higher education have significantly more earnings than comparable Whites while Black males have comparably less earnings. The wage differential for Asian males with higher education have converged but not for Asian females, although converging.

As previously shown in Graph 1, average wage level increases with educational attainment for each racial group. This section examines the returns to education relative to one's own racial group and gender, and whether there are significant differences in wage levels between racial groups at each education level.

From Graph 11, it appears that on average Black individuals with High school degree or lower consistently earn less wages and salaries than Whites. Asians began to diverge and earn a lower wage than Whites in the late 1980s, but appears to be converging in the new millennium.

Graph 11. Wages and salaries of individuals with High School degree or lower



Note: This graph uses a local polynomial smoother using biweight kernel function with polynomial degrees 6, 6, and 4, for Whites, Blacks, and Asians, respectively.

sample siz	e jor C	тарп 1	1										
YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	
White	3,109	2,851	2,969	3,252	3,171	1,577	3,700	1,757	1,586	3,255	3,029	2,991	
Black	415	341	367	426	417	206	450	209	158	412	381	401	
Asian	119	27	16	23	26	15	25	41	75	111	119	84	
TOTAL	3,643	3,219	3,352	3,701	3,614	1,798	4,175	2,007	1,819	3,778	3,529	3,476	
YEAR	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	TOTAL
White	2,980	2,967	2,890	1,383	2,916	2,918	3,562	3,926	3,417	2,959	3,420	2,014	68,599
Black	352	359	364	169	382	377	416	511	484	396	408	211	8,612
Asian	107	102	108	54	140	129	151	176	165	121	168	73	2,175
TOTAL	3,439	3,428	3,362	1,606	3,438	3,424	4,129	4,613	4,066	3,476	3,996	2,298	79,386

Notes: Quarters with observations less than 5 are removed from this graph.

In Graph 12, it appears that Blacks consistently have a higher percent of zero wage and

salaries than Whites, while Asians fluctuate between Whites and Blacks.

Graph 12. Percent of individuals with High school degree or lower and zero wage



Note: This graph uses a local polynomial smoother using biweight kernel function with polynomial degrees 6, 6, and 4, for Whites, Blacks, and Asians, respectively.

~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	2												
YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	
White	8,702	8,150	7,417	8,025	8,088	4,051	9,225	4,534	4,132	7,824	7,725	7,495	
Black	1,153	1,099	1,044	1,128	1,251	569	1,271	671	496	1,084	1,096	1,142	
Asian	305	99	40	58	75	41	72	95	180	280	310	224	
TOTAL	10,160	9,348	8,501	9,211	9,414	4,661	10,568	5,300	4,808	9,188	9,131	8,861	
YEAR	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	TOTAL
White	7,424	7,421	7,206	3,712	7,698	7,967	9,801	11,149	11,220	10,782	11,326	5,828	186,902
White Black	7,424 1,118	7,421 1,092	7,206 1,194	3,712 591	7,698 1,200	7,967 1,218	9,801 1,446	11,149 1,747	11,220 1,783	10,782 1,705	11,326 1,743	5,828 844	186,902 27,685
White Black Asian	7,424 1,118 319	7,421 1,092 306	7,206 1,194 272	3,712 591 149	7,698 1,200 386	7,967 1,218 356	9,801 1,446 449	11,149 1,747 552	11,220 1,783 588	10,782 1,705 594	11,326 1,743 625	5,828 844 259	186,902 27,685 6,634
White Black Asian TOTAL	7,424 1,118 319 8,861	7,421 1,092 306 8,819	7,206 1,194 272 8,672	3,712 591 149 4,452	7,698 1,200 386 9,284	7,967 1,218 356 9,541	9,801 1,446 449 11,696	11,149 1,747 552 13,448	11,220 1,783 588 13,591	10,782 1,705 594 13,081	11,326 1,743 625 13,694	5,828 844 259 6,931	186,902 27,685 6,634 221,221

Sample size for Graph 12

Notes: Quarters with observations less than 15 are removed from this graph.

From Graph 13, it appears that Black and Asian individuals with Bachelors degree

consistently earn less wages and salaries than Whites.

Graph 13. Wages and salaries of individuals with Bachelors degree



Note: This graph uses a local polynomial smoother using biweight kernel function with polynomial degrees 6, 6, and 6, for Whites, Blacks, and Asians, respectively.

	~												
YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	
White	653	626	705	745	750	437	871	429	365	818	835	906	-
Black	32	43	49	56	52	25	62	26	37	67	77	66	
Asian	37	7	0	9	2	3	3	15	26	43	69	35	
TOTAL	722	676	754	810	804	465	936	470	428	928	981	1,007	_
YEAR	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	TOTAL
White	820	912	819	318	783	771	970	1,073	926	891	949	490	17,862
Black	63	77	49	26	61	62	54	77	85	53	63	46	1,308
Asian	46	51	66	24	70	65	65	84	78	76	103	38	1,015
TOTAL	929	1,040	934	368	914	898	1,089	1,234	1,089	1,020	1,115	574	20,185

Sample size for Graph 13

Notes: Quarters with observations less than 3 are removed from this graph.

In Graph 14, it appears that Blacks and Asians fairly consistently have a higher percent of

zero wage and salaries than Whites.

Graph 14. Percent of individuals with Bachelors degree and zero wage



Note: This graph uses a local polynomial smoother using biweight kernel function with polynomial degrees 6, 6, and 4, for Whites, Blacks, and Asians, respectively. Sample size for Graph 14

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YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	
White	1,410	1,316	1,339	1,465	1,530	846	1,659	892	604	1,541	1,538	1,640	
Black	82	87	95	104	113	50	125	71	60	115	126	118	
Asian	73	31	2	14	3	3	6	25	41	93	112	87	
TOTAL	1,565	1,434	1,436	1,583	1,646	899	1,790	988	705	1,749	1,776	1,845	
YEAR	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	TOTAL
White	1,629	1,709	1,630	727	1,519	1,578	2,031	2,332	2,275	2,337	2,405	1,176	37,128
Black	122	138	123	61	130	136	141	178	228	200	158	124	2,885
Asian	113	111	116	62	135	132	167	220	188	227	285	112	2,358
TOTAL	1,864	1,958	1,869	850	1,784	1,846	2,339	2,730	2,691	2,764	2,848	1,412	42,371

Notes: Quarters with observations less than 5 are removed from this graph.

From Graph 15, it appears that on average, Black individuals with Masters or Doctorate consistently earn less wages and salaries than Whites and this difference is increasing. Asians appear on average to earn about the same as Whites, however this results is weak due to a small sample size.

Graph 15. Wages and salaries of individuals with Masters or Doctorate



Note: This graph uses a local polynomial smoother using biweight kernel function with polynomial degrees 6, 6, and 4, for Whites, Blacks, and Asians, respectively.

sempre s	<b>__</b> <i>j</i> <b>o</b> .	0.00	10										
YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	
White	249	278	307	311	343	158	381	202	198	390	367	381	
Black	16	13	22	16	21	9	23	7	4	21	22	22	
Asian	18	8	1	3	1	0	2	9	12	20	21	16	
TOTAL	283	299	330	330	365	167	406	218	214	431	410	419	
YEAR	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	TOTAL
White	383	420	384	174	356	385	516	472	448	388	466	275	8,232
Black	16	22	17	7	23	22	27	32	39	29	30	19	479
Asian	22	30	22	14	20	38	36	27	30	30	40	18	438
TOTAL	421	472	423	195	399	445	579	531	517	447	536	312	9,149

Sample size for Graph 15

Notes: Quarters with observations less than 3 are removed from this graph.

It appears from Graph 16 Asians and Blacks generally have a higher percent of zero

wage.

Graph 16. Percent of individuals with Masters or Doctorate and zero wage



Note: This graph uses a local polynomial smoother using biweight kernel function with polynomial degrees 6, 4, and 4, for Whites, Blacks, and Asians, respectively. *Sample size for Graph 16* 

Sample S	20 901	Graph	10										
YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	
White	522	571	532	596	644	330	697	379	311	692	674	691	
Black	40	24	29	34	39	19	44	14	7	40	36	29	
Asian	32	28	1	4	1	0	4	12	18	38	42	33	
TOTAL	594	623	562	634	684	349	745	405	336	770	752	753	
YEAR	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	TOTAL
White	703	717	684	322	717	717	1,009	1,053	1,080	1,072	1,146	641	16,500
Black	31	45	29	19	34	47	69	71	86	84	87	48	1,005
Asian	42	49	41	24	42	78	89	95	104	95	114	48	1,034
TOTAL	776	811	754	365	793	842	1,167	1,219	1,270	1,251	1,347	737	18,539

Notes: Quarters with a single observation are removed from this graph.

#### **EMPIRICAL SPECIFICATION**

The previous section shows the wage difference between racial groups at each education level. In this section, I will model and quantify this difference, and with additional controls. I start with the following model:

(10) 
$$lwage_i = \beta_0 + \beta_1 Black_i + \beta_2 Asian_i + \beta_3 Male_i + X\gamma_1 + \varepsilon_i$$

Where *lwage* is the natural logarithm of wage.  $X\gamma_1$  is a vector of year and region controls as in the previous models. Our analysis is restricted to the individuals with strictly positive wage.

I then add hours and weeks worked controls to the previous model:

(11)  $lwage_{i} = \beta_{0} + \beta_{1}Black_{i} + \beta_{2}Asian_{i} + \beta_{3}Male_{i} + X\gamma_{1} + \eta_{1a}HoursWkd_{i} + \eta_{1b}WksWkd_{i} + \varepsilon_{i}$ 

Next, I add age controls to the previous model:

(12)  $lwage_{i} = \beta_{0} + \beta_{1}Black_{i} + \beta_{2}Asian_{i} + \beta_{3}Male_{i} + X\gamma_{1} + \eta_{1a}HoursWkd_{i} + \eta_{1b}WksWkd_{i} + \eta_{2a}Age + \eta_{2b}Age^{2} + \varepsilon_{i}$ 

I then add marital status controls to the previous model:

(13)  $lwage_{i} = \beta_{0} + \beta_{1}Black_{i} + \beta_{2}Asian_{i} + \beta_{3}Male_{i} + X\gamma_{1} + \eta_{1a}HoursWkd_{i} + \eta_{1b}WksWkd_{i} + \eta_{2a}Age + \eta_{2b}Age^{2} + X\gamma_{5} + \varepsilon_{i}$ 

Where  $X\gamma_5$  is a vector of marital status controls as in the previous models.

And finally, I add educational controls to the previous model:

(14)  $lwage_{i} = \beta_{0} + \beta_{1}Black_{i} + \beta_{2}Asian_{i} + \beta_{3}Male_{i} + \beta_{4}Bachelors_{i} + \beta_{5}MastDoct + X\gamma_{1} + \eta_{1a}HoursWkd_{i} + \eta_{1b}WksWkd_{i} + \eta_{2a}Age + \eta_{2b}Age^{2} + X\gamma_{5} + \varepsilon_{i}$ 

Results are shown in Table 6.

I now add race and education level interactions to differentiate between specific racial

groups at a certain education level, and I also differentiate between genders.

(15)  $lwage_{i} = \beta_{0} + \beta_{1}Bachelors_{i} + \beta_{2}MastDoct_{i} + \beta_{3}Black_{i} + \beta_{4}Asian_{i} + \beta_{5}(Black_{i}*Bachelors_{i}) + \beta_{6}(Black_{i}*MastDoct_{i}) + \beta_{7}(Asian_{i}*Bachelors_{i}) + \beta_{8}(Asian_{i}*MastDoct_{i}) + X\gamma_{1} + \eta_{1a}HrsWkd_{i} + \eta_{1b}WksWkd_{i} + \eta_{2a}Age + \eta_{2b}Age^{2} + X\gamma_{5} + \varepsilon_{i}$ 

This regression is run twice, once with females only and another with males only. This detailed analysis gives effects on wage specific to certain racial groups at certain education levels and to certain genders. Results are shown in Table 7. I also measure the wage differential by testing the following hypotheses using regression results from (15). Results are shown in Table 8.

Black-White wage differential for Bachelors: H₀:  $\beta_3 + \beta_5 = 0$ H_a:  $\beta_3 + \beta_5 \neq 0$ Black-White wage differential for Masters or Doctorate: H₀:  $\beta_3 + \beta_6 = 0$ H_a:  $\beta_3 + \beta_6 \neq 0$ Asian-White wage differential for Bachelors: H₀:  $\beta_4 + \beta_7 = 0$ H_a:  $\beta_4 + \beta_7 \neq 0$ Asian-White wage differential for Masters or Doctorate: H₀:  $\beta_4 + \beta_8 = 0$ H_a:  $\beta_4 + \beta_8 \neq 0$ 

Next, I examine the trend of the wage levels, using five-year intervals with model (13) except for year indicators. This model does not condition on education level. Results are shown in Table 9.

Next, I examine the trend of the wage levels, using five-year intervals with model (14), conditioned on education. This model does not differentiate gender specific race and education level effects. Results are shown in Table 10.

Then, I exam the trend of wage levels, using five-year intervals with model (14) except for year indicators, which includes interaction terms to differentiate between specific race and education level effects, for females. I also apply the same hypothesis tests as in model (14) to determine the direction, magnitude, and significant of wage differences. I then run the same model with males. Results are shown in Table 11, Table 12, Table 13, Table 14.

Since the previous models are conditioned on wage being strictly positive, I will model the probability that a certain individual has zero wage or salary and examine if there are significant differences between racial groups and education levels. To capture this, I use a logit model and report odds ratios:

(16) 
$$\frac{\Pr[nowage_i=1|\mathbf{X}_i]}{\Pr[nowage_i=0|\mathbf{X}_i]} = \exp[\beta_0 + \beta_1 Bachelors_i + \beta_2 MastDoct_i + \beta_3 Black_i + \beta_4 Asian_i + \beta_5 (Black_i * Bachelors_i) + \beta_6 (Black_i * MastDoct_i) + \beta_6 ($$

$$\beta_7(Asian_i * Bachelors_i) + \beta_8(Asian_i * MastDoct_i) + \beta_9 Male_i + X\gamma_{1b} + \eta_{2a}Age + \eta_{2b}Age^2 + X\gamma_5 + \varepsilon_i]$$

Where  $X\gamma_{1b}$  is a vector or regional controls and  $X\gamma_5$  is a vector of marital status controls, as specified in previous models. This regression is run for each of the five-year intervals and for all years. Results are shown in Table 15. Similar to the idea in model (14), I also test relative to Whites with the same education level, whether Blacks or Asians have different probabilities of having zero wage. The following  $\beta$  coefficients corresponds to odds ratios. Results are shown in Table 16.

> Black-White no wage odds for Bachelors: H₀:  $\beta_3 * \beta_5 = 1$ H_a:  $\beta_3 * \beta_5 \neq 1$ Black-White no wage odds for Masters or Doctorate: H₀:  $\beta_3 * \beta_6 = 1$ H_a:  $\beta_3 * \beta_6 \neq 1$ Asian-White no wage odds for Bachelors: H₀:  $\beta_4 * \beta_7 = 1$ H_a:  $\beta_4 * \beta_7 \neq 1$ Asian-White no wage odds for Masters or Doctorate: H₀:  $\beta_4 * \beta_8 = 1$ H_a:  $\beta_4 * \beta_8 \neq 1$

#### RESULTS

Pooled Across All Years

Table 6 shows the differences in log wage between races. With only year and regional indicators, Blacks earn 15% less and Asians earn 0% less than Whites. Males earn 55% more than females. These differences are the total wage differentials. Additional individual characteristic controls are added to capture the residual wage differential, which to an extent can be considered the wage differential due to discrimination if heterogeneity between individuals are properly controlled for. When controlling for other individual characteristics expect for education level, the wage differential decreases to 10% for Blacks and increased to 2% for

Asians. Adding educational controls, the wage differential decreases to 6% for Blacks, but is increased to 6% for Asians. In combination with previous results that Blacks have lower average education level than White and Asians have higher average education level than Whites, the decrease in wage differential for Blacks when educational controls are added is not surprising, but for Asians, this decrease indicates that with the same education level, Asians earn on average lower wages than Whites. After all indicated controls are added, an individual with a Bachelors degree on average earn 34% more than with only a High school degree. An individual with a Masters or Doctorate on average earn 48% more than with only a High school degree. Blacks and Asians earn 6% less than comparable Whites, and males earn 25% more than females. These estimates are all highly significant.

	(10)	(11)	(12)	(13)	(14)
Black	-0.15 (-12.10)***	-0.11 (-11.80)***	-0.11 (-13.10)***	-0.10 (-11.01)***	-0.06 (-6.49)***
Asian	0.00 (-0.25)	-0.02 (-1.35)	-0.02 (-1.11)	-0.02 (-1.33)	-0.06 (-4.48)***
Male	0.55 (82.84)***	0.23 (46.91)***	0.26 (56.04)***	0.25 (53.89)***	0.25 (54.75)***
Bachelors					0.34 (56.48)***
Masters or Doctorate					0.48 (52.43)***
Year & regional indicators	Yes	Yes	Yes	Yes	Yes
Hrs and wks wkd controls	No	Yes	Yes	Yes	Yes
Age controls	No	No	Yes	Yes	Yes
Marital Status controls	No	No	No	Yes	Yes
Educational controls	No	No	No	No	Yes
$R^2$	0.12	0.57	0.60	0.60	0.62

*Table 6. Wage differential by race and gender* 

Notes: Robust standard errors (clustered by household) are used. t-statistics are shown in parentheses. *significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level

Table 7 and Table 8 show the differences in log wage between different education levels and between different races with interactions. Returns to Bachelors degree is 37% for females and 30% for males. Returns to Masters or Doctorate is 54% and 39% for females and males, respectively. Black females without higher education earn 5% less, and Asian females without higher education earn 4% less than White females without higher education, and Black males without higher education earn 11% less, and Asian males without higher education earn 12% less than White males without higher education. Black females with Bachelors earn 3% more than White females with Bachelors, but insignificant. Black females with Masters or Doctorate earn 17% more than White females with Masters or Doctorate. Black males with Bachelors earn 14% less than White males with Bachelors, and 8% less (but insignificant) for Ph.Ds.. Asian males with Bachelors, Masters or Doctorate earn about the same as White Males with Doctorate. Overall, it appears that the wage difference between racial groups diminishes with higher education, and sometimes even becomes the opposite, i.e. wage level surpasses baseline Whites. This is the case for Black females, who obtain higher education. A Black female on average obtain 45% (37%+8%) higher wages from a Bachelors degree and 76% (54%+22%) higher wages from a Masters or Doctorate. At this rate, the average wage of a Black female surpasses that of a White female for those with higher education.

	Female	Male
Bachelors	0.37	0.30
	(40.26)***	(34.64)***
Masters/Doctorate	0.54	0.39
	(40.53)	(29.64)***
Black	-0.05	-0.11
Diwon	(-4.29)***	(-8.62)***
Asian	-0.04	-0.12
1 101411	(-1.86)*	(-5.19)***
<b>Black Bachelors</b>	0.08	-0.03
Didek Duchelois	(2.79)***	(-0.88)
Black Masters/Doctorate	0.22	0.04
Didek Wasters Doctorate	(5.72)***	(0.56)
Asian Bachelors	0.00	0.06
Asian Dachelors	(0.10)	(1.34)
Agian Mastars/Doctorata	0.01	0.12
Asian Masiers/Duciolate	(0.16)	(3.04)***
R ²	0.64	0.57

Table 7. Returns to education by race and gender with interactions

Note: Specification (15). Robust standard errors (clustered by household) are used. t-statistics are shown in parentheses. *significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level

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Table 8.	Wage	differential-	compare	d to	Whites	with	<u>sim</u> ilar	education	levels

	Female	Male
Black Bachelors	0.03 (1.13)	-0.14 (-4.95)***
Black Masters/Doctorate	0.17 (4.60)***	-0.08 (-1.14)
Asian Bachelors	-0.04 (-1.29)	-0.07 (-1.86)*
Asian Masters/Doctorate	-0.03 (-0.52)	0.01 (0.23)

Note: t-statistics are shown in parentheses. *significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level

#### In 5-year Intervals

From Table 9, it appears that the conditional wage differential is steadily decreasing for Blacks. For Asians, the wage differential remains insignificantly different compared to Whites. For males, the wage differential is gradually decreasing.

10000 11	age anjjer enna	e e e l'anno near en c	an conn on enpee	t entreation tien	-01
	1980-1984	1985-1989	1990-1994	1995-1999	2000-2003
Black	-0.14 (-7.51)***	-0.13 (-5.56)***	-0.10 (-5.47)***	-0.08 (-4.28)***	-0.04 (-1.91)*
Asian	-0.03 (-0.56)	-0.02 (-0.40)	-0.03 (-1.02)	-0.04 (-1.54)	0.02 (0.71)
Male	0.33 (32.66)***	0.27 (23.40)***	0.25 (24.91)***	0.22 (21.77)***	0.20 (17.45)***
$\mathbb{R}^2$	0.63	0.60	0.60	0.58	0.57
# of obs	22,902	18,240	24,270	23,862	19,446

Table 9. Wage differential conditioned on all controls expect education- trend

Notes: Robust standard errors (clustered by household) are used. t-statistics are shown in parentheses. *significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level. With same controls as in specification (13) minus year indicators

From Table 10, the returns to higher education are increasing over the years. The wage differential between Blacks and Whites diminished to virtually zero over these years. The wage differential between Asians and Whites, however, still remains non-zero, over 4%. The wage differential between genders has dropped from 33% to 21% from years 1980 to 2003.

	1980-1984	1985-1989	1990-1994	1995-1999	2000-2003
Bachelors	0.28	0.34	0.33	0.39	0.38
	(19.33)***	(23.32)***	(25.95)***	(30.91)***	(26.45)***
Masters or	0.40	0.43	0.45	0.55	0.52
Doctorate	(19.46)***	(17.16)***	(25.10)***	(29.95)***	(24.27)***
Black	-0.11	-0.09	-0.05	-0.03	0.00
	(-5.89)***	(-3.96)***	(-2.99)***	(-1.86)*	(0.02)
Asian	-0.04	-0.04	-0.07	-0.09	-0.04
	(-0.88)	(-0.93)	(-2.46)**	(-3.63)***	(-1.61)
Male	0.33	0.27	0.25	0.22	0.21
	(32.67)***	(23.16)***	(25.00)***	(22.80)***	(18.54)***
$R^2$	0.63	0.60	0.60	0.58	0.57
# of obs	22,902	18,240	24,270	23,862	19,446

Table 10. Wage differential and returns to higher education- trend

Notes: Robust standard errors (clustered by household) are used. t-statistics are shown in parentheses. *significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level. With same controls as in specification (14) minus year indicators

#### Females

Table 11 and Table 12 displays the trends for females. Similar to the previous results, returns to higher education has increased over the years. The Black-White wage differential has diminished to virtually zero over the years for females, while the Asian-White wage differential is still non-zero, but is insignificant. It appears, conditional on all controls, the wage level of Black females with bachelors is consistently a bit higher than compared to White females with bachelors. The wage level of Black females with Masters or Doctorate is significantly much higher than White females with Masters or Doctorate but is diminishing over these years. The conditional wage differential between Asians and Whites is insignificantly different from 0 for all education levels.

It appears that the returns to higher education for Asian women are generally insignificantly different than the returns for White women. Black women, however, have over a 10% higher return to Bachelors degree than White women, and this higher return has stayed fairly constant over the years. Black women also have a much higher return to a Masters Degree or Doctorate, but this additional return compared to White women dropped from 31% in the early 1980s to 13% in the early 2000s.

Tuble 11. Relai	ns io nigher eu	acanon irena w		Temules	
	1980-1984	1985-1989	1990-1994	1995-1999	2000-2003
Bachelors	0.34	0.37	0.36	0.42	0.37
	(15.98)***	(17.52)***	(18.53)***	(22.15)***	(15.88)***
Masters or	0.53	0.47	0.48	0.61	0.61
Doctorate	(16.44)***	(13.14)***	(16.49)***	(22.16)***	(22.35)**
Black	-0.11	-0.10	-0.02	-0.04	0.01
	(-4.15)***	(-3.10)***	(-0.84)	(-1.69)*	(0.25)
Asian	-0.09	0.02	-0.02	-0.05	-0.05
	(-1.07)	(0.34)	(-0.38)	(-1.15)	(-1.15)
Black	0.12	0.13	-0.03	0.09	0.13
Bachelors	(1.93)*	(2.33)**	(-0.41)	(1.32)	(2.19)**
Black Masters	0.31	0.27	0.22	0.19	0.13
or Doctorate	(2.96)***	(2.28)**	(2.35)**	(2.64)***	(1.76)*
Asian	-0.05	-0.17	0.01	0.00	0.06
Bachelors	(-0.42)	(-1.26)	(0.17)	(-0.04)	(0.73)
Asian Masters	-0.05	-0.22	0.10	-0.01	0.01
or Doctorate	(-0.38)	(-0.74)	(0.76)	(-0.05)	(0.11)
$R^2$	0.65	0.62	0.59	0.59	0.57
# of obs	10,662	8,806	11,843	11,716	9,597

 Table 11. Returns to higher education trend with interactions- Females

Notes: Robust standard errors (clustered by household) are used. t-statistics are shown in parentheses. *significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level. With same controls as in specification (14) minus year indicators.

	1980-1984	1985-1989	1990-1994	1995-1999	2000-2003
Black	0.01	0.04	-0.05	0.05	0.14
Bachelors	(0.21)	(0.75)	(-0.76)	(0.73)	(2.54)**
Black Masters	0.20	0.17	0.19	0.14	0.14
or Doctorate	(1.95)*	(1.53)	(2.19)**	(2.16)**	(1.99)*
Asian	-0.14	-0.15	-0.01	-0.05	0.01
Bachelors	(-1.76)*	(-1.20)	(-0.12)	(-1.01)	(0.09)
Asian Masters	-0.14	-0.21	0.08	-0.06	-0.04
or Doctorate	(-1.47)	(-0.69)	(0.67)	(-0.49)	(-0.32)

 Table 12. Wage differential trend compared to Whites with similar education levels- Females

Notes: t-statistics are shown in parentheses. *significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level. With same controls as in specification (14) minus year indicators.

Graph 17 and Graph 18 visualizes Table 12. The wage differential appears to have improved significantly for Black Females without higher education, improved a bit for Bachelors, and remained about the same high level for Masters or Doctorate. For Asians, the standard error appears to be too large to make any significant conclusions.



Graph 17. Black-White Female Wage Differential

Note: 95% confidence interval denoted by dashed lines.



Graph 18. Asian-White Female Wage Differential



Graph 19 shows the wage level of Black and White females with Bachelors degree unconditional on controls. Asians are omitted due to small sample size. It appears that the wage levels are generally insignificantly different. This result is fairly consistent with the results in Table 8 and Table 12, where Black wages are a bit higher than White wage but the significance is fairly weak, mainly due to sample size.



Graph 19. Wages of Females with Bachelors degree

Note: This graph uses a local polynomial smoother using biweight kernel function with polynomial degrees 6 and 6 for Whites and Blacks, respectively.

Sector 2	// <b>_</b>	0.000	17										
YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	
White	276	258	323	322	320	186	406	208	165	376	376	419	
Black	15	24	30	38	32	10	36	16	26	34	45	38	
TOTAL	291	282	353	360	352	196	442	224	191	410	421	457	
YEAR	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	TOTAL
White	402	439	378	147	388	379	453	519	425	441	439	232	8,277
Black	37	44	27	15	39	33	32	45	49	32	39	30	766
TOTAL	439	483	405	162	427	412	485	564	474	473	478	262	9,043

Sample size for Graph 19

Notes: Quarters with observations less than 5 are removed from this graph.

Graph 20 shows the wage level of Black and White females with Masters or Doctorate unconditional on controls. Asians are omitted due to small sample size. It appears that the average wage level for Blacks are consistently higher than for Whites at this education level, although a small sample size for Blacks makes this result insignificant. Conditioning on all controls, as in specification (14), the magnitude of the wage difference is magnified, as shown in Table 12.

Graph 20. Wages of Females with Masters or Doctorate



Note: This graph uses a local polynomial smoother using biweight kernel function with polynomial degrees 6 and 6 for Whites and Blacks, respectively. Sample size for Graph 20

sumple si	2e j0i	Orupn	20										
YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	
White	86	95	118	95	133	52	152	63	82	146	143	136	
Black	11	7	12	9	12	6	14	5	2	10	10	7	
TOTAL	97	102	130	104	145	58	166	68	84	156	153	143	
YEAR	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	TOTAL
White	151	173	173	77	163	169	215	209	219	188	232	131	3,401
Black	8	14	12	5	14	12	13	21	26	17	18	10	275
TOTAL	159	187	185	82	177	181	228	230	245	205	250	141	3,676

Notes: Quarters with observations less than 3 are removed from this graph.

#### Males

Table 13 and Table 14 displays the trends for males. Similar to the previous results, returns to higher education has increased over the years. The Black-White wage differential for males appears to be converging but has not diminished to zero, while the Asian-White wage differential appears to be increasing, with Asian males earning less. It appears conditional on all controls, the Black-White wage differential for males with higher education is not significantly different than the wage differential for males with lower education. Asian-White wage differential for those with Bachelors degree seems to be generally insignificantly different than compared to lower education individuals; however it appears that Asian Males with Masters or Doctorate earn significantly more than comparable Whites in the later years. In the earlier years, Asian Males with Masters or Doctorate earned significantly less than White Males with Masters or Doctorate. This difference is steadily and completely reversed from 1980 to 2003.

The returns to higher education for Black males appear to be insignificantly different from the returns to higher education for White males. For Asian males, the returns appear to be roughly increasing for obtaining a Bachelors Degree and significantly increasing for obtaining a Masters Degree or Doctorate. In the early 1980s, the average return to a Masters or Doctorate for Asian males is surprisingly -3% (30%-33%). These returns are increased to 65% (39%+26%) in the early 2000s. The return to a Masters or Doctorate appears for Asian male appear to significantly surpass the return for a White male, on average. Due to this high return, the average wage level of an Asian male surpasses that of a White male both with a Masters or Ph.D, in the recent years.

	1980-1984	1985-1989	1990-1994	1995-1999	2000-2003
Bachelors	0.22	0.29	0.29	0.35	0.36
	(10.93)***	(13.69)***	(16.19)***	(19.73)***	(17.45)***
Masters or	0.30	0.39	0.38	0.47	0.39
Doctorate	(12.22)***	(10.67)***	(16.15)***	(16.74)***	(10.50)***
Black	-0.15	-0.17	-0.13	-0.05	-0.08
	(-5.81)***	(-4.33)***	(-4.73)***	(-1.89)*	(-2.58)***
Asian	0.06	0.00	-0.21	-0.16	-0.13
	(0.86)	(-0.05)	(-3.66)***	(-3.92)***	(-2.74)***
Black	-0.19	0.11	0.00	-0.11	0.05
Bachelors	(-2.24)**	(1.67)*	(-0.05)	(-1.69)*	(0.73)
Black Masters	-0.14	0.07	0.19	-0.03	0.05
or Doctorate	(-0.49)	(0.64)	(2.39)**	(-0.35)	(0.40)
Asian	0.00	-0.15	0.17	-0.05	0.14
Bachelors	(-0.04)	(-0.96)	(1.99)**	(-0.65)	(1.87)*
Asian Masters	-0.33	-0.13	0.16	0.19	0.26
or Doctorate	(-2.32)**	(-1.06)	(1.73)*	(2.20)**	(3.37)***
$\mathbb{R}^2$	0.57	0.54	0.56	0.54	0.54
# of obs	12,240	9,434	12,427	12,427	9,849

 Table 13. Returns to higher education trend with interactions- Males

Notes: Robust standard errors (clustered by household) are used. t-statistics are shown in parentheses. *significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level. With same controls as in specification (14) minus year indicators.

10000 100 10 10 00						_
	1980-1984	1985-1989	1990-1994	1995-1999	2000-2003	
Black	-0.34	-0.06	-0.13	-0.16	-0.04	
Bachelors	(-4.22)***	(-1.08)	(-2.26)**	(-2.66)***	(-0.63)	
Black Masters	-0.29	-0.10	0.06	-0.08	-0.03	
or Doctorate	(-1.01)	(-1.03)	(0.84)	(-0.91)	(-0.28)	
Asian	0.05	-0.15	-0.04	-0.21	0.01	
Bachelors	(0.47)	(-1.03)	(-0.63)	(-2.93)***	(0.20)	
Asian Masters	-0.28	-0.13	-0.05	0.03	0.13	
or Doctorate	(-2.18)**	(-1.30)	(-0.62)	(0.40)	(2.07)**	

Table 14. Wage differential trend compared to Whites with similar education levels- Males

Notes: t-statistics are shown in parentheses. *significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level. With same controls as in specification (14) minus year indicators.

Graph 21 and Graph 22 visualizes Table 14. It appears that Black males with High school degree or lower or with a Bachelors degree consistently earn less than comparable Whites. The wage differential appears to converge with a Masters or Doctorate. For Asian males with High school degree or lower or with a Bachelors degree, the wage differential appears to be getting worse, but for the individuals with a Masters or Doctorate, the wage differential appears to be disappearing, and then reversing in favor of Asians.





Note: 95% confidence interval denoted by dashed lines.





Note: 95% confidence interval denoted by dashed lines.

Graph 23 shows the wage level of Black and White Males with Bachelors degree unconditional on controls. Asians are omitted due to small sample size. It appears that Black males earn significantly less than White males. This result is consistent with Table 8 and Table 14, which are conditioned on controls. Although not obvious in this graph, it seems that the conditional wage gap is somewhat decreasing from Table 14.

Graph 23. Wages of Males with Bachelors degree



Note: This graph uses a local polynomial smoother using biweight kernel function with polynomial degrees 6 and 6 for Whites and Blacks, respectively.

T T		- · · r	-										
YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	
White	377	368	382	423	430	251	465	221	200	442	459	487	
Black	17	19	19	18	20	15	26	10	11	33	32	28	
TOTAL	394	387	401	441	450	266	491	231	211	475	491	515	
YEAR	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	TOTAL
White	418	473	441	171	395	392	517	554	501	450	510	258	9,585
Black	26	33	22	11	22	29	22	32	36	21	24	16	542
TOTAL	444	506	463	182	417	421	539	586	537	471	534	274	10,127
N ( O	4 14	1	1 /1	5	1	с .d.:	1						

Sample size for Graph 23

Notes: Quarters with observations less than 5 are removed from this graph.

Graph 24 shows the wage level of Black and White Males with Masters or Doctorate unconditional on controls. Asians are omitted due to small sample size. It appears that the average wage levels for Blacks are consistently lower than for Whites, however the small sample size makes this results insignificant. Table 14 shows this difference conditioned on all controls, and indicates that this wage difference is generally insignificant, though Table 8 indicates that overall, there still may be a bit of a difference.

Graph 24. Wages of Males with Masters or Doctorate



Note: This graph uses a local polynomial smoother using biweight kernel function with polynomial degrees 6 and 4 for Whites and Blacks, respectively. Sample size for Graph 24

Sumple s	120 101	Gruph	47										
YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	
White	163	183	189	216	210	106	229	139	116	244	224	245	
Black	5	6	10	7	9	3	9	2	2	11	12	15	
TOTAL	168	189	199	223	219	109	238	141	118	255	236	260	
YEAR	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	TOTAL
White	232	247	211	97	193	216	301	263	229	200	234	144	4,831
Black	8	8	5	2	9	10	14	11	13	12	12	9	204
TOTAL	240	255	216	99	202	226	315	274	242	212	246	153	5,035

Notes: Quarters with observations less than 3 are removed from this graph.

#### No Wage

From Table 15 and Table 16, it appears that overall, a White individual with a Bachelors degree has the probability of having zero-wage change by a factor of 0.77 compared to without and by a factor of 0.72 for a Masters or Doctorate. A Black and Asian individual without higher education compared to a White individual have a significantly higher probability of having zero-wage, higher by a factor of 1.36, and 1.24, respectively. With higher education, the Black-White probability difference is diminished, but the Asian-White probability difference is exacerbated. For Blacks with Bachelors and Blacks with Masters or Doctorate, the probability of having zero-wage relative to Whites without higher education, in addition to the baseline factor for higher education, is 0.86 for Bachelors and 0.79 for Masters or Doctorate. This appears to be fairly constant over the years. For Asians, this factor is 1.07 (but insignificant) for Bachelors and 1.30 for Masters or Doctorate. This indicates that in addition to the factor of Asians with higher

probability of having no wage relative to Whites, higher education exacerbates this difference. Overall, the zero-wage probability of an Asian who attains a Masters or Doctorate changes by a factor of 0.94 (0.72*1.30). Over the years, the factor for Males increased from 0.71 in the early 1980s to 0.87 in the yearly 2000s, indicating that the percent of females with zero wages is converging with that of males. This may be because of the increasing number of females working than staying at home.

	0	0	/			
	1980-1984	1985-1989	1990-1994	1995-1999	2000-2003	All years
Bachelors	0.81	0.75	0.75	0.77	0 79	0.77
Daeneiors	(-7.05)***	(-8 77)***	(-10 42)***	(-9 56)***	(-8.42)***	(-20 33)***
	( /)	( 0., , )	(10.12)	().00)	( 0)	(20.00)
Masters or	0.79	0.72	0.70	0.68	0.74	0.72
Doctorate	(-5.30)***	(-6.72)***	(-8.64)***	(-9.88)***	(-7.47)***	(-17.65)***
Dootoiute						
Black	1.23	1.30	1.46	1.42	1.40	1.36
	(5.55)***	(5.96)***	(10.20)***	(9.82)***	(8.76)**	(17.93)***
Asian	1.15	1.08	1.23	1.15	1.29	1.24
	(1.26)	(0.73)	(2.97)***	(2.30)**	$(4.00)^{***}$	(6.47)***
	0.04	0.04	0.70	0.00	0.05	0.07
Black	0.84	0.84	0.70	0.89	0.95	0.86
Bachelors	(-1.54)	(-1.52)	(-3.54)***	(-1.19)	(-0.60)	(-3.40)***
Black Masters	0.77	0.94	0.50	0.81	0.77	0.70
Diack Masters	(-1.42)	(-0.31)	(-2.90)***	(-1.38)	(-1.88)*	(-3.08)***
or Doctorate	(-1.+2)	(-0.51)	(-2.90)	(-1.58)	(-1.00)	(-5.08)
Asian	1.21	1.04	1.01	1.14	0.94	1.07
Bachelors	(0.80)	(0.18)	(0.08)	(1.26)	(-0.63)	(1.12)
Ducherons					~ /	
Asian Masters	1.31	0.86	1.09	1.48	1.28	1.30
or Doctorate	(0.86)	(-0.51)	(0.49)	(2.70)***	(1.64)	(3.25)***
Male	0.71	0.81	0.81	0.82	0.87	0.80
	(-21.48)***	(-11.78)***	(-13.38)***	(-12.94)***	(-9.13)***	(-31.06)***
# of obs	57,395	43,261	57,502	62,356	61,617	282,131

 Table 15. No wage trend (logit- odds ratios)

Notes: Robust standard errors (clustered by household) are used. z-statistics are shown in parentheses. *significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level. With regional indicators, age controls, and marital status controls.

	1980-1984	1985-1989	1990-1994	1995-1999	2000-2003	All years
Black	1.04	1.09	1.03	1.27	1.33	1.16
Bachelors	(0.33)	(0.75)	(0.27)	(2.66)***	(3.15)***	(3.52)***
Black Masters	0.94	1.22	0.86	1.16	1.08	1.08
or Doctorate	(-0.31)	(0.94)	(-0.84)	(0.98)	(0.54)	(1.04)
Asian	1.39	1.12	1.24	1.32	1.21	1.33
Bachelors	(1.55)	(0.60)	(1.97)**	(3.00)***	(2.15)**	(5.59)***
Asian Masters	1.51	0.93	1.34	1.70	1.65	1.62
or Doctorate	(1.40)	(-0.27)	(1.84)*	(4.01)***	(3.68)***	(6.45)***

Table 16. No wage trend odds ratios compared to Whites with same education level

Notes: z-statistics are shown in parentheses. *significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level

Graph 25 and Graph 26 visualize Table 16. It appears that compared to Whites with High school degree or lower, Blacks with the same level of education have consistently higher probability of no wage. The no wage factor for Blacks with Bachelors in the early 1990s start to diverge, while for those with Masters or Doctorate, the difference is insignificant. Generally, the no wage factor for Blacks seems to converge with increasing education. For Asians, the no wage factor for High school degree or lower, and for Bachelors is generally greater than 1, meaning higher probability of no wage compared to Whites at same education level, but the difference is on the edge of being significant and insignificant at the 95% confidence level. For Asians with Doctorate, the factor is rising over the years and is significant.



Graph 25. No wage trend odds ratios- Black-White

Note: 95% confidence interval denoted by dashed lines.



Graph 26. No wage trend odds ratios- Asian-White

Note: 95% confidence interval denoted by dashed lines.

#### VII. SUMMARY OF RESULTS & CONCLUSION

Unconditional on individual or family characteristics, Asians have higher and Blacks have lower family income than Whites. This trend appears to be diverging between the years 1980 and 2008. Previous research has indicated that some of this income or wage difference can be explained by differences in individual characteristics such as educational attainment, and the rest possibly due to discrimination. Over these years, household educational spending, especially in higher education has increased significantly for Asians relative to Whites, while Blacks have spent comparatively less. Asian singles have especially spent much more on higher education than any other groups. Not surprisingly, there is a significant rise in the percent of Asians relative to Whites who obtained a higher educational degree, while Blacks remained significantly lower than Whites. Though income levels for each racial group seem to reflect educational attainment of each group, there exist significant differences in returns to education for each group and significant wage level differences conditional on education and individual characteristics.

Pooling across all years and education levels and unconditional on individual characteristics, Blacks appear to have on average 15% less wages than Whites and Asians have virtually no difference in wages than Whites (Table 6). This difference is diminished to 6% for blacks and increased to -6% for Asians when controlling for individual characteristics and education level (Table 6). Also from Table 6, when controlling for education level, the Black-White wage differential decreases by 4% while the Asian-White wage differential increases by 4%. This is expected for Blacks, as their average education level is lower, however for Asians, this decrease indicates that Asians on average earn lower wages given the same education level as Whites. Wages are 55% and 25% higher for males than females unconditional and conditional on individual characteristics, respectively (Table 6). The wage differential for Black males (-11%) or Asian males (-12%) compared to White males is much greater than for Black females (-

5%) or Asian females (-4%) compared to White females (Table 7). This difference is diminished with higher education for females of minority groups, but generally not for males (Table 7 and Table 8).

Over the years 1980 through 2003, conditional on individual controls, wage differential for Black females without higher education has disappeared, and the wage differential for Black females with higher education has reversed (Table 11 and Table 12). In the latter years, Black females with higher education enjoy on average 14% higher wages than comparable White females. For Asian females, however, the wage gap still exists across all education levels, though insignificant due to small sample size. For Black males without higher education, the wage differential is diminishing but still significant, while for Asian males without higher education, the wage differential is generally increasing, but decreasing in the latter years (Table 13 and Table 14). With higher education, the wage differential generally does not change for Black males, but for Asian males, higher education diminishes and reverses the wage differential. In more recent years, Asian males with masters or doctorate enjoys on average 13% higher wages than comparable White males.

Although on the surface, it may appear that Asians have higher incomes and Blacks have lower incomes than Whites, a careful analysis shows that there are significant difference between males and females of different race and across different education levels. Relative to comparable Whites, Asian females, Asian males with lower education, and Black males, are at a disadvantage, while Black females, especially those with higher education, and Asian males with highest education are at an advantage.

These results have important policy implications. The complexity of the issue and the heterogeneity of different groups imply that a uniform public policy may be less effective than

strategies that consider the particular circumstances of each individual group. Equalizing employment opportunities may be important for one group, while decreasing the barriers to access to education may be more effective for another, but more data and analysis must be considered before implementing certain rules by which to guide any policy decisions.

	Direction									
	Early 1980s	Early 2000s	of change	Converged?						
Higher Educa	tional Spending	(as % of expendit	tures) Relative	e to Whites						
Black	-0.22%	-0.33%	_	No						
Asian	-0.26%	1.30%	+	No						
Higher Educa	tional attainmen	t Relative to Whit	tes							
Black	-9.5%	-9.3%	0	No						
Asian	14.4%	21.9%	+	No						
Wage differen	tial- w/o educati	onal controls								
Black	-14.0%	-3.9%	+	Yes						
Asian	-2.5%	2.0%	0	Yes						
Wage differen	tial- with educat	ional controls								
Black	-10.8%	0.0%	+	Yes						
Asian	-3.9%	-4.2%	0	No						
Wage differen	tial with higher e	education- Femal	les							
Black	6.4%	13.6%	+	No						
Asian	-14.6%	-2.6%	+	Yes						
Wage differen	tial with higher e	education- Males								
Black	-32.9%	-3.5%	+	Yes						
Asian	-9.5%	5.2%	+	Yes						
No Wage odds	5									
Black	1.23	1.41	+	No						
Asian	1.21	1.26	+	No						
No Wage odds	s with higher edu	cation								
Black	1.01	1.25	+	No						
Asian	1.43	1.33	-	No						

Table 17. Summary of All Results

Note: Higher education means Bachelors, Masters, or Doctorate

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### IX. DATA APPENDIX

Before dropping any observations, the total number of observations is 449,484. I briefly summarize any modifications and restrictions imposed on the data.

- Members of a household who are unrelated to the head of the household, relation not indicated, or missing, are dropped from the analysis. This accounts for 6.9% of the original dataset.
- Under race, observations with "American Indian or Aleut Eskimo" and "other" are dropped from the analysis. This accounts for 1.6% of the original dataset.
- Individuals with wage or income greater than \$200,000 are dropped from the analysis. This accounts for 0.5% of the original dataset.
- Households with family size greater than 10 are dropped from the analysis. This accounts for 0.3% of the original dataset.
- Individuals who worked more than 80 hours per week are dropped from the analysis. This accounts for 0.1% of the original dataset.
- After generating family age structure for households, individuals less than 18 years of age are dropped from the analysis. This accounts for 30.4% of the original dataset.
- Because of an unreasonably high proportion of members in the category "Never attended school" (over 50%) in 1987-Q3 through 1988-Q2, the validity of the education level data for this period is questionable. Observations in these 4 quarters are dropped from the analysis. This accounts for 4.3% of the original dataset.

After dropping these observations, the total number of observations is 282,131. The results of this paper do not significantly change without these restrictions.

Summary statistics for the variables used in this paper are shown in Table 18.

	Wh	ite	Bla	ick	Asi	ian
	Females	Males	Females	Males	Females	Males
Family Income (gross)	\$39,	207	\$26,	387	\$48,	915
	(\$32,	527)	(\$25,	351)	(\$38,	314)
Wage & salary  wage>0	\$17,751	\$28,473	\$16,620	\$21,879	\$21,589	\$30,063
	(\$16,529)	(\$23,157)	(\$14,436)	(\$17,991)	(\$18,939)	(\$24,808)
Expenditures						
Total	\$24,404		\$16,949		\$27,801	
	(\$20,206)		(\$13,970)		(\$21,652)	
Education	\$53	53	\$3	13	\$9.	55
	(\$2,0	)05)	(\$12	.09)	(\$2,6	569)
Age	42.3	40.3	38.8	37.2	39.4	38.1
	(19.5)	(18.3)	(18.3)	(17.8)	(17.5)	(17.1)
Family size	3.0		3.4		3.7	
	(1.7)		(1.8)		(1.9)	

Table 18. Sample Means and Standard Deviations by Race and Gender

	Wł	nite	Bla	ıck	As	ian
	Females 1 -	Males	<b>Females</b>	Males	<b>Females</b>	Males
Number of Full/Part Time Earners	1	.7	1.	5	1.	9
	(1	.1)	(1.	1)	(1.	2)
Weeks worked	25.9	32.9	25.5	27.1	25.8	31.5
	(24.1)	(23.3)	(24.3)	(24.3)	(24.4)	(23.9)
Hours worked per week	17.1	24.8	16.4	19.0	17.3	22.6
	(19.7)	(22.4)	(19.6)	(21.2)	(20.2)	(22.3)
Occupation						
Managerial and professional	0.14	0.16	0.10	0.08	0.12	0.15
specialty						
Technical, sales, and admin	0.17	0.10	0.15	0.09	0.16	0.11
support						
Service	0.07	0.06	0.10	0.08	0.08	0.08
Farming, forestry, and fishing	0.00	0.01	0.00	0.01	0.00	0.01
Precision production, craft, and	0.01	0.06	0.01	0.04	0.01	0.04
repair						
Operators, fabricators, and laborers	0.04	0.11	0.05	0.13	0.04	0.08
Armed forces	0.00	0.00	0.00	0.01	0.00	0.00
Self employed	0.03	0.06	0.01	0.03	0.03	0.05
Not working	0.19	0.09	0.23	0.19	0.22	0.13
Retired	0.11	0.09	0.08	0.07	0.07	0.06
Other, including not reported	0.25	0.26	0.27	0.28	0.26	0.28
Employment type						
Private company	0.37	0.45	0.33	0.37	0.36	0.41
Government employee	0.08	0.08	0.10	0.09	0.07	0.08
Self-employed	0.03	0.07	0.01	0.03	0.04	0.06
Working without pay	0.00	0.00	0.00	0.00	0.00	0.00
Not reported	0.52	0.40	0.55	0.52	0.53	0.45
Education						
No HS graduate	0.24	0.24	0.33	0.37	0.24	0.22
HS graduate	0.24	0.24	0.33	0.37	0.24	0.22
Some college	0.33	0.30	0.33	0.35	0.20	0.22
Bachelors	0.14	0.25	0.23	0.20	0.22	0.21
Masters or Ph D	0.05	0.15	0.03	0.03	0.21	0.22
	0.05	0.00	0.05	0.05	0.07	0.12
Marital Status	0.55	0.50	0.20	0.40	0.50	0.57
Married	0.55	0.59	0.30	0.42	0.58	0.57
Widowed, divorced, or separated	0.20	0.10	0.28	0.14	0.14	0.05
Never Married	0.25	0.31	0.42	0.44	0.29	0.38
Region						
Rural	0.06	0.07	0.04	0.04	0.01	0.01
Northeast region	0.20	0.19	0.17	0.16	0.13	0.13
Midwest region	0.24	0.24	0.21	0.21	0.10	0.10
South region	0.27	0.27	0.49	0.48	0.13	0.13
West region	0.23	0.24	0.09	0.11	0.63	0.63
Sample size	133,970	125,460	20,339	15,076	5,701	5,180

#### **DEFINITIONS OF SUMMARY VARIABLES:**

Family income = wages + bus + farm + rents + div + int_l + pension + socsec + ssi_f + unemp + workcomp + welfare + scholar + foodstmp + rentnpay

Variable	Variable description	NBER CEX
name		Category
wages	Wages and Salaries	001
bus	Proprietor's Accounting Profit	002
farm	Farm Accounting Profit	003
rents	Rental Accounting Profit	004
div	Dividends Received	005
int 1	Interest Received	006
pension	Government/Private Pensions	007
socsec	Social Security Benefits	008
ssi_f	Supplemental Security Income	009
unemp	Unemployment Compensation	010
workcomp	Worker's Comp/Veteran's Benefits	011
welfare	Public Assistance/Welfare	012
scholar	Scholarships, Foster Children	013
foodstmp	Food Stamp Benefits	014
rentnpay	Rent Received as Pay	073

*Total expenditures* = Sum of all household expenditures including food, nonfood, clothing, personal care, housing, utilities, medical expenses, vehicles and other transportations, education, charity, and recreation

Corresponding NBER CEX Categories for these variables are 023 to 069

Variable	Variable description	NBER CEX
name		Category
highedu	Higher education	066
lowedu	Nursery, Elementary and Secondary Education	067
othedu	Other Education Services	068

*Total educational spending = highedu + lowedu + othedu*