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NOTES

DEGREES MATTER: NEW EVIDENCE ON SHEEPSKIN EFFECTS IN THE RETURNS TO EDUCATION

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Abstract—Because many individuals do not complete their degrees in the standard number of years, previous estimates of diploma effects, which have been based only on an individual's years of education, are biased. Using a data set from a matched sample of the 1991 and 1992 March Current Population Survey that has information on both years of education and diplomas received, this paper improves on earlier estimates and finds that using "true" information on degree receipt substantially increases estimated sheepskin effects of high school and college degrees. Unlike past research, this paper finds that there are few statistically significant differences in sheepskin effects between race and sex groups. The relative returns to Associate's and post-graduate degrees are also examined.

Screening theories of education suggest that in addition to increasing individual productivity, education serves as a *signal* of greater productivity, and that this signal is rewarded in the labor market. One prediction of the screening theory is that individuals who receive diplomas will earn more than their counterparts with the same number of years of schooling who do not possess the diploma. The existence of such "sheepskin effects," the difference in earnings between individuals possessing a diploma and those who do not, conditional on years of schooling, is documented by Olneck (1977), Hungerford and Solon (1987), Belman and Heywood (1991), and Card and Krueger (1992) using a variety of data sets.

Previous estimates of sheepskin effects have been limited by the lack of information on degree attainment. In particular, studies which use the usual continuous measure of completed years of schooling do not directly measure degree receipt but must impute it from the "usual" number of years of education taken to complete a degree. Because some individuals do not earn degrees, and others take different amounts of time to complete them, sheepskin estimates based only on individuals' years of education will be biased estimates of the true effects.

We employ a data set drawn from a matched sample of the 1991 and 1992 March Current Population Survey (CPS) that allows us to estimate diploma effects that are free from the bias of previous studies. Our data have information on *both* years of education and diplomas received, allowing us to estimate sheepskin effects directly while controlling for time spent in school. We find that the estimates of sheepskin effects for high school diplomas and Bachelor's degrees using information on degrees received are more than twice as large as those which use only the information on completed years of education.

In addition, our data allow us to address two questions that have not been thoroughly analyzed in the literature. We estimate separate diploma effects for white men and women and black men and women and compare across these demographic groups. Belman and Heywood (1991) estimate the returns to education separately for whites and minorities and men and women, and find evidence suggesting that the return to the 16th year of education is higher for minorities. However, they do not test whether the effects are significantly different across groups. We test for differences across groups using explicit information on degrees received, and find little evidence that such differences exist.

We also examine diploma effects for degrees other than high school and bachelor's degrees. Kane and Rouse (1995) use the National Longitudinal Study of the High School Class of 1972 (NLS72) to determine the value of a community college education and find that the credentialling effects of both two and four year college degrees are generally small. We supplement their findings with estimates based on our larger sample from the CPS and find that there are significant credentialling effects associated with Associate's degrees (for white men and women) and Bachelor's degrees (for all four demographic groups). In addition, we examine returns to post-graduate degrees and find significant returns above those for receiving a Bachelor's degree.

Section I describes our data. Section II examines the extent to which previous estimates of sheepskin effects may differ from estimates using information on actual diploma receipt. Section III discusses the differences in high school and Bachelor's degree sheepskin effects across demographic groups. Section IV investigates diploma effects for Associate's and post-Baccalaureate degrees and section V concludes.

I. Description of the Data

In January 1992 the focus of the educational attainment question in the CPS changed to degree receipt from years of education. While this change has other implications for researchers using the CPS, it allows us to create a data set which contains information on *both* years of education and degree receipt. We utilize the sampling structure of the CPS to create a data set drawn from the 1991 and 1992 March surveys that has responses to both the "old" and "new" educational attainment questions.[1] Individuals in the first four rotations in March 1991 were asked the old question (on years of schooling) in 1991 and the new question (on degrees received) in 1992.

We match individuals across these two years of the survey to create a sample with responses to both questions. Individuals are matched by household identification number, survey line number within household, race, sex, whether the individual lived in the household the previous year and whether the change in the individual's age was in the range [0, 1, 2]. The matching procedure used is similar to that of Welch (1993) and is detailed further in the appendix of Jaeger (forthcoming). Our sample is comprised of individuals whose reported race is black or white, who were 25 to 64 years old in 1992, who were not enrolled in school in either 1991 or 1992, and whose school enrollment status was not imputed in either year. Of the 31,664 individuals meeting these criteria in the 1992 data whose household identification number appeared in both years, 25,871 individuals (or 82%) are matched to individuals in the 1991 file.

All variables used in this paper, with the exception of years of education, are taken from the 1992 file. Individuals whose wage and salary income, weeks worked, or usual hours worked were imputed are excluded. In addition, those who lived on a farm or reported no earnings, weeks worked, or usual hours worked are excluded. These exclusions reduce the total sample to 18,699 individuals.

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[1] The CPS follows a 4-8-4 rotation. That is, individuals are in the CPS for four months, do not appear for eight months, and then are questioned again for four months.

TABLE 1.—CROSS-TABULATION OF HIGHEST DEGREE RECEIVED BY COMPLETED YEARS OF EDUCATION

Years of Education	Highest Degree Received									Year Total	Year Share
	None	High School	Some College	Occ. Assoc.	Acad. Assoc.	Bach.	Mast.	Prof.	Doct.		
0 through 8	655	41	3	0	0	2	2	0	0	703	0.038
9	302	33	2	1	0	1	0	0	0	339	0.018
10	446	62	2	0	0	0	0	0	0	510	0.027
11	348	131	6	2	0	0	1	0	0	488	0.026
12	236	6,331	797	92	25	44	6	1	0	7,532	0.403
13	9	165	1,083	80	39	23	4	0	0	1,403	0.075
14	8	109	1,016	413	428	70	8	2	0	2,054	0.110
15	3	18	325	74	93	104	4	5	2	628	0.034
16	3	31	101	52	65	2,542	115	9	2	2,920	0.156
17	0	5	10	4		267	212	11	9	523	0.028
18 or more	0	13	12	4	8	197	987	211	167	1,599	0.086
Degree Total	2,010	6,939	3,357	722	663	3,250	1,339	239	180	18,699	
Degree Share	0.108	0.371	0.180	0.039	0.036	0.174	0.072	0.013	0.010		

Note: Tabulated from a matched sample of individuals 25 to 64 years old with positive wage and salary income, weeks worked, and usual hours worked from the 1991 and 1992 March Current Population Survey.

II. Extent of Bias of Previous Estimates

We focus our attention on the studies of Hungerford and Solon (1987, henceforth HS) and Belman and Heywood (1991, henceforth BH), who explicitly estimate sheepskin effects using the May 1978 CPS. Lacking a direct measure of degree receipt, both studies use a spline function of completed years of educational attainment with discontinuous knots at the typical degree years to estimate sheepskin effects. This approach accurately measures the true diploma effects of high school graduation (for example) only if all individuals who receive a high school diploma graduate after their 12th year of school *and* if *all* individuals who complete 12 years of school receive a high school diploma. If some individuals finish high school early, or take longer than 12 years or if some individuals complete 12 years and do not receive a high school diploma, HS and BH's estimates of sheepskin effects will be biased. In the simple case of only one possible degree, the direction of the bias depends on the sign and magnitude of the covariance between the true indicator of diploma receipt and the proxy variable that HS and BH use.

Table 1 presents a cross-tabulation of degrees received by completed years of education.[2] Among individuals whose highest reported degree was a high school diploma, 91% received exactly 12 years of education, 5% took longer than 12 years, and the remaining 4% finished in less than 12 years. Only 84% of those individuals who reported finishing exactly 12 years of education received a high school diploma. Similarly, 87% of individuals with 16 years of education received a Bachelor's degree, while 78% of those who received a Bachelor's degree finished college in four years and 14% had more than 16 years of education. These results suggest that using only information on years of education will result in biased estimates of the effect of high school and college degree receipt.

To illustrate, table 2 presents estimates of the returns to education for white men using four different specifications. The dependent variable is log hourly wages.[3] Each model includes potential experience and potential experience squared.[4] In column (1), the coefficients are estimated using a linear spline function like that used by HS and BH. The spline has knots at 8, 12, and 16 years of education, with dummy variables for 17 and 18 years. Our results are comparable those of HS and BH. Like them, we find insignificant sheepskin effects for eighth grade and high school graduation. We find a statistically significant diploma effect for college graduation of 12%, which is somewhat larger than HS's (9%) and BH's (10%) estimates.[5] This difference in estimated effects may reflect an increase in the relative return to college education since 1978.[6] Like previous studies, we estimate no statistically significant wage effects for years 17 and 18. Note that years of education are truncated at 18 in the CPS so that the estimated coefficient on the dummy variable for 18 years is the wage effect of having 18 or more years of education.

The coefficients in column (2) are estimated from a model that includes years of education, a spline knot at 8 years, years of education after and including 12, and dummy variables for specific degrees received. We assume that those with some college or a post-secondary degree have completed high school, and that those with graduate degrees have completed a Bachelor's degree. We therefore set the high school dummy variable equal to 1 for those with schooling beyond high school, and the high school and Bachelor's degree dummy variables equal to 1 for those with graduate degrees. The advantage of this specification over column (1) is that the diploma effects are identified by individuals who complete a degree, regardless of when they finish. The estimated return of 11% for a high school diploma is substantially larger than the 3% effect estimated with the first specification, and unlike the estimate in column (1), it is statistically significantly different from 0. The true effect of a traditional high school diploma is likely even larger as our sample of high school diploma recipients includes those with GEDs, for whom the return to high school completion is typically low (Cameron and Heckman (1993)). The estimated diploma effect of 31% for Bachelor's degrees is also considerably higher than that using only the information on years of education.[7]

[2] Although "Some College, No Degree" is not technically a degree, Arrow (1973) hypothesizes that there is a signalling effect for attending college. Because individuals who attended college without receiving a college degree are identified in the 1992 data, we include attending college without receiving a diploma as a separate "degree" category.

[3] Defined as log[hourly wages] = log[annual wage and salary income/(number of weeks worked × usual numbers of hours per week)].

[4] We define potential experience in the usual way: potential experience ≡ age − completed years of education − 6.

[5] The percentage increase in wages associated with a dummy variable coefficient is calculated as $e^{\hat{\beta}} - 1$.

[6] Bound and Johnson (1992) and Katz and Murphy (1992), among others, document the rising relative returns to college education during the 1980s.

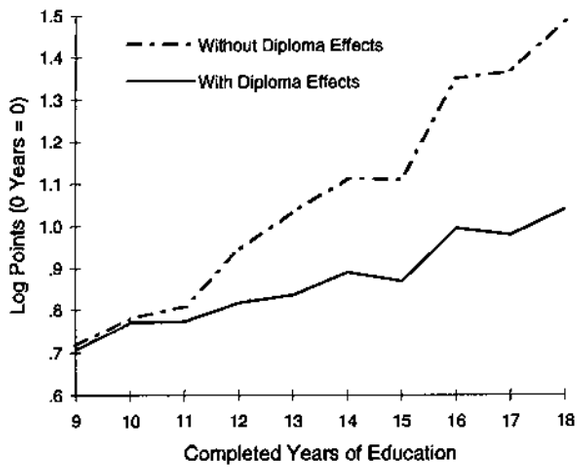
[7] We also estimated the models in columns (1) and (2) without $S \geq 8$ and $(S \geq 8) \cdot (S - 8)$. In this case, the coefficient on $S \geq 12$ was 0.073 (with a standard error of 0.034) in the spline model and the coefficient on the high school diploma variable was 0.104 (with a standard error of 0.030) using the true measures of diploma receipt. The coefficients and significance levels on the other sheepskin effects were unaffected.

TABLE 2.—ESTIMATED DIPLOMA EFFECTS FOR WHITE MEN USING DIFFERENT SPECIFICATIONS

	Model			
Coefficient	(1)	(2)	(3)	(4)
Completed Years of Education (Spline)				
Years of Education (S)	0.076	0.076		
	(0.018)	(0.018)		
$S \geq 8$	−0.141	−0.112		
	(0.080)	(0.078)		
$(S \geq 8) \cdot (S - 8)$	0.002	−0.022		
	(0.027)	(0.023)		
$S \geq 12$	0.034			
	(0.053)			
$(S \geq 12) \cdot (S - 12)$	−0.006	−0.019		
	(0.022)	(0.017)		
$S \geq 16$	0.114			
	(0.035)			
$S = 17$	−0.055			
	(0.042)			
$S = 18$	−0.006			
	(0.031)			
Completed Years of Education (Dummy)				
9			−0.227	−0.109
			(0.049)	(0.061)
10			−0.164	−0.046
			(0.040)	(0.054)
11			−0.137	−0.044
			(0.043)	(0.051)
12			ref.	ref.
13			0.089	0.020
			(0.027)	(0.033)
14			0.167	0.073
			(0.022)	(0.031)
15			0.166	0.052
			(0.038)	(0.044)
16			0.406	0.178
			(0.019)	(0.045)
17			0.422	0.164
			(0.039)	(0.057)
18 or more			0.544	0.224
			(0.023)	(0.054)
Diploma Effects				
High School		0.106		0.123
		(0.037)		(0.041)
Marginal Effect Over High School				
Some College, No Degree		0.074		0.083
		(0.022)		(0.027)
Occupational Associate's		0.074		0.076
		(0.039)		(0.043)
Academic Associate's		0.188		0.191
		(0.042)		(0.046)
Bachelor's		0.273		0.245
		(0.038)		(0.045)
Marginal Effect Over Bachelor's				
Master's		0.032		0.050
		(0.030)		(0.041)
Professional		0.271		0.286
		(0.050)		(0.059)
Doctoral		0.052		0.067
		(0.058)		(0.067)
R^2	0.145	0.153	0.147	0.154
Adjusted R^2	0.144	0.151	0.145	0.151
Mean Square Error	0.372	0.369	0.372	0.369

Note: Dependent variable is log hourly wages. Estimated using ordinary least squares. Standard errors are in parentheses. Calculated from a matched sample of individuals 25 to 64 years old from the 1991 and 1992 March Current Population Survey. Model also includes Potential Experience and Potential Experience Squared as covariates. Columns (3) and (4) also include dummy variables for zero through eight completed years of education. Sample size is 8,957.

FIGURE 1.—TOTAL RETURNS TO COMPLETED YEARS OF EDUCATION FOR WHITE MEN



Column (3) presents a model that has dummy variables for each completed year of school. The left out year is the 12th, so that the coefficient on the dummy variable for 14 years of schooling indicates the return to getting two years of schooling beyond the 12th. The estimates in column (4) are from a specification that includes dummy variables for the number of years of completed education and for each degree obtained. By relaxing the assumption that education enters the wage equation linearly or piece-wise linearly, this specification maximizes the amount of wage variation that can be explained by years of schooling. Even under this most flexible model, the estimated diploma effects continue to be much larger than those presented in column (1).

A substantial part of the total return to education appears to be due to sheepskin effects. If we interpret the dummy variables in column (3) as the total return to education, and the coefficients on the years-of-education dummy variables in column (4) as the total return to education net of sheepskin effects, the difference between the two columns can be interpreted as the part of the total return that is due to sheepskin effects. In figure 1 we normalize the coefficients on completed years of education from columns (3) and (4) to be relative to 0 years rather than 12 years and plot the total return to completed years of education.[8] Sheepskin effects explain approximately a quarter of the total return to completing 16 years of education and more than half of the return to completing 16 years relative to 12 years.[9]

To be consistent with HS and BH our models constrain the sheepskin effect associated with high school graduation, for example, to be the same for all years of educational attainment. That is, we assume that the difference between those with 11 years of school but no high school diploma and 11 years of school and a high school diploma is the same as the difference between those with 12 years of education but no high school diploma and 12 years of school and a diploma. To test the robustness of our results, we estimated a fully-interacted model like that estimated with the February 1990 CPS by Park (1994).[10] This model enters each interaction of years of education and degrees as a separate dummy variable (we group all years of education from zero to eight together). Our results are comparable to those of Park (1994) and are presented in appendix table A1. The estimated sheepskin effect for high school diploma receipt, conditional on attending 12 years of school, is 18%. The marginal effect of completing a Bachelor's degree over attending "some college" is 33%, conditional on attending school for 16 years. The diploma effects in column (4) may therefore somewhat underestimate sheepskin effects conditional on the "usual" years of educational attainment.

III. Differences in High School and College Sheepskin Effects Across Demographic Groups

The literature on statistical discrimination suggests that sheepskin effects may vary across demographic groups if diplomas provide a stronger productivity signal for some groups than for others. Starting with a model in which employers base expectations of worker productivity on the average productivity of the worker's race/sex group, BH predict that the sheepskin effects for minorities and women should be larger than those for white men. Using the May 1978 CPS to estimate sheepskin effects from a specification like that in table 2, column (1), they find that minority men and women appear to receive a higher return to completing 16 or more years of education than their white counterparts, although they do not statistically test this hypothesis.

The results of section II indicate that biases may be present in BH's estimates of sheepskin effects. We therefore wish to test whether their hypothesis that diploma effects differ across demographic groups holds when the sheepskin effects are estimated with actual indicators of diploma receipt. Appendix table A2 show the distribution of education across the demographic groups. We present estimated diploma effects for white and black men and women in table 3 and tests for the equality of diploma effects across the four demographic groups in table 4.[11] The model estimates the effects for all four groups in one regression by interacting demographic group dummy variables with each of the years of education and diploma dummy variables. The diploma variables are defined as in table 2 so that we estimate the marginal effects over high school diploma receipt of attending some college, Associate's and Bachelor's degrees and the marginal effects over Bachelor's degree receipt of professional, Master's, and Doctoral degrees. As in table 2, the model includes potential experience and potential experience squared as covariates. We estimate separate intercepts, while the coefficients on the experience variables are restricted to be the same across the four demographic groups.

We find relatively little support for BH's hypothesis regarding high school and college degrees. While we find statistically significant effects for high school diploma receipt only among white men, the wage returns for black men and women are of roughly the same size, and the difference in returns across all groups is not statistically significant.

The sheepskin effects of receiving a Bachelor's degree are large and statistically significant for all four groups. The estimated diploma effects *are* larger for blacks than for whites, but we cannot reject the hypothesis that all four effects are equal. The failure to reject the hypothesis of equality across the groups may result from the relatively small numbers of blacks in these categories.

Unlike BH, our results indicate that for high school and four year college graduation, there is little difference between the diploma effects for whites and blacks. In addition to our information on degree

[8] The coefficient on the 0 years dummy is −0.944 for the model in column (3) and −0.816 for the model in column (4).

[9] 1.350 − 0.994 = 0.356 or 26% the total return; 0.406 − 0.178 = 0.288, or 56% of the return relative to 12 years.

[10] The February 1990 CPS asked both the old and new education questions as a test for the subsequent change.

[11] Unlike BH we exclude individuals whose reported race is "other." While including other races with blacks changes some of the point estimates of the diploma effects, it does not affect the conclusions drawn from the hypothesis tests based on those coefficients.

TABLE 3.—ESTIMATED DIPLOMA EFFECTS FOR FOUR DEMOGRAPHIC GROUPS

	Men		Women	
Coefficient	White	Black	White	Black
Completed Years of Education				
9	−0.097	−0.065	−0.344	−0.196
	(0.060)	(0.152)	(0.067)	(0.151)
10	−0.032	0.003	−0.229	−0.267
	(0.054)	(0.140)	(0.058)	(0.127)
11	−0.039	−0.280	−0.173	−0.157
	(0.051)	(0.128)	(0.055)	(0.113)
12	ref.	ref.	ref.	ref.
13	0.018	0.043	0.016	0.134
	(0.033)	(0.110)	(0.033)	(0.095)
14	0.071	0.001	0.084	0.232
	(0.031)	(0.106)	(0.033)	(0.093)
15	0.045	0.122	0.154	0.243
	(0.044)	(0.156)	(0.044)	(0.123)
16	0.167	0.046	0.271	0.159
	(0.044)	(0.137)	(0.046)	(0.126)
17	0.150	−0.201[a]	0.250	0.365
	(0.057)	(0.307)	(0.060)	(0.200)
18 or more	0.215	−0.280	0.335	0.208
	(0.054)	(0.245)	(0.059)	(0.176)
Diploma Effects				
High School	0.125	0.119	0.062	0.105
	(0.041)	(0.108)	(0.044)	(0.097)
Marginal Effect Over High School				
Some College, No Degree	0.083	0.133	0.101	0.079
	(0.027)	(0.092)	(0.027)	(0.076)
Occupational Associate's	0.075	0.162	0.305	−0.008
	(0.043)	(0.151)	(0.041)	(0.133)
Academic Associate's	0.188	0.145	0.241	−0.103
	(0.046)	(0.166)	(0.044)	(0.140)
Bachelor's	0.245	0.305	0.223	0.394
	(0.045)	(0.134)	(0.046)	(0.130)
Marginal Effect Over Bachelor's				
Master's	0.055	0.658	0.155	0.125
	(0.041)	(0.223)	(0.043)	(0.155)
Professional	0.286	0.541[a]	0.488	0.570[a]
	(0.059)	(0.331)	(0.091)	(0.378)
Doctoral	0.083	0.792[a]	0.103	0.352[a]
	(0.066)	(0.382)	(0.097)	(0.367)
Sample Size	8,957	711	8,122	909

Note: Dependent variable is log hourly wages. Estimated using ordinary least squares. Standard errors are in parentheses. Calculated from a matched sample of individuals 25 to 64 years old from the 1991 and 1992 March Current Population Survey. Model also includes separate intercepts for each group, dummy variables for zero through eight years of education for each group, Potential Experience, and Potential Experience Squared as covariates. The R^2 for the model is 0.229; the mean squared error is 0.367.

[a] Cells with 10 or fewer observations.

attainment, the widening black-white wage differential documented for the 1980s using CPS data by Bound and Freeman (1992), for men, and Bound and Dresser (1996), for women, may provide an explanation for the difference in results.[12] As the results in the next section show, estimates of diploma effects for other degrees do sometimes differ across race and sex groups, but there is no consistent pattern.

IV. Sheepskin Effects for Other Post-Secondary Degrees

In this section we examine the returns to Associate's and postgraduate degrees. The returns to Associate's degrees have received recent attention in a paper by Kane and Rouse (1995, henceforth KR) in which they employ the National Longitudinal Study of the High School Class of 1972 (NLS72). Unlike the CPS, the NLS72 data that KR use have information on both college credits and diplomas received. Hence, KR's estimates do not suffer from the same bias as earlier studies. Our data allow us to supplement their evidence on returns to post-secondary schooling with estimates based on a larger sample.

For men, KR find no statistically significant effects of Associate's degree receipt. In contrast, we find that receiving an academic Associate's degree raises white men's wages by 21%, a result that is statistically significant. We also find that Associate's degrees raise the wages of black men by between 16% and 18%, although these effects are not statistically significant. Our results for Bachelor's degrees, documented in section II, are similar to KR's. For white men, the difference in the sheepskin effects between occupational and academic Associate's degrees is significant at the 5% level while the difference between occupational Associate's degrees and Bachelor's degrees is statistically significant at the 1% level.

Kane and Rouse document significant Associate's degree sheepskin

[12] Our finding relates only to the diploma effects themselves, and does not suggest that *overall* returns to education are the same for the four demographic groups.

TABLE 4.—HYPOTHESIS TESTS FOR DIPLOMA EFFECTS: EQUALITY ACROSS DEMOGRAPHIC GROUPS

	Hypothesis						
F Statistic	White Men = Black Men	White Women = Black Women	White Men = White Women	Black Men = Black Women	White = Black	Men = Women	All Equal
High School	0.032	0.161	1.088	0.009	0.082	0.548	0.378
	[0.955]	[0.688]	[0.297]	[0.924]	[0.921]	[0.578]	[0.769]
Marginal Effect Over High School							
Some College, No Degree	0.268	0.071	0.206	0.203	0.170	0.205	0.144
	[0.604]	[0.790]	[0.650]	[0.652]	[0.844]	[0.815]	[0.934]
Occupational Associate's	0.306	5.021	14.870	0.714	2.663	7.792	5.691
	[0.580]	[0.025]	[0.000]	[0.398]	[0.070]	[0.000]	[0.001]
Academic Associate's	0.064	5.487	0.668	1.307	2.776	0.987	1.901
	[0.800]	[0.019]	[0.414]	[0.253]	[0.062]	[0.373]	[0.127]
Bachelor's	0.176	1.542	0.123	0.228	0.859	0.175	0.580
	[0.675]	[0.214]	[0.726]	[0.633]	[0.424]	[0.839]	[0.628]
Marginal Effect Over Bachelor's							
Master's	7.053	0.035	2.864	3.850	3.544	3.357	2.984
	[0.008]	[0.852]	[0.091]	[0.050]	[0.029]	[0.035]	[0.030]
Professional	[a]	[a]	3.459	[a]	[a]	[a]	[a]
			[0.063]				
Doctoral	[a]	[a]	0.030	[a]	[a]	[a]	[a]
			[0.864]				

Note: Entries in table are *F* statistics. *p*-values are shown in square brackets. Coefficients estimated using ordinary least squares. Dependent variable is log hourly wages. Calculated from a matched sample of individuals 25 to 64 years old from the 1991 and 1992 March Current Population Survey.

[a] Tests based on cells with 10 or fewer observations.

effects for women, but do not find similar effects for Bachelor's degrees. We, too, find statistically significant effects for Associate's degrees, but only for white women, for whom occupational Associate's degrees carry a 36% premium and academic Associate's degrees raise wages by 27%. The negative and not statistically significant estimates for black women are puzzling, but note that the estimated effects of years 13 and 14 are large and positive, yielding an overall positive return for black women obtaining an Associate's degree. In addition, and in contrast to KR, we find that Bachelor's degrees carry a statistically significant diploma effect for women. For black women, the marginal effects of Bachelor's degree receipt are statistically significantly different at the one percent level from those of both types of Associate's degrees. For white women the diploma effects for occupational and academic Associate's degrees are different at the 10% level as is the difference between diploma effects for occupational Associate's and Bachelor's degrees.

We find statistically significant differences in the size of the diploma effects of occupational Associate's degrees across the four groups. In particular, the credentialling effect of an occupational Associate's degree is larger for white women than for the other three groups, possibly resulting from the fact that these degrees are used by many white women as stepping stones into relatively lucrative occupations such as nursing. White men and black men and women do not typically select into these occupations. Occupational selectivity may also explain the positive difference in diploma effects between occupational Associate's degrees and Bachelor's degrees for white women.

Our results may differ from KR's because they utilize the measures of ability and family background in the NLS72 that are not found in the CPS. Taken as a whole, however, our results suggest that the labor market values Associate's and Bachelor's degrees differently, and that these wage differences do not result solely from differences in years of education.

Our data also allow us to explore the returns to post-graduate degrees. Because the CPS did not contain any information on degree receipt prior to 1992 and truncated the reported years of education of individuals at 18 years, estimates based on earlier years are especially poor at estimating the returns to post-Baccalaureate education. For example, table 2, column (1) shows *negative* (but not significant) returns to attending 17 or 18 years of school. Our results using information on actual degree receipt indicate that there are substantial and significant sheepskin effects associated with post-graduate degrees. The results in table 3 show that among white men and women, professional school graduates earn 33% and 63% more, respectively than those who receive only a Bachelor's degree but complete the same number of years of education. The signal imparted by these degrees appears to be at least as important as the human capital acquired in obtaining them. For Doctoral degree recipients, these differences are 9% and 11%, respectively. Master's degree holders earn 6% and 17% more, respectively, than those who hold a Bachelor's degree. The effects for blacks are generally larger, although most of these estimates are based on very small numbers of individuals.

There are substantial differences in the point estimates for graduate degrees among the groups, most notably a very high return to Master's degrees for black men.[13] This effect is significantly different from that for white men, and may result from differences in the number of individuals receiving Master's degrees in these groups. The effect for black men is also significantly different from that for black women, although the total wage return to master's degree recipients with 18 years of education is similar for the two groups. Supply differences may also explain why sheepskin effects associated with Master's and professional degrees are higher for white women than they are for white men.

V. Conclusion

Using newly available data on diploma receipt, we have shown that significant diploma effects exist for all post-secondary degrees for at least some demographic groups. We have also shown that Bachelor's and post graduate degrees are valued by the labor market at least as

[13] There are 10 or fewer sample members for black men and women for professional and Doctoral degrees.

much as years of education. Returns to individual years of schooling are small relative to the estimated sheepskin effects of these degrees, which do not suffer from the bias inherent in previous research. In general, we find larger diploma effects than we would have if we had been limited to the education variables available to previous researchers.

Contrary to prior research, we find little evidence that the sheepskin effects of high school and college graduation differ across race and sex groups. The credentialling effect of occupational Associate's degrees is statistically significantly larger for white women than for other demographic groups, however. Within demographic groups, we often find significant differences in diploma effects for different degrees, particularly between occupational Associate's and Bachelor's degrees. This implies that the signalling component of educational attainment varies with the *type* of education. While we are reluctant to interpret our results as purely causal effects of diploma receipt on wages, they suggest that sheepskin effects do matter in the returns to education.

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APPENDIX

TABLE A1.—ESTIMATED RELATIVE WAGES FOR COMPLETED YEARS OF EDUCATION BY DEGREES RECEIVED FOR WHITE MEN

	Highest Degree Received								
Years of Education	None	High School	Some Coll.	Occ. Assoc.	Acad. Assoc.	Bach.	Mast.	Prof.	Doct.
0 through 8	−0.415								
	(0.035)								
9	−0.235								
	(0.052)								
10	−0.179								
	(0.043)								
11	−0.144	−0.102							
	(0.051)	(0.079)							
12	−0.164	ref.	0.129	0.065					
	(0.060)		(0.034)	(0.092)					
13		0.175	0.083						
		(0.073)	(0.030)						
14		0.047	0.168	0.144	0.256				
		(0.078)	(0.030)	(0.046)	(0.047)				
15			0.109			0.269			
			(0.048)			(0.093)			
16			0.148			0.432	0.385		
			(0.089)			(0.020)	(0.089)		
17						0.368	0.530		
						(0.055)	(0.059)		
18 or more						0.500	0.509	0.773	0.532
						(0.062)	(0.029)	(0.049)	(0.057)

Note: Empty cells contain 40 or fewer observations. Estimated using ordinary least squares. Standard errors in parentheses. Calculated from a matched sample of individuals 25 to 64 years old from the 1991 and 1992 March Current Population Survey. Model also contains Potential Experience and Potential Experience Squared as covariates. The R^2 for the model is 0.156; the mean square error is 0.370. Sample size is 8,957.

TABLE A2.—DISTRIBUTION OF DEGREES AND MEAN YEARS OF EDUCATION BY DEGREE FOR FOUR DEMOGRAPHIC GROUPS

	Men				Women			
	White		Black		White		Black	
Highest Degree	Share	Mean Years	Share	Mean Years	Share	Mean Years	Share	Mean Years
No Degree	0.113	8.84	0.214	9.16	0.086	9.26	0.169	9.64
		(2.63)		(2.48)		(2.45)		(2.24)
High School	0.352	12.00	0.416	12.01	0.386	12.01	0.392	11.95
		(0.85)		(0.91)		(0.74)		(1.02)
Some College, No Degree	0.175	13.42	0.152	13.35	0.184	13.30	0.204	13.48
		(1.17)		(1.04)		(1.08)		(1.13)
Occupational Associate's	0.034	13.86	0.035	14.32	0.044	13.89	0.035	14.13
		(1.07)		(1.11)		(1.11)		(1.10)
Academic Associate's	0.031	14.29	0.027	14.47	0.042	14.24	0.031	14.46
		(1.02)		(1.07)		(0.89)		(1.17)
Bachelor's	0.182	16.06	0.108	15.48	0.176	16.06	0.120	16.04
		(0.84)		(1.29)		(0.88)		(1.02)
Master's	0.079	17.57	0.034	17.54	0.070	17.57	0.042	17.47
		(1.02)		(0.78)		(1.02)		(1.08)
Professional	0.020	17.84	0.008	17.83	0.006	17.43	0.003	18.00
		(0.69)		(0.41)		(1.04)		(0.00)
Doctoral	0.014	17.91	0.006	18.00	0.006	17.89	0.003	17.00
		(0.40)		(0.00)		(0.31)		(1.73)
Sample Size	8,957		711		8,122		909	

Note: Standard deviations in parentheses. Tabulated from a matched sample of individuals 25 to 64 years old from the 1991 and 1992 March Current Population Survey. The measure for years of education is truncated at 18.

WAGE DECLINES AMONG OLDER MEN

Richard W. Johnson and David Neumark*

Abstract—We examine the evidence on whether real wages decline with age among older men. While the general human capital model of wage growth over the life cycle predicts that wages will fall as workers approach the end of their career, alternative models of wage growth do not predict these wage declines. We find that in longitudinal estimates of age–wage profiles wage declines only set in for workers in their 60s. Furthermore, these longitudinal declines are at least partly due to interactions with the Social Security system. The earnings cap or other effects of Social Security appear to lead some workers to choose jobs and job characteristics associated with lower wages.

I. Introduction

The human capital model attributes the variation of wages over the life cycle to different levels of investment in depreciable human capital (Becker (1975); Mincer (1974)). Since the work-life is finite, young individuals invest heavily in schooling and job training, and then gradually reduce the rate of investment as they age and the time over which they can recoup their investment dwindles. In particular, the general human capital model predicts that wages will rise with age and experience as the stock of general human capital increases, but that wages will eventually fall when the loss of general human capital through depreciation exceeds gross investment.[1] Cross-sectional estimates of age–wage or experience–wage profiles support these predictions. In the most common procedure, age or experience profiles estimated on cross-sections of workers reveal wages that initially increase with age or experience, peak in the forties or fifties, and then slowly decline.

In this paper we re-examine evidence on whether the real wages of older men actually diminish with age. The observed decline may reflect biases attributable to factors other than the depreciation of general human capital. First, most specifications of the earnings function include linear and quadratic terms for age or experience. This functional form may lead to spurious or overstated declines in wages at older ages solely because of the curvature of the age-earnings profile at earlier ages.[2] Second, many older workers partially retire by changing jobs and perhaps reducing the number of hours they work, without completely withdrawing from the labor market (Ruhm (1990), Gustman and Steinmeier (1984)). For a number of reasons offered by alternative models of the age–earnings profile (lost specific human capital, leaving a job where wages exceed marginal product), partial retirement

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[1] In the general human capital model wages and productivity move lock-step with each other. In the specific human capital model, bonding considerations may drive wedges between wages and marginal products, so predictions of declining wages at older ages are less firm.

[2] Murphy and Welch (1990), in a paper that examines richer specifications than the quadratic, report that "two-thirds of the late career decline implied by the quadratic is an artifact of specification . . . the quadratic provides a poor approximation to actual earnings growth over the career" (p. 204); nonetheless, they do not reject the conclusion that earnings decline near retirement.