THE STABILITY PATTERN OF SHEEPSKIN EFFECTS AND ITS IMPLICATIONS FOR THE HUMAN CAPITAL THEORY—SCREENING HYPOTHESIS DEBATE

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INTRODUCTION

In a wide range of empirical studies, it has been observed that schooling and earnings are strongly and consistently positively related, with causation running from schooling to earnings. These issues are indisputable. What is still debated after more than a generation of theoretical and empirical studies are the reasons why schooling enhances earnings. Regarding this issue, two fundamental schools of thought exist: the human capital theory, and the screening hypothesis.

The human capital theory concludes that the skills learned in school directly enhance job-related productivity; this in turn results in higher earnings. The screening hypothesis posits that schooling is simply used as a screening device which allows employers to assess quickly and cheaply the productivity levels of potential employees. According to this hypothesis, those with more schooling are typically more productive to begin with, indicating that the skills acquired in school may not contribute much (if at all) to subsequent job-related productivity. Consequently, the observed positive relationship between schooling and earnings is explained by the role of schooling as a screening device.

A thorough examination of which school of thought better explains the schooling-earnings relationship is especially important due to, among other reasons, the far-reaching implications for traditional educational policy if the screening hypothesis in an extreme form holds true. In this situation, Ehrenberg and Smith [(1982) (1985) 1991] conclude that schools would be very ineffective in improving one's socioeconomic status.

Many studies have addressed the human capital theory-screening hypothesis debate using a variety of innovative approaches. One underutilized method for empirically testing for the validity of the screening hypothesis is developed by Wiles [1974], and applied in Miller and Volker [1984] and Arabsheibani [1989]. This test determines whether or not individuals realize a *ceteris paribus* earnings premium when the skills they acquire in school are directly relevant to their occupations, as opposed to the situation where they are not. The presence of such an earnings premium supports human capital theory while its absence supports the screening hypothesis.

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Empirical applications of the Wiles test have not yielded consistent conclusions. Miller and Volker's results largely support the screening hypothesis while Arabsheibani's results largely support human capital theory.

Another method which has been used to test empirically the validity of the screening hypothesis is to determine if there are sheepskin effects in the returns to schooling. In other words, does the rate of return on years of schooling increase disproportionately during years when diplomas are conferred? In this situation, the screening hypothesis would be supported if such a disproportionate increase exists, and reflects the use of the diploma as a screening device as opposed to, for example, the contribution to productivity and earnings resulting when one acquires the particular school year during which the diploma happens to be conferred.

Layard and Psacharopoulos [1974] find no empirical evidence of sheepskin effects. They indicate that this finding supports the human capital theory over the screening hypothesis since they assert that one of the "three unverified predictions of the screening hypothesis" is the presence of sheepskin effects in the returns to schooling.

Primarily intended as a response to Layard and Psacharopoulos [1974], and by making use of "the type of data [Layard and Psacharopoulos] wished they had," Hungerford and Solon [1987] find that sheepskin effects do exist and conclude that "the previous dismissals of the screening hypothesis were premature." However, they acknowledge that their results are "amenable to nonscreening interpretations also."

One human capital theory interpretation of the presence of sheepskin effects is discussed in Lang and Kropp [1986] but is not considered at all in Hungerford and Solon [1987]. This involves the possibility that investment in schooling is "lumpy." This means that the rate of return on years of schooling will increase disproportionately during school years in which diplomas are conferred due to more substantial job productivity-enhancing effects resulting from the completion of an entire program of study, demonstrated by the conferral of a degree, compared with the lower job productivity-enhancing effects realized when one completes a particular year of schooling unaccompanied by the receipt of a diploma.

By finishing an entire program of study, evidenced by the receipt of a diploma, one obtains a much more complete understanding of the material presented since one has acquired a complete package of knowledge, and is in a position to be most able to recognize and appreciate the uses and interrelations among the material learned compared with the situation for individuals who do not complete the entire program of study, and who instead have acquired an incomplete package of knowledge evidenced by the lack of a diploma. If investment in schooling is lumpy in this manner, the presence of sheepskin effects could be used as empirical support for the human capital theory.

The purpose of this study is to shed additional light on the human capital theory—screening hypothesis debate from a different vantage point. This is accomplished by empirically testing for the presence of sheepskin effects in the returns to schooling, and determining the stability of these effects across the two groups of individuals which form the basis of the Wiles test: 1) those whose acquired schooling is relevant for their occupations, and 2) those whose acquired schooling is not relevant for their occupations. Rate of return estimates on years of schooling are also examined for stability across the same two groups.

Previous studies do not examine stability properties in this manner, and could mask potential differences in the importance of sheepskin effects, and in the rate of return estimates on years of schooling between these two groups of individuals. In this study, differences are uncovered, giving us greater insight into the human capital theory-screening hypothesis debate than from other studies analyzing sheepskin returns to schooling.

THE DATA AND EMPIRICAL ESTIMATES

The data used in the empirical estimations is the National Longitudinal Study of the High School Class of 1972 (NLS72). This is a national probability sample consisting of almost 23,000 high school seniors who were first surveyed in spring 1972. Follow-up surveys were conducted in fall 1973, fall 1974, fall 1976, fall 1979, and spring and summer 1986. The data contain a wide range of information including socioeconomic background variables as well as educational and employment plans and outcomes. More detailed information about the portion of the data set used in this study can be found in Riccobono et al. [1981].

The empirical model used to determine the presence and stability of the sheepskin effects in the returns to schooling, and the stability of the empirical rate of return estimate on years of schooling—Equation (1)—is a variant of the Mincerian semi-log earnings equation because of its attractive statistical properties, and since the results obtained can be more easily compared with previous studies. In addition, unlike previous empirical models of this type which test for the presence of sheepskin effects, the model used in this study includes an ability measure, parental income, and a very comprehensive years of work experience variable. Prior studies which made use of Current Population Survey (CPS) data lack these important background variables, and years of work experience is crudely measured as [age − years of schooling − 6].

$$
\begin{aligned}
(1)\qquad \ln(W) &= \alpha + \beta\,(ED) + \beta'\,(ED \times SEX) + \gamma\,(ABILITY) + \gamma'\,(ABILITY \times SEX) \\
&\quad + \zeta\,(PINCOME) + \zeta'\,(PINCOME \times SEX) + \eta\,(EXPER) \\
&\quad + \eta'\,(EXPER \times SEX) + \theta\,(EXPER)^2 + \theta'\,[(EXPER)^2 \times SEX] \\
&\quad + \kappa\,(EDEX) + \kappa'\,(EDEX \times SEX) + \lambda\,(DEGREE1) \\
&\quad + \lambda'\,(DEGREE1 \times SEX) + \mu\,(DEGREE2) + \mu'\,(DEGREE2 \times SEX) \\
&\quad + \xi\,(SEX) + \epsilon_i,
\end{aligned}
$$

where ϵ_i is assumed to be a well-behaved disturbance term. Variable definitions can be found in Table 1.

TABLE 1
Variable Definitions

W	=	Usual weekly earnings / hours usually worked per week.
ED	=	Years of schooling. The variable *FT67* in the NLS72 data set assigns individuals across six educational categories representing educational attainment at the time of the fourth follow-up survey in fall 1979. I arbitrarily assigned specific years of schooling values to individuals in each of the six educational categories as follows: 12 years (the minimum years of schooling for individuals in the NLS72 data set) for "I have not attended college;" 13 years for "Some, but less than 2 years of college;" 15.25 years for "Two or more years of college;" 16.5 years for "Finished college (four- or five-year degree);" 18 years for "Master's degree or equivalent;" and 20 years for "Ph.D. or advanced professional degree."
ABILITY	=	Sum of the scores on vocabulary, reading, letter groups, and mathematics subtests in a battery of tests which were administered to the NLS72 sample in 1972.
PINCOME	=	Before-tax yearly income of student's parents (or guardian), which includes taxable and nontaxable income from all sources. This variable takes on values of 1 through 10, with each value designating an income range. The average of each range was reassigned to each value with one exception: when *PINCOME* = 10, before-tax yearly income is over \$18,000, and *PINCOME* is arbitrarily reassigned a value of \$18,000.
EXPER	=	Years of work experience. This variable was constructed by summing up the weeks worked variables for the time periods 10/72-10/73, 10/73-10/74, 10/74-10/75, 10/75-10/76, 10/76-10/77, 10/77-10/78, and 10/78-10/79, and dividing this sum by 52.
$EXPER^2$	=	*EXPER* squared.
EDEX	=	*ED* multiplied by *EXPER*.
DEGREE1	=	*ED* multiplied by the 0-1 dummy variable *SHEEP1* which equals 1 if *ED* = 16.5 years (indicating the attainment of a four- or five-year college degree), and which equals 0 otherwise.
DEGREE2	=	*ED* multiplied by the 0-1 dummy variable *SHEEP2* which equals 1 if *ED* = 18 years (indicating the attainment of a Master's or equivalent degree), and which equals 0 otherwise.
SEX	=	sex (1 = male; and 0 = female).

Unfortunately, the NLS72 data set does not include a standard, straightforward variable which measures years of schooling at the time of the fourth follow-up survey in the fall of 1979. As can be seen in Table 1, I constructed a years of schooling variable *ED* from the categorical variable *FT67* which is included in the NLS72 data set. Given my rather arbitrary construction of the variable *ED*, one could argue that any OLS estimate of Equation (1) may possibly yield biased estimates of the rate of return on years of schooling, as well as of estimates of the rates of return on other variables.

The stability of the sheepskin effects in the returns to schooling, and the stability of the empirical estimate of the rate of return on years of schooling are examined by estimating Equation (1) using OLS separately for the two groups of individuals according to whether or not they found their accumulated schooling relevant for their occupations. The empirical results can be found in the first and second columns, respectively, of Table 2.

The NLS72 data allow for an efficient identification of these two groups of individuals. In its fourth follow-up questionnaire in fall 1979, individuals were asked to

TABLE 2
Alternative OLS Estimates of Equation (1)[a]

Independent Variables	Equations (1[b])	Equations (1[c])	Independent Variables	Equations (1[b])	Equations (1[c])
Intercept	−0.23	1.22	$(EXPER)^2 \times SEX$	−0.003	−0.02
	(0.47)	(3.14)		(0.26)	(3.09)
ED	0.09	−0.02	*EDEX*	−0.01	0.004
	(3.17)	(0.63)		(1.38)	(0.82)
$ED \times SEX$	−0.02	0.06	$EDEX \times SEX$	−0.01	−0.02
	(0.46)	(1.67)		(0.66)	(2.43)
ABILITY	0.004	0.001	*DEGREE1*	−0.01	0.01
	(4.50)	(0.83)		(1.82)	(4.07)
$ABILITY \times SEX$	−0.002	0.000004	$DEGREE1 \times SEX$	0.003	−0.01
	(1.77)	(0.004)		(0.68)	(1.69)
PINCOME	0.00001	0.00001	*DEGREE2*	−0.01	0.02
	(2.28)	(3.47)		(1.25)	(3.13)
$PINCOME \times SEX$	0.000002	0.00001	$DEGREE2 \times SEX$	0.01	−0.01
	(0.42)	(1.55)		(1.46)	(1.00)
EXPER	0.18	0.02	*SEX*	0.43	−1.22
	(1.58)	(0.20)		(0.46)	(1.97)
$EXPER \times SEX$	0.13	0.44			
	(0.58)	(3.29)	F-statistic	14.3	35.3
$(EXPER)^2$	−0.01	0.001	R^2	0.13	0.13
	(0.71)	(0.13)	N	1674	3979

All references made to the individuals' jobs refer only to their most recent primary job held during the period from 1 November 1978 through October 1979.

Observations containing variables which are given error and missing data codes were eliminated. These codes designate the following: partial response, don't know, out-of-range response, multiple response, refusal, blank or nonresponse, legitimate nonresponse, and missing.

Observations containing variables which were considered inconsistent, and/or were manually edited were eliminated, as were those whose hours usually worked per week and usual weekly earnings were equal to zero.

All individuals responded to the Base Year Questionnaire, and the First through the Fourth Follow-Up Questionnaires.

a. Data is from the National Longitudinal Study of the High School Class of 1972 (NLS72). The dependent variable is ln *(W)*.
b. Includes those individuals who indicated that it was their experience that most of what was done on the job was learned in school.
c. Includes those individuals who indicated that it was not their experience that most of what was done on the job was learned in school.

Absolute t-statistics are in parentheses.

determine whether or not it was their experience that "most of what I did on the job I learned to do in school." Those who do are assumed to have acquired schooling which is relevant in content to the skills used in their occupations, while those who do not are said to have acquired schooling which is not relevant for their occupations.

Regardless of the population universe used in the estimation of Equation (1), theory dictates that the coefficient estimate of *ABILITY* should be positive and statistically significant. As with other independent variables, including a variable measuring ability makes the rate of return estimate on years of schooling more unbiased than those of the numerous extant studies which do not include an ability variable, *ceteris paribus*.

The coefficient estimate of *PINCOME* is also expected to be positive and statistically significant. This variable captures many factors which contribute to future job productivity, including the level of motivation the individual likely received when young, and the availability of newspapers and encyclopedias in the home while the individual was growing up.

The sign and level of statistical significance of the coefficient estimate of *EDEX* is not predicted by the screening hypothesis. It is pointed out in Riley [1979] that if the signal is correct on average, there is no reason for the observed return to the signal (years of education obtained) to fall with experience.

DEGREE1 is a dummy variable which captures the disproportionate change in the rate of return on years of schooling as a result of the attainment of a four- or five-year college degree. The dummy variable *DEGREE2* captures the analogous disproportionate change in the situation where a master's or equivalent degree is earned.

Given that it is most likely that males and females were treated differently by employers during the time period covered by the surveys of the NLS72 data set used in this study, not only were all of the variables listed in Table 1 (except *W*) included as independent variables in Equation (1), but also each of these variables (excluding the variable *SEX*) are multiplied by the 0-1 dummy variable *SEX* and included as well. This is done so that differences in the regression coefficients of the original independent variables between males and females (excluding the variable *SEX*) can be identified. The variable *SEX* is included separately as an independent variable in Equation (1) to determine if the intercept term differs by sex. The empirical results in Table 2 also enable one to determine if any differences in the individual coefficient estimates and in the intercept terms between men and women are statistically significant.

Consider the empirical results obtained when Equation (1) is estimated for all the individuals who indicate that most of what was done on the job was learned in school (see the first column of Table 2). The rate of return estimate on years of schooling is positive and statistically significant; however, the coefficient estimates of *DEGREE1* and *DEGREE2* are not statistically significant, indicating the absence of sheepskin effects.

The rate of return on years of schooling does not increase disproportionately when either a four- or five-year college degree or a master's or equivalent degree are conferred, indicating that schooling is not a lumpy investment for these individuals. These findings indicate that diplomas are not used as screening devices. A *ceteris paribus* increase in years of schooling alone positively and significantly affects the natural logarithm of usual hourly earnings for individuals who find their schooling relevant for their occupations, demonstrating support for the human capital theory.

Equation (1) is also estimated for all individuals who indicate that it was not their experience that "most of what was done on the job was learned in school." See the second column of Table 2 for these empirical results. Interestingly, the empirical results demonstrate that a *ceteris paribus* increase in *ED* does not increase one's earnings, which is evidence that *ED* has no direct productivity and earnings-enhancing impact. This empirical finding is consistent with the human capital theory.

The coefficient estimates of the dummy variables *DEGREE1* and *DEGREE2* which enable one to test whether or not the rate of return on years of schooling increases disproportionately when one receives a four- or five-year college degree and a master's or equivalent degree, respectively, are both positive and statistically significant. These empirical results indicate that the acquisition of diplomas contributes to earnings and at the same time the content of schooling as measured by *ED* does not.

The only way to reap monetary returns from schooling for this group of individuals is to earn diplomas, demonstrating that schooling is used solely as a screening device in this situation. Employers are using diplomas as signals for superior preexisting job-productivity-related ability levels of individuals with diplomas compared with the preexisting job-productivity-related ability levels of individuals without diplomas. In addition, one could also argue that diplomas are signaling for certain character traits of diploma recipients that positively impact job-productivity-related ability levels such as perseverance. This character trait is necessary for one to bring one's formal schooling to a successful conclusion as demonstrated by the receipt of a diploma.

Within the context of these results, given schooling's virtual irrelevance for one's occupation, and given that empirically a *ceteris paribus* increase in *ED* does not increase one's earnings, any potential human capital interpretation of the presence of sheepskin effects would not apply.

CONCLUSIONS

Hungerford and Solon [1987] demonstrate the presence of sheepskin effects in the returns to schooling using Current Population Survey (CPS) data, and conclude "that previous authors' dismissal of the screening hypothesis on the ground that sheepskin effects do not exist was premature." In this study, sheepskin effects are found to exist, but are not stable across individuals according to whether or not they found their accumulated schooling relevant for their occupations. Rate of return estimates on years of schooling between these two groups of individuals are not stable either. The stability pattern of sheepskin effects in the returns to schooling observed in this study provides novel insight into the human capital theory-screening hypothesis debate.

For individuals whose schooling is related to their occupations, the rate of return estimate on years of schooling is large and positive as well as being statistically sig-

nificant, and sheepskin effects are not present. These results are consistent with the human capital theory.

For individuals whose schooling is not related to their occupations, additional years of schooling attained do not cause an increase in the natural logarithm of usual hourly earnings, *ceteris paribus*. This is consistent with the human capital theory. However, sheepskin effects are found to be present, indicating that diplomas are being used as screening devices for this group of individuals.

Given the virtual irrelevance of schooling for one's occupation in this situation, and given that empirically a *ceteris paribus* increase in *ED* does not increase one's earnings, any potential human capital interpretation of the presence of sheepskin effects would not apply. In this case, one's ability to conclude that the presence of sheepskin effects validates the screening hypothesis is far greater than in other studies interpreting the presence of sheepskin effects in the returns to schooling since in these other studies, human capital interpretations of the presence of sheepskin effects could not be ruled out as easily.

The demonstrated pattern and lack of stability in the sheepskin effects in the returns to schooling, and in the rate of return estimate on years of schooling between these two groups of individuals, more directly indicate support for the human capital theory in addition to the screening hypothesis as opposed to other analyses of sheepskin effects such as Hungerford and Solon [1987], Belman and Heywood [1991], Shabbir [1991], and Heywood [1994] which interpret the presence of sheepskin effects as validating predominantly the screening hypothesis.

The findings in this study are consistent with the arguments of both human capital theorists and supporters of the screening hypothesis. Layard and Psacharopoulos [1974] correctly indicate that the strongest advocates of the human capital theory would agree that in certain instances schooling is used as a screening device, just as proponents of the screening hypothesis would acknowledge that, at least to a certain extent, schooling enhances job-related productivity, which in turn enhances earnings. The results obtained in this study indicate this more convincingly and comprehensively than other studies examining sheepskin effects in the returns to schooling.

NOTES

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REFERENCES

Arabsheibani, G. The Wiles Test Revisited. *Economics Letters*, 1989, 361-64.

Belman, D. and Heywood, J. Sheepskin Effects in the Returns to Education: An Examination of Women and Minorities. *Review of Economics and Statistics*, November 1991, 720-24.

Ehrenberg, R. and Smith, R. *Modern Labor Economics: Theory and Public Policy*. New York: HarperCollins Publishers Inc., (1982) (1985) 1991.

Heywood, J. How Widespread are Sheepskin Returns to Education in the U.S.? *Economics of Education Review*, September 1994, 227-34.

Hungerford, T. and Solon, G. Sheepskin Effects in the Returns to Education. *Review of Economics and Statistics*, February 1987, 175-77.

Lang, K. and Kropp, D. Human Capital Versus Sorting: The Effects of Compulsory Attendance Laws. *Quarterly Journal of Economics*, August 1986, 609-24.

Layard, R. and Psacharopoulos, G. The Screening Hypothesis and the Returns to Education. *Journal of Political Economy*, September-October 1974, 985-98.

Miller, P. and Volker, P. The Screening Hypothesis: An Application of the Wiles Test. *Economic Inquiry*, January 1984, 121-27.

Riccobono, J., Henderson, L., Burkheimer, G., Place, C., and Levinsohn, J. *National Longitudinal Study: Base Year (1972) Through Fourth Follow-Up (1979) Data File Users Manual*. Research Triangle Park, NC: Center for Educational Research and Evaluation, 1981.

Riley, J. Testing the Educational Screening Hypothesis. *Journal of Political Economy*, October 1979, S227-S252.

Shabbir, T. Sheepskin Effects in the Returns to Education in a Developing Country. *The Pakistan Development Review*, Spring 1991, 1-19.

Wiles, P. The Correlation Between Education and Earnings: The External-Test-Not-Hypothesis (ETNC). *Higher Education*, February 1974, 43-58.