**FIEF Working Paper Series 2000** ISSN 1651-0852

No. 158

# Sheepskin Effects in the Returns to Education: Evidence on Swedish Data

by

**Jesper Antelius**§

## Abstract

The empirical labor literature often refers returns to specific credentials of education as sheepskin effects. Previous studies might suffer from potential flaws as they use an approach, which overlook the presence of an ″education effect″ from receipt of a diploma. This paper examines and reports evidence of sheepskin effects at both university level and at high school level, in the Swedish labor market. In contrast to previous US studies the paper considers and reports the existence of an ″educational effect″ involved when estimating the sheepskin effect. The paper also reports evidence on diminishing sheepskin effects with tenure at the current firm.

**Keyword:** Returns to education; Sheepskin effects
**JEL classification:** I20; I21

**February 18, 2000**

♣ Address: Trade Union Institute For Economic Research, FIEF, Wallingatan 38, S-111 24 Stockholm, Sweden. Phone: +46 8 696 99 15, Fax: +46 8 20 73 13
E-mail: j.antelius@fief.se

# I. Introduction

Several studies in different countries have confirmed that individuals earn higher wages the higher their level of formal education. Returns to education are mostly estimated per year of completed schooling as in the common Mincer wage equation. The most common explanation for the wage effect of education has been that schooling increases employee productivity, an idea usually associated with the human capital theory.

In real life however, an employer setting the wage or salary of a new employee does not ask for years of schooling but for a school leaving certificate, high school diploma or university degree. Screening theories, in turn, assume that educational achievement can be used to predict individual productivity, as the individual's true productivity cannot be monitored without some significant cost. When there is uncertainty about an individual employee's true productivity, employers use educational achievement as a screening device. Employees in their turn will use their educational credentials as a signal to employers of their potential productivity.

It could be argued, however, that years of schooling are too crude an instrument for estimating returns to education. Years of schooling are not the basis for employers' wage setting and the implied linearity of wages by years of schooling is not verified by data. Individuals who have the same number of years of schooling or the same certificates of education can vary widely in level of productivity. This suggests that the appropriate approach to estimating returns to education is to separate the screening or signaling effects of educational credentials (such as diplomas) from the productivity effects of education.

In the literature, the returns to specific credentials of education rather than accumulated years of schooling are often referred to as "sheepskin effects" (see for example Hungerford & Solon, (1987)). The term follows from the tradition in the US of presenting diplomas on parchment, usually made from the skin of a sheep. This also means that wages are not necessarily a linear function of time spent in school.

Several US studies have confirmed the existence of non-linearities in the return to schooling (e.g. Hungerford & Solon, (1987), Jaeger & Page, (1996) and Park, (1999)) and these non-linearities have been attributed to sheepskin effects. But in most of the previous empirical work on estimating sheepskin effects, the actual diploma effects have not been taken into consideration due to limitations in the data used. Absence of adequate data has meant that sheepskin effects are usually defined as disproportionately large increases in returns to schooling after the completion of a certain year of schooling such as the 8th, 12th or 16th, which usually lead to some kind of diploma.

Another potential flaw in previous studies of sheepskin effects seems to be that they have overlooked the presence of an actual 'education' effect from receipt of a diploma. Implicitly, individuals who receive a diploma or a degree have had a longer education. This suggests that previous research might have overestimated the sheepskin effects by not considering this education effect. But this potential flaw can easily be overcome by using a well-known wage decomposition procedure.

A key issue concerning the signaling value of educational credentials is how quickly the employers learn about a employee's true productivity. A reasonable hypothesis is that the employer uses the individuals' tenure in the firm as an indicator. As employees' tenures in the firm increase, the employer can directly observe the true productivity differences among them. This additional information about true individual productivity can then be used to correct individual wages. As a result, the wage-screening role of educational credentials should diminish over time. Two previous empirical studies using US data have found support for this hypothesis (Belman & Heywood, (1997) and Liu & Wong, (1982)). Outside the US labor market this issue has not been subject to any empirical investigation.

This paper examines the existence of sheepskin effects in the Swedish labor market using the 1991 Swedish Level of Living Survey, which includes explicit information on the individuals' highest diploma, years of schooling and hourly wage. In contrast to previous studies, this paper takes potential education effects into consideration when estimating sheepskin effects by using the Blinder-Oaxaca wage decomposition method. The paper also empirically investigates the attenuation of sheepskin effects with increasing tenure when employers learn about each individual's true productivity. This is done by estimating the sheepskin effects conditional upon years of tenure in the current firm.

The main findings of this paper are as follows. There is Swedish evidence to support sheepskin effects both at the university and high school levels. There is also evidence in estimations of the sheepskin effect using previous methods that an education effect is involved. Finally, the paper reports evidence of diminishing sheepskin effects with tenure in the current firm.

The paper proceeds as follows. In the next section, the different approaches used in previous studies to estimate sheepskin effects in the return to schooling are discussed and a new approach is suggested. Section three describes the data. Section four applies the new approach to estimate the sheepskin effects in the Swedish material and Section five investigates how quickly they will diminish. In Section six conclusions are presented.

## II. Estimating sheepskin effects.

The most common approach when estimating the return to schooling is based on the Mincer human capital wage equation:

$$\ln w_i = a_i + ßS_i + lX + e_i \qquad (1)$$

where the dependent variable is the natural logarithm of hourly earnings. $S_i$ denotes years of schooling, while β is interpreted as the wage premium from an additional year of schooling. $X$ is a vector including additional explanatory variables and λ is a vector of parameters.

The specification of schooling in equation (1) assumes that the return to schooling is a linear function of time spent in school. In investigating potential non-linear returns to schooling, the common approach is to estimate a wage equation, which specifies the schooling variable as:

$$\ln w_i = a_i + \sum ßD_i(schooling) + lX + e_i \qquad (2)$$

where *D(schooling)* denotes dummies for different levels of schooling and β is interpreted as the wage premium of that certain level or year of schooling. In a number of studies the non-linearities at 12 and 16 years of schooling have been empirically confirmed in US data. In some of these studies these findings have been interpreted as sheepskin effects, i.e. when completion of a certain year of schooling that normally leads to some kind of diploma acquires for the individual an extra wage premium.

Equation (2) is the basis of most of the previous research on sheepskin effects in the United States. However, the data used in some of these studies do not contain any information about the individuals' actual diplomas (Hungerford & Solon, (1987) and Belman & Heywood, (1997)), see *Table 1*. Instead, these studies are based on a modified version of equation (2), using a discontinuous function for disproportionately large increases in the return to schooling for those years that usually lead to a diploma. The discontinuities in this case are expressed as dummy variables for S≥8, S≥12 and S≥16, where these dummy variables are thought of as capturing the sheepskin effects.

Other studies are based on information about individuals' actual degrees but utilize different approaches. Jaeger & Page (1996) and Arkes (1999) use a model that is discontinuous for each educational level (e.g. high school, college etc.). Arkes also includes a dummy variable for received diploma as well as information about AFQT scores.[1] On the other hand, Park (1999) adds interaction terms for different levels of schooling into the equation. This means an interaction between years of schooling and highest diploma/degree obtained, expressed as D(degree)*D(years of schooling completed). The sheepskin effects are then interpreted for e.g. a bachelor's degree as the estimated coefficient for the interaction term D(years of schooling=16)* D(degree =university).

Nevertheless, there are potential flaws in all these studies. First, the assumption that individuals take their exams in the standard number of years might lead to a bias in the estimated sheepskin effects for the reason that many individuals do not do so (see for example Björklund & Kjellström (1999), Jaeger & Page (1996) or *Table 8* in the Appendix). In addition, the studies might also capture an effect of going from e.g. 15 to 16 years of schooling. This could lead to an over-estimation of the sheepskin effects as it then also includes the education effect.

**Table 1. Previous studies on sheepskin effects.**

| | Hungerford & Solon (1987) | Jaeger & Page (1996) | Belman & Heywood (1997) | Arkes (1999) | Park (1999) |
|---|---|---|---|---|---|
| Model | Discontinuous spline function. Discontinuities at 8, 12 and 16 years of schooling. | Discontinuous function, with dummies for each year of schooling and dummies for degrees. | Discontinuous spline function Discontinuities at 8, 12 and 16 years of schooling. | Discontinuous function, with dummies for each year of schooling and dummies for degrees. | Discontinuous function, with interaction between years of schooling and degree. |
| Info. about degree | No | Yes | No | Yes | Yes |
| Data set | CPS, May 1978. | A match of CPS, January 1992 and March 1991. | CPS, 1991. | NLSY, 1993. | CPS, February 1990. |
| Sample | White males, age 25 – 64. | White males, age 25 –64. | Non-black males, age 24 – 65. | Males, age 28 – 30. | Age 25 – 64. |
| Sample size | 16,498 | 8,957 | 68,838 | 1,064 | 12,187 |
| Sheepskin effects: | | | | | |
| High school diploma | $0.0350^{*}$ | $0.123^{**}$ | $0.069^{**}$ | 0.055 | $0.089^{**}$ |
| Univ. degree | $0.0895^{***}$ | $0.245^{***}$ | $0.140^{***}$ | $0.192^{***}$ | $0.211^{***}$ |

**Note**: The sheepskin effects for Belman & Heywood (1997) are the average sheepskin effects computed for the significant coefficients. $^{***}$ denotes coefficients significantly different from zero at the 1 % level, $^{**}$ at the 5 % level and $^{*}$ at the 10 % level.

[1] Armed Forces Qualification Test, the score is the sum of arithmetic reasoning score, word knowledge score, paragraph comprehension score and one-half the numerical operations score.

Indirectly, Jaeger & Page (1996) do account for the presence of an education effect by letting each year of schooling as well as the highest diploma received enter the equation as dummy variables. The authors compare a wage equation regressed without any information as to received diploma with a regressed wage equation including such information. The difference between the estimated coefficients for the years of schooling from the two equations might then be interpreted as sheepskin effects. However, there is a risk that the estimated sheepskin effect for different diplomas is biased for individuals who do not complete their diplomas in the standard number of years.

In the following, another approach is presented for capturing a potential education effect when estimating sheepskin effects. The starting point is to estimate wage differentials between individuals who have completed their university studies with a degree and individuals with some university studies but no degree. Running separate wage regressions for the two groups moderates the assumption of similar coefficient values for the variables included in the wage equation in the approaches of previous studies. The wage differentials between the two groups are then analyzed by the well-known Blinder-Oaxaca wage decomposition procedure, which computes one explained part and one unexplained part of the wage differentials. In particular the following formula is applied:

$$\overline{\ln w_D} - \overline{\ln w_N} = (\overline{X_D^{'}} - \overline{X_N^{'}})\hat{\beta}_D + \overline{X_N^{'}}(\hat{\beta}_D - \hat{\beta}_N) \quad (3)$$

where $w_D$ is the hourly earnings for the group of individuals with a university degree and $w_N$ is the hourly earnings for the group of individuals with no degree but who have attended university. $X$ is a vector of explanatory variables and $\beta$ is a vector of estimated parameters. The first expression on the right-hand side of equation (3) is the explained part and the second expression is the unexplained part. The unexplained part is interpreted as the maximum part of the wage differentials that can be attributed to sheepskin effects.

The education effect will arise on average as $S_D > S_{ND}$, where $S_D$ is average years of schooling for those who have received a degree and $S_{ND}$ the average years of schooling for those who have attended university but not attained a degree. As this component is included in the $X$ vector, this makes it possible to consider the education effect apart from the sheepskin effect.

## III. Data and regression results

My estimations rely on the 1991 Swedish Level of Living Survey, a data set based on interviews combined with register data (for details see Fritzell and Lundberg, (1994)). The sample consists of individuals who have received their education mainly within the Swedish school system. Further, only individuals aged 24 – 65 are included, as more likely to have finished their studies.

Agricultural employees and the self-employed are excluded from the sample due to the difficulties of approximating their hourly earnings. Individuals who have not reported any wage and those who were not employed at the time are also excluded from the sample.

This leaves a sample of 2,571 respondents, of whom 1,304 are men and 1,267 women. *Table 2* shows descriptive statistics for the sample of individuals used. The average age in the sample of employees aged 25-64 is 42 years. The male/female balance is almost even. The average number of years of education is 11.7; 17 per cent have a university degree and 21 per cent have a high school diploma. The average wage in 1991 was 83,4 SEK per hour.

Years of schooling completed are transformed into dummy variables starting with 9 years or fewer and ending with 18 or more years of completed schooling, which implies the following construction of the dummy variable: $S \leq 9$ (D9), $S=10$ (D10),...., $S\geq18$ (D18).

The variable "highest received formal education" is a categorical dummy. The first category contains the individuals who have received a university degree. The second category contains the individuals who have attended university for one or more years but not completed a degree. Finally, the third category contains the individuals with a high school diploma. Due to the limitations of my data I cannot make a distinction between the 2-year, more vocational type and the 3–year, more theoretical type of high school education in Sweden. Obvious discrepancies between years of schooling and educational level according to SUN (Swedish Education Nomenclature) have been corrected.

**Table 2. Sample characteristics.**

| Variable | Mean | Std. Dev. |
|---|---|---|
| Age | 42.1 | 10.8 |
| Years of education | 11.7 | 3.2 |
| Years of work experience | 20.4 | 11.1 |
| Wage (SEK per hour) | 83.4 | 28.3 |
| ln wage | 4.38 | 0.29 |
| Sector (1 if private) | 0.53 | 0.50 |
| Big city (1 if big) | 0.28 | 0.45 |
| Sex (1 if male) | 0.51 | 0.50 |
| **Completed years of education:** | | |
| 9 | 0.28 | 0.45 |
| 10 | 0.09 | 0.28 |
| 11 | 0.16 | 0.37 |
| 12 | 0.10 | 0.30 |
| 13 | 0.08 | 0.27 |
| 14 | 0.10 | 0.31 |
| 15 | 0.06 | 0.25 |
| 16 | 0.05 | 0.21 |
| 17 | 0.04 | 0.19 |
| 18 | 0.05 | 0.21 |
| **Highest credential:** | | |
| University degree | 0.17 | 0.38 |
| Some university (no degree) | 0.04 | 0.21 |
| High school diploma | 0.21 | 0.41 |
| Some high school (no diploma) | 0.03 | 0.17 |
| Number of observations | 2 571 | |

**Note:** Own calculations from the 1991 Swedish Level of Living Survey.

*Table 3* shows characteristics of those who have a university degree compared to those who have attended university but not completed a degree. The characteristics of both groups are in many ways similar with two main exceptions. First, those who have a university degree have relatively more years of schooling on average and less work experience. Second, the hourly wage on average is higher (as expected) for those who have a university degree. The wage difference is about 6 per cent.

**Table 3. Sample characteristics for university groups.**

| Variable | University degree | | No university degree | |
|---|---|---|---|---|
| | Mean | Std. Dev | Mean | Std. Dev |
| Sex (1 if male) | 0.46 | 0.50 | 0.49 | 0.50 |
| Average age | 41.2 | 9.9 | 41.1 | 11.3 |
| Years of education | 16.1 | 2.1 | 14.6 | 1.4 |
| Years of work experience | 16.0 | 9.4 | 18.2 | 11.9 |
| Big city (1 if big) | 0.41 | 0.49 | 0.42 | 0.50 |
| Wage (SEK per hour) | 100.3 | 36.5 | 94.8 | 40.5 |
| ln wage | 4.55 | 0.31 | 4.49 | 0.34 |
| No. of observations | 447 | | 113 | |

**Note:** Own calculations from the 1991 Swedish Level of Living Survey.

*Table 4* reports findings from three different types of specifications of wage equations often used when estimating sheepskin effects. In all of the models the years of schooling are entered as discontinuities, expressed as separate dummies for each year. The first specification represents the baseline model and includes no information about the actual diploma. In the second model two dummy variables are introduced, one representing high school diplomas and the other representing university degrees. This is supposed to cleanse the returns to schooling from a possible diploma effect. Finally, the third model introduces a dummy variable for partial university studies. This variable is introduced in order to investigate whether merely attending a university for a time signals something about productivity/ability that employers find worthwhile.

All of the estimated coefficients have the expected signs. In model (1) the estimated coefficients are all significant at the 1 % level. The estimated coefficients for the control variables are all standard signs. One additional year of experience gives close to two per cent in wages. Male wages and private sector wages are on average 10 per cent higher than female and public sector wages. Wages in the three largest cities in Sweden are approximately seven per cent higher than in the rest of the country.

The same is valid in model (2). Further, in the third model the only insignificant coefficient is the dummy representing partial university education. Finally, a control for partial high school education was included but it turns out not to be significant

**Table 4. Estimated sheepskin effects, using different specifictions.**

| Model | Model (1) | | Model (2) | | Model (3) | |
|---|---|---|---|---|---|---|
| Constant | 3.825 | *(0.023)* | 3.806 | *(0.023)* | 3.805 | *(0.023)* |
| | | | | | | |
| Experience | 0.018 | *(0.002)* | 0.019 | *(0.002)* | 0.019 | *(0.002)* |
| Experience$^2$ | -0.000 | *(0.000)* | -0.000 | *(0.000)* | -0.000 | *(0.000)* |
| Gender (Male=1) | 0.116 | *(0.009)* | 0.115 | *(0.010)* | 0.115 | *(0.010)* |
| Sector (Private=1) | 0.105 | *(0.010)* | 0.106 | *(0.010)* | 0.106 | *(0.010)* |
| Urban (metropolitan=1) | 0.071 | *(0.011)* | 0.071 | *(0.011)* | 0.070 | *(0.011)* |
| | | | | | | |
| **Completed years of education (dummies:)** | | | | | | |
| 9 or less | ref. | | ref. | | ref. | |
| 10 | 0.098 | *(0.017)* | 0.098 | *(0.017)* | 0.098 | *(0.171)* |
| 11 | 0.124 | *(0.014)* | 0.101 | *(0.016)* | 0.100 | *(0.016)* |
| 12 | 0.148 | *(0.017)* | 0.132 | *(0.017)* | 0.131 | *(0.017)* |
| 13 | 0.219 | *(0.020)* | 0.200 | *(0.021)* | 0.197 | *(0.021)* |
| 14 | 0.273 | *(0.018)* | 0.239 | *(0.020)* | 0.231 | *(0.022)* |
| 15 | 0.358 | *(0.025)* | 0.321 | *(0.027)* | 0.315 | *(0.029)* |
| 16 | 0.436 | *(0.029)* | 0.396 | *(0.032)* | 0.390 | *(0.034)* |
| 17 | 0.413 | *(0.029)* | 0.365 | *(0.031)* | 0.358 | *(0.032)* |
| 18 or more | 0.439 | *(0.030)* | 0.389 | *(0.031)* | 0.383 | *(0.032)* |
| | | | | | | |
| **Diploma effects:** | | | | | | |
| High school diploma | - | | 0.050 | *(0.014)* | 0.053 | *(0.014)* |
| Some university, no degree | - | | - | | 0.022 | *(0.030)* |
| University degree | - | | 0.070 | *(0.020)* | 0.077 | *(0.022)* |
| $R^2$ | 0.347 | | 0.353 | | 0.353 | |
| Number of observations | 2,571 | | 2,571 | | 2,571 | |

**Note:** Standard errors in parentheses are corrected for heteroskedasticity using White's robust standard errors; estimation method OLS. The dependent variable is log hourly wages. The percentage increase in wages associated with a dummy variable coefficient is to be calculated as $e^{\beta}$ - 1.

One way of looking at the results presented in *Table 4* is to interpret the estimated coefficients for each diploma—high school or university—as the sheepskin effect of that particular diploma. For reasons discussed in the previous section, this could lead to an overestimation of the sheepskin effects since individuals with a diploma on average (see *Table 3*) have more schooling. A more appropriate way to interpret the results is to compare the estimated coefficients from model (1) with the same coefficients from model (2) or model (3). *Table 5* presents these differences in estimated schooling coefficients between model (1) and (2). The differences might be interpreted as the part of the total returns to schooling that are due to sheepskin effects.

**Table 5. Implied sheepskin effects, models (1) – (2).**

| Completed years of schooling | Estimated coeff-cients in model (1) | Estimated coeffi-cients in model (2) | Implied sheepskin effects: (1) - (2) |
|---|---|---|---|
| 10 | 0.098 | 0.098 | 0 |
| 11 | 0.124 | 0.101 | 0.023 |
| 12 | 0.148 | 0.132 | 0.016 |
| 13 | 0.219 | 0.200 | 0.019 |
| 14 | 0.273 | 0.239 | 0.034 |
| 15 | 0.358 | 0.321 | 0.037 |
| 16 | 0.436 | 0.396 | 0.004 |
| 17 | 0.413 | 0.365 | 0.048 |
| 18 | 0.439 | 0.389 | 0.05 |

**Note:** The implied sheepskin effects are computed as the estimated coefficients for each year of schooling in column (1) minus the same coefficients in column (2).

However, this means that the average sheepskin effect for each particular year of schooling is obtained. This could lead to a bias of the implied sheepskin effect since many students do not complete their exams in the standard number of years (see Appendix, *Table 8*). For example, the implied sheepskin effect for 16 years of schooling in *Table 5* represents both a high school diploma and a university degree. Since the sheepskin effect from the former should be lower than from the latter it is obvious that the implied sheepskin effect is downward biased for university and upward biased for high school in this example.

A more appropriate way of estimating sheepskin effects is to compare individuals who have studied at the same level (e.g. university). By using the Blinder-Oaxaca wage decomposition method it is possible to cleanse the sheepskin effects from a potential education effect.

The group of individuals with partial university education serves as a control group and is compared with the group with university degrees. As this method forces the two groups to take the same values on the right-hand side of the wage equation, the unexplained part of the decomposition can be interpreted as the maximum amount of sheepskin effects. The outcome of this computation is that the sheepskin effect for university studies is 9.3 % at maximum**.**

The result from the computation for high school suggests that the sheepskin effect is at maximum 1.6 %. The explanation for the large discrepancy between this result and the outcome in model (2) in *Table 4* is that the dummy variable in the second model is interpreted against the constant term. This constant term will include all individuals with different educational attainment below a high school diploma. This suggests that the “dummy variable-model” might be too restrictive and that the use of the

Blinder-Oaxaca method is more appropriate when calculating sheepskin effects.

## IV. On diminishing sheepskin effects

Sheepskin effects are supposed to arise from an information problem. Suppose that the firm has two decisions to make when hiring and offering wages. First, each job is associated with a certain level of productivity and the firm has to decide whether or not to hire a certain individual for the job. Second, the firm must offer a wage to the (hired) individual. While the market determines the average wage for that particular job, the individual wage can deviate from the average wage. This is due to uncertainty about the true productivity of the individual employee. But as tenure increases, the employers can directly observe the individual's productivity, which allows them to correct the wage. This then raises the interesting question, how soon will the employers learn about the employee's true level of productivity?

This issue has been empirically investigated in two previous studies that have focused on the hypothesis of diminishing sheepskin effects with increasing tenure. Liu & Wong (1982) used a Mincer wage equation and included information about highest diploma in terms of dummy variables. The equation was then regressed conditional upon groups of overlapping tenure intervals. The findings suggest that the high school diploma effect will disappear after 2 to 4 years of tenure in the firm and the bachelor's degree effect after 4 to 6 years. Belman & Heywood (1997) also found evidence of diminishing sheepskin effects by utilizing another approach. They divided the sample into cohorts and investigated whether or not sheepskin effects differ across cohorts. The implicit assumption is that older individuals have had longer tenure.

In the following, a modified version of the wage-screening test used by Liu & Wong (1982) is utilized. In particular, the estimation is conditional upon the individual's years of tenure in the current firm. This leads to the following model:

$$\ln w_{ij} = \varphi_{ij} + \gamma_1 X_j + \gamma_2 D(degree)_{ij} + \gamma_3 D(schooling)_{ij} + \eta_{ij} \quad (4)$$

where subindex $j$ denotes the $j$th tenure interval. If the hypothesis is supported by the data the sheepskin effects should attenuate as tenure in the firm increases, i.e. $\gamma_2$ should diminish.

*Table 6* presents the results from estimating equation (4) on six tenure intervals. Due to the small number of observations when estimating conditional upon tenure, it is not possible to utilize the earlier mentioned method of wage decomposition. Instead the results are interpreted in terms of the pattern of dummy coefficients representing a university degree and a high school diploma, and the implied sheepskin effects.

First, analysis of the diploma effects in terms of dummy coefficients tells a rather straightforward story. The diploma effects increase slightly at the beginning of tenure**,** but after the individuals have been working in the firm for about 2 to 4 years the effects start to attenuate and disappear completely after 3 to 5 years for high school diplomas and 4 to 6 years for university degrees.

**Table 6. Estimating attenuating sheepskin effects, with overlapping intervals.**

| Variables | 0<= t =>2 | 1<= t =>3 | 2<= t =>4 | 3<= t =>5 | 4<= t =>6 | 5<= t =>7 |
|---|---|---|---|---|---|---|
| Constant | 3.842 | 3.802 | 3.863 | 3.930 | 3.965 | 3.982 |
| | *(0.050)* | *(0.045)* | *(0.043)* | *(0.042)* | *(0.052)* | *(0.063)* |
| **Completed years of education (dummies)** | | | | | | |
| 9 | ref. | ref. | ref. | ref. | ref. | ref. |
| 10 | 0.036 | 0.083 | 0.081 | 0.064 | -0.045 | -0.011 |
| | *(0.045)* | *(0.041)* | *(0.045)* | *(0.049)* | *(0.051)* | *(0.061)* |
| 11 | 0.098 | 0.055 | 0.056 | 0.146 | 0.165 | 0.117 |
| | *(0.040)* | *(0.037)* | *(0.040)* | *(0.056)* | *(0.063)* | *(0.075)* |
| 12 | 0.132 | 0.071 | 0.087 | 0.149 | 0.195 | 0.153 |
| | *(0.048)* | *(0.046)* | *(0.048)* | *(0.050)* | *(0.055)* | *(0.072)* |
| 13 | 0.117 | 0.075 | 0.138 | 0.232 | 0.254 | 0.274 |
| | *(0.053)* | *(0.040)* | *(0.047)* | *(0.050)* | *(0.057)* | *(0.071)* |
| 14 | 0.175 | 0.176 | 0.205 | 0.224 | 0.213 | 0.207 |
| | *(0.045)* | *(0.043)* | *(0.050)* | *(0.057)* | *(0.065)* | *(0.071)* |
| 15 | 0.303 | 0.239 | 0.224 | 0.245 | 0.321 | 0.383 |
| | *(0.075)* | *(0.058)* | *(0.060)* | *(0.073)* | *(0.083)* | *(0.079)* |
| 16 | 0.202 | 0.366 | 0.316 | 0.337 | 0.596 | 0.510 |
| | *(0.080)* | *(0.095)* | *(0.074)* | *(0.076)* | *(0.111)* | *(0.115)* |
| 17 | 0.234 | 0.340 | 0.398 | 0.458 | 0.477 | 0.460 |
| | *(0.059)* | *(0.072)* | *(0.095)* | *(0.136)* | *(0.073)* | *(0.090)* |
| 18 | 0.370 | 0.425 | 0.328 | 0.257 | 0.420 | 0.408 |
| | *(0.066)* | *(0.060)* | *(0.072)* | *(0.084)* | *(0.096)* | *(0.114)* |
| **Diploma effects** | | | | | | |
| High school | 0.073 | 0.107 | 0.069 | -0.041 | -0.055 | -0.012 |
| diploma | *(0.035)* | *(0.034)* | *(0.034)* | *(0.035)* | *(0.041)* | *(0.047)* |
| University | 0.128 | 0.152 | 0.125 | 0.113 | -0.012 | 0.029 |
| degree | *(0.046)* | *(0.046)* | *(0.050)* | *(0.061)* | *(0.062)* | *(0.061)* |
| $R^2$ | 0.328 | 0.427 | 0.398 | 0.3978 | 0.469 | 0.451 |
| Number of observations | 432 | 398 | 336 | 280 | 239 | 207 |

**Note**: Standard errors in parentheses are corrected for heteroskedasticity using White's robust standard errors; estimation method OLS. The dependent variable is log hourly wages. The model also includes general experience (calculated as work experience minus tenure in current firm), general experience squared, and control variables for sector (private sector employees = 1), big city (metropolitan dwelling = 1), and gender (males = 1). The percentage increase in wages associated with a dummy variable is calculated as $e^{\beta} - 1$.

*Table 7* presents the implied sheepskin effects and tells the same story as the dummy coefficients. A slight increase in sheepskin effects can be observed at the beginning of tenure, but then they start to attenuate and have vanished after 3 to 5 years for a high school diploma and 4 to 6 years for a university degree. It is worth noting that the size of the sheepskin effects might be biased for reasons described in the previous section. Nevertheless, the important aspect of these results is the pattern of diminishing sheepskin effects with increasing tenure in the firm.

**Table 7. Implied sheepskin effects for different tenure intervals.**

| Years of completed schooling | Tenure intervals 0-2 | 1-3 | 2-4 | 3-5 | 4-6 | 5-7 |
|---|---|---|---|---|---|---|
| 10 | 0 | 0.003 | 0 | -0.003 | -0.009 | -0.001 |
| 11 | 0.037 | 0.062 | 0.039 | -0.024 | -0.031 | -0.006 |
| 12 | 0.033 | 0.045 | 0.030 | -0.020 | -0.022 | -0.002 |
| 13 | 0.027 | 0.045 | 0.019 | -0.020 | -0.029 | -0.007 |
| 14 | 0.064 | 0.074 | 0.060 | 0.031 | -0.009 | 0.012 |
| 15 | 0.082 | 0.099 | 0.066 | 0.045 | -0.007 | 0.012 |
| 16 | 0.096 | 0.086 | 0.052 | 0.057 | 0.002 | 0.016 |
| 17 | 0.088 | 0.105 | 0.095 | 0.076 | -0.012 | 0.018 |
| 18 | 0.078 | 0.092 | 0.084 | 0.062 | -0.001 | 0.025 |

**Note:** The implied sheepskin effects are computed in the same way as in *Table 5*.

## VI. Conclusions

This paper reports the empirical investigation of two hypotheses. The first hypothesis concerns the existence of sheepskin effects when estimating returns to schooling in the Swedish labor market. The empirical analysis reports evidence of such sheepskin effects at both high school and university level. The paper also highlights several difficulties in estimating sheepskin effects and suggests a new approach that takes into consideration a potential education effect that might affect such estimations. By using the Blinder-Oaxaca wage decomposition method the unexplained part could be interpreted as the maximum part of the wage differentials that could be due to sheepskin effects. The fact that these effects are considerably lower than in previous US studies is in line with the fact that in general the estimated return to schooling is lower in the Swedish data than in US data.

The second hypothesis concerns the signaling value to employers of educational credentials as indicators of the individual's productivity. As tenure increases, the employer gains more information about the employee's true productivity and will adjust the wage accordingly. Diminishing sheepskin effects with increasing tenure in the firm indicate empirical support for this hypothesis. The results suggest that sheepskin effects for a high school diploma will completely disappear after 3 to 5 years and for a university degree after 4 to 6 years of tenure in the firm.

In conclusion, diplomas do matter when calculating the private return to schooling, but only initially—as signaling and screening mechanisms. As employers gain more information about their employees in terms of productivity, the sheepskin effects attenuate. However, whether this information problem only occurs when an employee is entering the labor market for the first time or every time s/he changes to a new job must be a subject for future research.

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## Appendix

**Table 8. Cross-tabulation between years of schooling and different educational groups.**

| Years of schooling | High school diploma | Some university but no degree | University degree |
|---|---|---|---|
| <=9 | 0 | 0 | 0 |
| 10 | 12 | 0 | 0 |
| 11 | 242 | 0 | 0 |
| 12 | 108 | 0 | 0 |
| 13 | 101 | 19 | 0 |
| 14 | 37 | 52 | 121 |
| 15 | 20 | 17 | 86 |
| 16 | 6 | 11 | 74 |
| 17 | 3 | 9 | 74 |
| >=18 | 5 | 5 | 92 |

**Note**: Own calculations from the 1991 Swedish Level of Living Survey.

**Table 9. Descriptive statistics for the different tenure intervals.**

| Tenure intervals, in years. | 0 - 2 | 1 - 3 | 2 - 4 | 3 - 5 | 4 - 6 | 5 - 7 |
|---|---|---|---|---|---|---|
| Years of education | 12.5 | 12.1 | 12.2 | 12.2 | 11.9 | 12.1 |
| ln wage | 4.33 | 4.33 | 4.36 | 4.37 | 4.38 | 4.40 |
| St. Dev. of ln wage | 0.28 | 0.28 | 0.28 | 0.28 | 0.29 | 0.29 |
| High school dipl. (%) | 22 | 20 | 40 | 28 | 31 | 26 |
| University degree (%) | 24 | 21 | 19 | 16 | 15 | 18 |
| No. of observations | 432 | 398 | 336 | 280 | 239 | 207 |

**Note**: Own calculations from the 1991 Swedish Level of Living Survey.

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