In a recent paper in this journal Knapp (1977) examines the relationship between education and the intensity and time span of postschool human investment. By utilizing the Mincer (1974) specification of the human capital earnings function, and a technique developed in Knapp and Hansen (1976), Knapp estimates that the initial investment ratio upon entering the labor market, $k_o$, is lower for those with more education. Further, he argues that the period of positive net investment, $T$, is longer for those with more schooling. The purpose of this note is to show that the use of an alternative estimating procedure indicates that the investment ratio is higher for those with more education. This result is found to hold when we use coefficient estimates from Knapp's own data and when we employ data from the one-in-one-hundred file of the 1970 Census. In addition, estimates of $T$ obtained from the Census data indicate that the net investment span is shorter, rather than longer, for those groups with more education.

Knapp uses the following specification of the human capital model suggested by Mincer (1974, p. 91), where the proportion of potential earnings invested in postschool training declines linearly from some initial fraction, $k_o$, to zero after $T$ years of positive net investment (such that $k_t = k_o(1 - t/T)$):

$$\ln Y_t = [A - k_o(1 + k_o/2)] + r_tS + [r_tk_o + (k_o/T)(1 + k_o)]t$$
$$- [r_tk_o/2T + (k_o^2/2T^2)]t^2 + u_t$$
$$= b_o + b_1S + b_2t + b_3t^2 + u_t,$$

where: $\ln Y_t =$ the natural logarithm of earnings in year $t$ of the working life,

$A =$ the natural logarithm of earnings that would be obtained without human investment,

$r_t =$ the average rate of return to education,

$S =$ years of education,

$r_t =$ the average rate of return to postschool investments,

and $u_t =$ a normally distributed random error term with zero mean and constant variance.
Equation (1), in effect, constrains the earnings function parameters \( k_0 \) and \( T \) to be equal among educational groups.

In order to observe differences among educational groups in the shapes of earnings-experience profiles, and to make inferences about the relative values of \( k_0 \) and \( T \), Knapp estimates the following:

\[
\ln Y_t = b_{OH} + b_{OC}(C) + b_{OG}(G) + b_1 S + b_2 t + b_{2C}(C)t \\
+ b_{2G}(G)t + b_{3H}t^2 + b_{3C}(C)t^2 + b_{3G}(G)t^2 + w_t,
\]

where \( H \) = the "base group" consisting of individuals with no more than a high school education; \( C \) = a binary variable taking on a value of \( 1 \) if the individual has had some college without degree; and \( G \) = a binary variable taking on a value of \( 1 \) if the individual has at least a college degree. Equation (2) is used to test whether differences in earnings-experience profiles among educational groups are statistically significant. Knapp rejects the relevant null hypothesis that \( b_{OC} = b_{OG} = 0, b_{2C} = b_{2G} = 0, \) and \( b_{3C} = b_{3G} = 0 \) hold jointly.\(^1\)

Table 1 presents regression results obtained from equations (1) and (2) using data from the 1970 Census.\(^2\) The relevant F ratio comparing the sums of squared residuals from (1) and (2) is calculated to equal 24.88, thus the null hypothesis that earnings-experience profiles do not vary among educational groups is easily rejected.

Because of identification difficulties the parameters \( k_0 \) and \( T \) cannot be directly estimated from the coefficients of the earnings function. Knapp uses a technique developed in Knapp and Hansen (1976) by which \( k_0 \) is estimated for each individual by looking at one minus the ratio of actual earnings to potential earnings in year \( t = 0 \). Potential earnings is represented by actual earnings at the estimated year of "overtaking" (where \( t = 1/r_t \)), which in turn was estimated by using Johnson's (1970, p. 558) estimates of \( r_t \) for various socioeconomic groups. Obviously, the use of this technique requires a data set with observations on an individual's earnings during the initial year \( (t = 0) \) and at the year of overtaking. Knapp obtains mean values for \( k_0 \) of .408, .386, and .321 for the H, C, and G educational groups respectively. He lends theoretical support to his estimates of \( k_0 \) by arguing that \( k_0 \) will be lower for more educated groups if they face the same marginal benefit and marginal cost schedules for human investments as do those with less

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1. Knapp uses data from the Coleman-Rossi Retrospective Life History Study whose population consists of males aged 30 to 39 in 1968. Knapp's sample of 273 white, full-time, non-farm workers provided 4,420 observations.

2. The data used are drawn from the 1/100 file of the 1970 Census Public Use Sample. The sample includes 7,667 white, non-farm, non-student males between the ages of 15 and 64 who had some earnings in 1969, and who resided in 48 Standard Metropolitan Statistical Areas (selected from among SMSAs with populations greater than 250,000 and less than 3 million). Age-Schooling is used as a proxy for postschool work experience.
schooling. All groups will then choose to acquire identical dollar amounts of human capital, which implies a lower $k_0$ for those with greater earnings capacity (more schooling).

As Knapp indicates, the choice of $k_0$ also depends on such factors as the ability to produce human capital, access to human capital markets, the initial endowment, and the discount rate. Because several of these factors, in particular the ability to produce human capital, are believed to vary systematically with educational level, the behavior of $k_0$ with respect to education must be established empirically rather than a priori. It will be useful, therefore, to compare Knapp's estimates of $k_0$ with those obtained using different assumptions and a different data source.

An alternative method of estimating $k_0$, the initial investment ratio, is to make an assumption about $T$, the length of the net investment span. This will allow the earnings function parameter $k_0$ to be identified from the coefficients $b_2$ and $b_3$. Utilizing the specification in (1) and solving first for $r$, and then for $k_0$, we find $k_0 = b_2 T + 2b_3 T^2$. The variable $T$ corresponds to the unobserved peak of earnings capacity and will precede the observed peak of earnings by approximately a decade or $1/r$, years (see Mincer, 1974, pp. 20-23). Thus, one way to estimate $T$ (and in turn

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**TABLE 1**

Regression Estimates of Equations (1) and (2)

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Constant</th>
<th>$S$</th>
<th>$t$</th>
<th>$t^2$</th>
<th>$R^2$</th>
<th>$n$</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) $\ln Y$,</td>
<td>7.3080</td>
<td>.0757</td>
<td>.0732</td>
<td>-.00123</td>
<td>.268</td>
<td>7667</td>
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<tr>
<td></td>
<td></td>
<td>(.0023)</td>
<td>(.0019)</td>
<td>(.00004)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Constant</th>
<th>$C$</th>
<th>$G$</th>
<th>$S$</th>
<th>$t$</th>
<th>$t(C)$</th>
<th>$t(G)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>(2) $\ln Y$,</td>
<td>7.5111</td>
<td>-.1162</td>
<td>.1298</td>
<td>.0568</td>
<td>.0703</td>
<td>.0263</td>
<td>.0218</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(.0541)</td>
<td>(.0531)</td>
<td>(.0038)</td>
<td>(.0023)</td>
<td>(.0059)</td>
<td>(.0056)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>$t^2$</th>
<th>$t^2(C)$</th>
<th>$t^2(G)$</th>
<th>$R^2$</th>
<th>$n$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-.00116</td>
<td>-.00074</td>
<td>-.00068</td>
<td>.282</td>
<td>7667</td>
</tr>
<tr>
<td></td>
<td>(.00005)</td>
<td>(.00014)</td>
<td>(.00014)</td>
<td></td>
<td></td>
</tr>
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</table>
obtain estimates of $k_0$ is to subtract ten from $t^*$, the peak of observed earnings (where $\partial \ln Y / \partial t = 0$). We can therefore estimate $T$ by:

$$T = t^* - 10 = (-b_2/2b_3 - 10).$$

Estimates of $T$ and $k_0$ by educational group can be obtained similarly by utilizing the regression coefficients from (2). Table 2 presents these estimates calculated from both Knapp’s data and from the 1970 Census.

**TABLE 2**

Estimates of $k_0$ and $T$ by Education Group

<table>
<thead>
<tr>
<th>Education Group</th>
<th>Knapp’s Data</th>
<th>Census Data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$k_0$</td>
<td>$T$</td>
</tr>
<tr>
<td>Pooled Sample</td>
<td>$a$</td>
<td>$a$</td>
</tr>
<tr>
<td>High School (H)</td>
<td>.406</td>
<td>20.4</td>
</tr>
<tr>
<td>Some College (C)</td>
<td>.595</td>
<td>28.6</td>
</tr>
<tr>
<td>Graduate (G)</td>
<td>.658</td>
<td>31.5</td>
</tr>
</tbody>
</table>

*Correct estimate is not possible. Knapp’s reported coefficient on $t^*$ for the pooled sample (p. 286, Table 1) is inconsistent with his results reported for equation (2), the unrestricted regression.*

The results obtained from both data sources cast doubt upon Knapp’s proposition that $k_0$ decreases and $T$ increases with education. Using the retrospective survey data, $k_0$ is found to be greater, and $T$ longer, for the more highly educated groups. Estimates from the Census data indicate that $k_0$ is higher for the G group than for the H group, while lower for the G than for the C group. The investment span is found to be shorter for the more educated groups. Thus a comparison of the G and H groups from Census data indicate a $k_0$, $T$ pattern exactly the opposite of that proposed by Knapp.3

In short, if the Mincer specification of the earnings function employed by Knapp is a good approximation of reality, then empirical evidence indicates that $k_0$ is higher, rather than lower, for more highly educated groups. Of course, we do not intend to argue that the earnings generation

3. Borjas and Mincer (1976) also use the Coleman-Rossi retrospective survey and find, contrary to Knapp, that the initial investment ratio for white males is higher for those with more schooling. Mincer has recently estimated $k_0$, $T$, and $\eta$ from the Michigan Income Dynamics data and finds that $k_0$ increases with schooling level, while $T$ is about 20 and varies little (this evidence was kindly provided in personal correspondence).
process is completely specified in equation (2). Estimates of $k_0$ made here are somewhat higher than would seem plausible. However, the specification in equation (2) may measure accurately relative differences in $k_0$ between educational groups. If so, the evidence presented here clearly indicates that, in contrast to Knapp’s hypothesis of a decreasing $k_0$, the initial investment intensity increases with educational level. A higher investment ratio indicates that more educated groups possess a higher marginal benefit schedule (perhaps due to a greater ability to produce human capital) or lower marginal financing costs.

Differences in the estimates of the net investment span by educational groups most likely stem from the different nature of the two data sets. Results from the retrospective life history survey indicating, somewhat implausibly, that $T$ is longer for those who enter the labor market later in life differ from estimates derived from cross-sectional data and from other studies utilizing longitudinal data. Ideally, we would like to derive estimates of $k_0$ and $T$ from a panel of individuals observed over their entire working lives. However, our present sources of panel data are not sufficiently aged to allow this. We would attach limited weight to the specific values of $k_0$ and $T$ estimated either here or by Knapp. However, a strong case can be made that the initial investment ratio is larger and the length of the investment span no greater for more educated workers, just the opposite of what Knapp has argued.

4. Cross-sectional data are not ideally suited for retrieving earnings function parameters since vintage effects cause cross-sectional profiles to peak before true life-cycle profiles for any cohort. However, if vintage effects are neutral across education classes the relative ranking of the parameters should not be affected. The consistency of our results regarding the investment ratio with that estimated from Knapp’s own data, and with the results of other studies, increases our confidence in the qualitative results obtained from the Census data.

5. Knapp also looks at differences in the log profiles between educational groups and finds these differences consistent with the $k_0$, $T$ pattern he believes to exist (apart from the first few years in which the profiles converge, the differences he finds are also consistent with the $k_0$, $T$ estimates made here). Differences between log profiles among educational groups using the Census data revealed no particular pattern (these results are not shown).

REFERENCES


