Estimation of the Internal Rate of Return to the Two Year Post-BS PharmD Degree

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This study estimates the internal rate of return (IROR) to the post-BS, two year PharmD degree over the Bachelor of Science pharmacy (BS) degree. Rates of return were estimated using a cost-benefit methodology based upon the economic theories of human capital. Data used in this analysis come from the 1990 Purdue national pharmacy compensation survey, a rich and unique source of data on pharmacist salaries and benefits. The study found that post-BS PharmD pharmacists have a positive marginal rate of return, ranging from 1.73 to 3.96 percent (assuming $10,000 annual earnings by post-BS students). This indicates that those choosing to pursue the post-BS PharmD degree can expect to earn a relatively low IROR compared to other investment opportunities. However, these rates of return only represent monetary benefits. When other nonmonetary benefits are considered, such as job satisfaction, the returns to the PharmD degree are likely to be much higher. Calls for continued study of the IROR within pharmacy are made.

INTRODUCTION

There are many factors influencing pharmacy students’ desire to continue their education beyond the entry level degree(1). As well, several degree options exist all of which possess unique incentive characteristics leading students into a field of advanced study. In particular, one degree option, the post-BS PharmD, has attracted a well educated, clinically oriented group of pharmacy students. Interest in this degree plan has continued to grow. Post-BS PharmD degrees granted annually has more than doubled from 117 in 1973 to 271 in 1991. Data from 1989-90 showed a 36 percent increase over the previous year in post-BS PharmD degrees awarded; however, data from 1990-91 reported a 10 percent decrease(2).

Factors influencing students’ decision to pursue the post-BS PharmD may include perceived higher levels of job satisfaction, the ability to utilize clinical skills, greater opportunity for advancement and promotion, or the ability to obtain certain jobs not obtainable with the BS degree. A 1978 study of practicing post-BS PharmDs provides some insight as the authors assessed the career goals prompting the pursuit of this degree(3). O’Hara et al. concluded that “PharmD programs are attracting people who are looking for some means of enriching their professional careers.” It was also found that 90 percent of post-BS PharmDs practicing in an institutional or educational setting felt that they “definitely or probably would not” have their present job and responsibilities without their advanced degree.

This paper empirically examines one factor, the monetary returns, influencing students’ desire to pursue the post-BS PharmD. This information should prove valuable to pharmacy educators since the decisions students and their families make on the type and amount of education to be gained are strongly influenced by expected earnings and other nonmonetary returns inherent within a given educational/occupational path. To accomplish this purpose, we estimated the internal rate of return (IROR) to the post-BS PharmD degree over the BS degree in pharmacy with the principal hypothesis being that post-BS PharmD pharmacists have a positive marginal IROR.

HUMAN CAPITAL THEORY AND ECONOMICS OF EDUCATION

The theoretical foundation upon which this study is based comes from the economic principles of human capital theory. The premise of human capital theory is based on the idea that differences in wages are due in part to the amount of human capital acquired by an individual. Individuals can acquire human capital through investments in education, health care and on-the-job training(4-6). Increasing one’s human capital by obtaining an advanced degree, for example, leads to a higher quality of labor which then leads to greater productivity and thus higher earnings. This idea is supported by the “orthodox” economic theory of marginal productivity, which argues that wages are determined according to the worker’s marginal contribution to the revenues of the firm, implying that more productive workers will be paid more, other things equal.

One branch of human capital theory, the economics of education, gives individuals and policy makers the tools to measure and evaluate both the costs and benefits (to the individual or society) in the educational decision-making process. Stated more formally, the economics of education is:

“the study of how people and society choose, with or without the use of money, to employ scarce resources to produce various types of training, the
development of knowledge, skill, mind, character, and so forth - especially by formal schooling - over time and to distribute them, now and in the future, among various people and groups in society. In essence, then, the economics of education is concerned with: (i) the process by which education is produced; (ii) the distribution of education among competing groups and individuals; and (iii) questions regarding how much should be spent by society (or any of its component individuals) on educational activities, and what types of educational activities should be selected(7).”

The investment component of education relates to individual or societal decisions to assume the costs associated with acquiring more education with the expectation of obtaining future benefits.

Individual benefits from increasing one’s level of education can be both monetary and nonmonetary. Individuals see the monetary benefits from education expressed through higher earnings. Nonmonetary benefits include greater flexibility in choosing a job or the utility gained through increased leisure activity(8). Another nonmonetary benefit, termed the “hedging” option, allows individuals, through higher education, to adjust to changing job opportunities(9). Advances in technology are quickly replacing human skills and abilities, while higher education and increased skill levels allow individuals to adapt to the changing work environment. Students may also consider furthering their education in hopes of obtaining a certain job, not attainable otherwise.

Society benefits as well from the increased skills and talents gained through higher education. These “external” benefits not captured by the individual are in part the basis for mandatory education in the United States. The benefits of education to society are many. Weisbrod outlines some of these benefits as: (i) anything which increases production possibilities, such as increased labor productivity; (ii) anything which reduces costs and thereby makes resources available for more productive uses, such as increased employment opportunities, which may release resources from law enforcement by cutting crime rates; and (iii) anything which increases welfare possibilities directly, such as development of public spiritedness or social consciousness of one’s neighbor(9).” Other more general benefits from education include better citizenship and the ability to appreciate and recognize a wider range of cultural and other services.

The study of IORs to education is important for several reasons. From a social efficiency perspective, actual returns can serve as a guide to educational budget and policy decisions(10). An association exists between returns for certain occupations and demand for those college graduates(11). Thus, a study of actual returns provides evidence of part of the incentive structure underlying the decision to pursue certain occupations.

Few studies have estimated the IOR to pharmacy specifically; however, work by McMahon and Wagner compared the expected and realized social rates of return of US white male students, for certain health and nonhealth professions including the BS pharmacy degree(12). The study, based on data from 1972-1976, estimated the social rate of return for BS level pharmacists to be 20.1 percent. This rate of return was higher than other health related occupations which ranged from 9.1 to 12.2 percent. However, compared to nonhealth related occupations (engineering-technical) the returns did not compare as favorably. We are not aware of more recent studies replicating McMahon and Wagner’s work.

DATA

The data used in this analysis came from the 1990 Purdue National Pharmacists’ Compensation Survey. The data provide a complete profile of pharmacists’ compensation and work patterns during 1990 and 1991, representing a cross-section of randomly selected practicing and nonpracticing pharmacists in the United States(13). The Purdue database provides the most comprehensive source of data on pharmacists’ compensation, creating a unique opportunity to conduct such an empirical analysis. Cost estimates for tuition, books and supplies were obtained from the American Association of Colleges of Pharmacy 1992 Pharmacy School Admission Requirements. These data provide summary information on costs for resident and nonresident tuition, books, supplies, and room and board expenses for schools of pharmacy.

The primary reason for choosing the comparison of post-BS PharmDs versus BS pharmacists is that the post-BS degree represents a real choice alternative for BS degree holders upon which to estimate marginal returns. Post-BS PharmDs consciously make the decision to continue their education beyond the BS degree with differing expectations and investment potentials. Entry-level PharmD pharmacists were not included because this degree does not involve a “marginal” decision. Additionally, there exist other inherent differences between this degree plan and the post-BS PharmD.

Only private direct and indirect costs are considered in the cost-benefit analysis. Direct costs were estimated using the mean of resident tuition, books and supply cost estimates for those schools which provide the post-BS PharmD degree program. Due to limitations of the data, it was not possible to match PharmD pharmacists by university or college granting their degree. Thus, a sensitivity analysis including the minimum and maximum values for direct costs was conducted to evaluate the effect of variation in this cost measurement on IOR. Recognition of potential bias in measurement of these costs is made since they are not the actual amount students pay (less scholarships, family contribution); however, these are the best available data, and there is no reason to believe that they are not reasonably valid. Also, room and board expenses are not included based upon the assumption that these costs would not significantly exceed room and board expenses students would incur had they not been in school.

Indirect costs, as measured by foregone earnings, are estimated for the PharmDs using the mean BS pharmacist salary for ages 24 and 25 from our sample population. Foregone earnings are those earnings that the PharmD students could expect to earn had they not been in school (i.e., BS pharmacist earnings). The ages 24 and 25 are used since this age group reflects earnings from the youngest age group available (after age 21) for which data were available.

1For a more descriptive portrayal of these data see reference 14.

2The entry level PharmD program typically is a six year entry level program whereas the post-BS PharmD degree requires two additional years of study subsequent to the BS degree in pharmacy.
in our sample population of BS pharmacists. Although the average age of the post-BS PharmD student is not known, wages from this age group should be an appropriate approximation for this student population. Also included are earnings obtained by post-BS PharmD students while in school. These earnings were estimated using an informal survey of 18 post-BS PharmD students at the Medical University of South Carolina in Charleston. The estimation of these earnings, while conservative ($10,000 annually) could be quite important given a pharmacist’s hourly wage rate. Ignoring these earnings could bias downward the IROR estimates.

METHODS

The method used to estimate the IROR is based upon the principles of cost-benefit analysis. Studies using cost-benefit analysis to estimate the IROR to education are well documented in the literature. Work by McMahon(14) and Cohn and Hughes(15) are among more recent studies. The method to be used in this analysis is adapted from work by Cohn and Hughes.

This method employs a formula (Equation 1) widely recognized for calculating a pure IROR. Solving for R in equation 1 gives an estimate for the IROR to the PharmD degree where \( Y_{pt} - Y_{bt} \) represents the earning differential between post-BS PharmD (\( Y_{pt} \)) and BS pharmacists (\( Y_{bt} \)) for age \( t (t=23 \) to 66) and \( c_1 \) represents the direct and indirect private costs of obtaining the two year post-BS PharmD degree.

\[
\frac{\sum_{t=23}^{66} (Y_{pt} - Y_{bt} - c_1)}{(1 + R)^{t-23}} = 0 \quad \text{Eq. 1}
\]

One caveat in estimating the IROR using the cost-benefit analysis framework of Equation 1 is that it assumes all earning differentials are strictly due to education and not to other factors such as ability. This method of analysis also fails to control for other extraneous variables thought to affect wage differentials. Therefore, in order to capture wage differentials strictly due to differences in education ordinary least squares regression (OLS) was used to obtain estimates of the earnings functions for BS and PharmDs which control for extraneous variables. This approach also allows for derivation of an earnings function which the raw data could not provide in situations of small sample size.

This process involves estimating log-linear earnings functions (Equations 2 and 3) for BS and PharmDs where \( Y_b \) represents annual earnings for BS pharmacists, \( Y_p \) represents annual earnings for PharmD pharmacists, \( A = \text{Age}, \) Ten = years of experience in current position, \( X \) is a vector of specific practice characteristics and geographic variations likely to influence wages, \( a, b_1, b_2, c_1, c_2, \) and the \( d \)'s are scalars, and \( \varepsilon \) is a random error term (see Table 1 for more complete variable definitions).

\[
\ln Y_b = a + b_1 A + b_2 A^2 + c_1 \text{Ten} + c_2 \text{Ten}^2 + \sum (d_i X_i) + \varepsilon \quad \text{Eq. 2}
\]

\[
\ln Y_p = a' + b_1' A + b_2' A^2 + c_1' \text{Ten} + c_2' \text{Ten}^2 + \sum (d_i' X_i) + \varepsilon \quad \text{Eq. 3}
\]

The quadratic specifications for age and experience are based on a wealth of research conducted by labor economists during the past 30 years.

Using the Purdue data, parameter estimates for Equa

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Table I. Definition of variables

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>All Other</th>
<th>Other (Omitted category)</th>
<th>Educator, Selected Positions within the Pharmaceutical Industry, Government Administration, Self-employed and all Other</th>
<th>West Coast States</th>
<th>Southwestern and Mountain States</th>
<th>All other: Omitted category</th>
<th>North-Central/Mid-Central/Prairie States</th>
<th>Southeast/Mid-South</th>
<th>Mid-Atlantic/New England</th>
</tr>
</thead>
<tbody>
<tr>
<td>REGION</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>POST-BS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHARM D</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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3 Schondelmeyer, et al.(13) reported national hourly wage equivalents by region ranging from $18.43 in the Prairie states to $23.02 in the West Coast states.

4 Earnings reported in the survey were annual earnings from different sources; earnings from primary and secondary pharmacy related jobs and a third nonpharmacy income source. Earnings used in the analysis come from the sum of primary and secondary pharmacy related earnings. This was done in an effort to provide a more complete picture of the true earnings potential.
ations 2 and 3 are obtained on the basis of data for BS and post-BS PharmD degree holders, respectively. Since BS and post-BS PharmD degree holders may have different characteristics, calculation of the predicted values of lnYb and lnYp is based on the following procedure. First, the mean values of the X vector (call it x) for the entire population of BS and post-BS PharmD pharmacists were used to calculate new intercepts, B and B', employing Equations 4 and 5:

\[ B = a + \sum (d_i x_i) \]  
\[ B' = a' + \sum (d'_i x_i) \]

where a, a', d, and d', are the estimated coefficients from Equations 2 and 3.

Second, B and B' are substituted into Equations 2 and 3 yielding Equations 6 and 7:

\[ \ln Y_b = B + b_1 A + b_2 A^2 + c_1 Ten + c_2 Ten^2 \]  
\[ \ln Y_p = B' + b'_1 A + b'_2 A^2 + c'_1 Ten + c'_2 Ten^2 \]

where b, b', c, and c' are the estimated coefficients from Equations 2 and 3.

Third, since age and experience are correlated to some extent, we use OLS to estimate Equations 8 and 9:

\[ Ten = a_1 + b_1 A + v_1 \]  
\[ Ten = a_2 + b_2 A + v_2 \]

where \( a_1, a_2, b_1 \) and \( b_2 \) are regression coefficients, and \( v_1 \) and \( v_2 \) are random error terms. Equation 8 is estimated for BS degree holders, whereas Equation 9 is estimated for PharmD degree holders. Substituting the right-hand side of Equations 8 and 9, respectively—ignoring the error term—into Equations 6 and 7, we obtain expressions for lnYb and lnYp in terms of a constant (C and C') and the variables A and A' only. The general form of the equations thus obtained is given in Equations 10 and 11:

\[ \ln Y_b = C + gA + hA^2 \]  
\[ \ln Y_p = C' + g'A + h'A^2 \]

where \( g \), \( g' \), h, and h' are the calculated coefficients of A and A'.

Equations 10 and 11 provide the desired expressions from which age-earning profiles may be derived. Since the derivation of the equations was achieved by controlling for factors other than years of education, the resulting age-earning profiles represent the best available estimates of the economic returns to pharmacy education, net of the influences of variables representing returns to nonschooling factors. The complete age-earning profiles for BS and PharmD pharmacists are derived by computing the log of earnings (and then earnings, by taking anti-logs) for each age from 23 to 66. That is, a new variable (A) is created, where \( A = 23, 24, ..., 66 \), then lnYb and lnYp (and then their antilog) are calculated for each value of A. Finally, the calculated age-earning profiles are substituted into Equation 1, from which the internal rates of return are computed.

### RESULTS

Means for variables used in wage equations for both BS and post-BS PharmDs are presented in Table II. The mean age for BS pharmacists is slightly greater than the mean for PharmDs (42 and 38 respectively). In addition, the average number of “years in current position” between BS and PharmD pharmacists differs by less than two years (8.3 and 6.5 respectively). Sixty-eight percent of the BS sample are males compared to 56 percent in the PharmD sample. Within both sample populations nearly 80 percent are married of which 57 percent of BS and 47 percent of PharmD pharmacists are males.

Distinct differences are exhibited between the two groups in the variables representing practice site and functional activity. Over 92 percent of BS pharmacists practice in either a community or institutional setting with a majority (60 percent) practicing in a community setting. This is compared to less than 78 percent of PharmDs practicing in either a community or institutional setting with approximately 70 percent practicing in an institutional setting. The variables measuring functional activity show that 47 percent of BS pharmacists hold upper-level management positions versus 24 percent for PharmD pharmacists. However, only a four percent difference is noted between BS and PharmD pharmacists with titles of General Staff or Employer; or Clinical Staff (46 versus 50 percent). Because of these differences, particularly in practice characteristics, the means for the entire sample (BS plus post-BS PharmDs) were used to obtain wage estimates.

Table III presents the coefficients from the OLS wage equations for the two models. It should be noted that the
Table III. OLS coefficients for wage equations\textsuperscript{a}

<table>
<thead>
<tr>
<th></th>
<th>BS</th>
<th>Post-BS PharmD</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONSTANT</td>
<td>10.43\textsuperscript{b}</td>
<td>8.80\textsuperscript{b}</td>
</tr>
<tr>
<td>(0.266)</td>
<td>(1.55)</td>
<td></td>
</tr>
<tr>
<td>AGE</td>
<td>0.009</td>
<td>0.086</td>
</tr>
<tr>
<td>(0.012)</td>
<td>(0.0780)</td>
<td></td>
</tr>
<tr>
<td>AGESQ</td>
<td>-0.0002</td>
<td>-0.001</td>
</tr>
<tr>
<td>(0.0001)</td>
<td>(0.0008)</td>
<td></td>
</tr>
<tr>
<td>TEN</td>
<td>0.014d</td>
<td>0.047</td>
</tr>
<tr>
<td>(0.0055)</td>
<td>(0.0388)</td>
<td></td>
</tr>
<tr>
<td>TENSQ</td>
<td>-0.0005\textsuperscript{d}</td>
<td>-0.004\textsuperscript{d}</td>
</tr>
<tr>
<td>(0.0002)</td>
<td>(0.0016)</td>
<td></td>
</tr>
<tr>
<td>GENDER</td>
<td>0.074</td>
<td>0.196</td>
</tr>
<tr>
<td>(0.0667)</td>
<td>(0.2564)</td>
<td></td>
</tr>
<tr>
<td>MARRIAGE</td>
<td>-0.239\textsuperscript{b}</td>
<td>0.015</td>
</tr>
<tr>
<td>(0.0573)</td>
<td>(0.2245)</td>
<td></td>
</tr>
<tr>
<td>GENDER*MARRIAGE</td>
<td>0.392b</td>
<td>0.047</td>
</tr>
<tr>
<td>(0.0758)</td>
<td>(0.2838)</td>
<td></td>
</tr>
<tr>
<td>COMMUNITY</td>
<td>-0.147\textsuperscript{b}</td>
<td>-0.207</td>
</tr>
<tr>
<td>(0.0746)</td>
<td>(0.3386)</td>
<td></td>
</tr>
<tr>
<td>INSTITUTIONAL</td>
<td>-0.038</td>
<td>0.057</td>
</tr>
<tr>
<td>(0.0744)</td>
<td>(0.1962)</td>
<td></td>
</tr>
<tr>
<td>UPPER-</td>
<td>0.280c</td>
<td>-0.036</td>
</tr>
<tr>
<td>MANAGEMENT</td>
<td>(0.0806)</td>
<td>(0.2523)</td>
</tr>
<tr>
<td>GENERAL</td>
<td>0.020</td>
<td>-0.190</td>
</tr>
<tr>
<td>STAFF</td>
<td>(0.0806)</td>
<td>(0.1973)</td>
</tr>
<tr>
<td>WEST COAST</td>
<td>0.194d</td>
<td>0.357</td>
</tr>
<tr>
<td>(0.0578)</td>
<td>(0.2466)</td>
<td></td>
</tr>
<tr>
<td>SOUTHWESTERN</td>
<td>-0.150\textsuperscript{c}</td>
<td>0.326</td>
</tr>
<tr>
<td>&amp; MOUNTAIN</td>
<td>(0.0397)</td>
<td>(0.3095)</td>
</tr>
<tr>
<td>N</td>
<td>1,237</td>
<td>34</td>
</tr>
<tr>
<td>Adjusted R2</td>
<td>20%\textsuperscript{c}</td>
<td>61%</td>
</tr>
<tr>
<td>F statistic</td>
<td>25.19</td>
<td>5.02</td>
</tr>
<tr>
<td>P value</td>
<td>0.0001</td>
<td>0.0007</td>
</tr>
</tbody>
</table>

\textsuperscript{a} Numbers in parentheses are standard errors.
\textsuperscript{b} Significant at the 0.0001 level.
\textsuperscript{c} Significant at the 0.01 level.
\textsuperscript{d} Significant at the 0.05 level.

The model used in this analysis represents a reduced-form equation. The reduced form was used due to its ability to provide the highest predictive power for the earnings function. However, it may not provide precise estimates of some of the coefficients (e.g., for position variables) if simultaneous-equations bias is present. If the objective was to accurately estimate model coefficients, then other estimation techniques, such as simultaneous or structural equations, might be more appropriate. Therefore, the interpretation of coefficients derived from our analysis should take this caveat into consideration.

The number of years of experience in current position for BS pharmacists is significant, as is the squared term. The signs of these two coefficients indicate that the number of years of experience (Ten) has a positive effect on earnings with wages decreasing (TenSq < 0) during later years. A similar effect is seen in both samples for the variables Age and AgeSq, although the coefficients are not statistically significant. While the signs for the coefficients for Age, AgeSq, and Ten for PharmD pharmacists follow the pattern expected for wage equations (i.e., positive in Age and Ten and negative in the squared term), the coefficients of these variables are not significantly different from zero.

Concerning gender and marital status of BS pharmacists, our specification in Equation 2 requires that the two are to be considered jointly, because of the inclusion of the interaction variable, GENDER*MARRIAGE. The results suggest that, other things equal, married females earn approximately 24 percent less than unmarried females, unmarried men earn about seven percent more than unmarried females and 31 percent more than married females, and married men earn approximately 15 percent more than unmarried males, 23 percent more than unmarried females, and nearly 47 percent more than married females. Thus, while marriage appears to enhance males' earnings, the opposite is true for females. On the other hand, notice that the effect of gender on wages is one-sided: men earn more than women, regardless of marital status. We should hasten to add that this latter result should not necessarily be construed as an indication of gender discrimination, because we may have left out of the equation important characteristics that could explain at least some of the gender differences in wages. Note, also, that none of the gender and marital-status coefficients for the PharmD equation are statistically significant, indicating that we cannot reject the null hypotheses of no gender and/or marital-status differences in these pharmacists' wages.

BS pharmacists practicing in a community setting earn less than those practicing in institutional or other settings (P ≤ 0.05) and wages for BS pharmacists in upper-level management positions are higher than those whose primary functional activity is general staff/employee or "other" (P ≤ 0.001). Significant geographical differences in earnings are also noted for those BS pharmacists living in the West Coast and Southwestern and Mountain states. Three other regional variables were tested but their coefficients were not statistically significant; therefore, they were excluded from the final version of the model.

Table IV presents the IROR estimates. To test for the sensitivity of IROR estimates to the cost of the post-BS PharmD education, three separate rates of return were computed using the minimum, mean and maximum direct cost estimates (Table V). Results indicate that return estimates show little sensitivity to tuition costs with rates differing by less than one-half of a percent between minimum and mean cost estimates. At the maximum tuition cost, however, the rate of return drops by approximately two percentage points. The sensitivity of IROR estimates to variation in earnings of post-BS PharmD students while in school was...
Table V. Annual direct cost estimates for the Post-BS PharmD degree

<table>
<thead>
<tr>
<th></th>
<th>Minimum cost</th>
<th>Mean cost</th>
<th>Maximum cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resident tuition,</td>
<td>$1,627</td>
<td>$5,753</td>
<td>$22,474</td>
</tr>
<tr>
<td>books, supplies and</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>other</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

also tested. Internal rates of return were estimated for students with zero, $10,000 and $20,000 annual earnings during the two years of post-BS education. Results show considerable variation, with IRORs ranging from 0.92 to 5.50 percent depending on assumed levels of student earnings and direct costs.

A graphical representation of the age-earning profiles of BS and PharmD pharmacists is presented in Figure 1. The age-earning profile of BS pharmacists appears flat which may in part be due to the rather high earnings enjoyed by new practitioners. In contrast, post-BS PharmD earnings show a more typical curvilinear age-earning profile with the first two years representing foregone earnings and the direct costs of education. The curvilinear profile of PharmD earnings across the ages of 31 to approximately 55 is an indication of greater advancement and promotion opportunities available with this degree compared to the BS degree.

One feature of interest in Figure 1 is the relation between the two earning profiles during the later years of practice. In particular, note the substantial drop in post-BS PharmD earnings compared to BS earnings. Two reasons are proposed to explain this feature. First, the estimates obtained for PharmDs within this later age category are based on few observations, so the estimates may not reflect the true earnings potential of post-BS PharmDs. Second, the higher BS earnings within this age category may be a reflection of the higher earnings potential of independent owners. Within our sample population of BS pharmacists, 21 percent of those over the age of 60 were classified as independent owners in contrast to 11 percent of those under the age of 60. There were no independent owners in the post-BS sample. To take this into consideration, two additional IRORs were estimated, assuming student earnings of $10,000. The first excluded all independent owners and the second estimated returns up to the age of 60. In each case rates of return increased by less than a percentage point across cost estimates (Table IV).

LIMITATIONS

One limitation, addressed earlier, is the difficulty in obtaining wage differentials due solely to differences in education. Differences in wages may in fact be due not to differences in education but to differences in individuals’ innate abilities. Obtaining a proxy measure of ability, such as IQ, is highly desirable. The omission of this variable may bias upward the wage estimates.

Finally, caution should be used in interpreting these results given the small number of post-BS PharmD pharmacists (N=34) included in our sample. Although a larger sample would be highly desirable, we were limited by data availability. Also, recognition is given to potential measurement errors inherent in self-reported income data employed in this and many other analyses.

DISCUSSION AND CONCLUSIONS

Our results indicate that those students choosing the post-BS PharmD degree can expect to earn on average a relatively low return on their educational investment compared to other available investment opportunities (Table V). However, these rates of return only represent monetary benefits. When other nonmonetary benefits, such as job satisfaction, are considered the returns to the PharmD degree are likely to be much higher. It must be stressed, however, that it is not known whether job satisfaction is higher for the sample of PharmDs relative to the sample of BS pharmacists.

Table VI. Selected rates of interest: 1990

<table>
<thead>
<tr>
<th>Year</th>
<th>1990</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate of interest on:</td>
<td></td>
</tr>
<tr>
<td>10-Yr. T Bill</td>
<td>8.55</td>
</tr>
<tr>
<td>Corporate bonds (Moody’s Aaa)</td>
<td>9.32</td>
</tr>
<tr>
<td>Prime rate</td>
<td>10.01</td>
</tr>
</tbody>
</table>


California schools were predominately post-BS programs which attracted “more intelligent or more highly motivated students.” If it is assumed that these same higher levels of intrinsic satisfaction are enjoyed by post-BS over BS pharmacists, the omission of this variable would bias our return estimates downward.

6 See, however, Griliches for analysis indicating that the ability bias is small or nonexistent(16).
The findings of low marginal IRORs for post-BS PharmD pharmacists indicate that these pharmacists may not be choosing to pursue this degree solely for monetary reasons. These pharmacists may wish to differentiate themselves from their entry level counterparts by obtaining differing job opportunities through advanced study. With the proposed changes in pharmacy education to the entry-level PharmD degree, the post-BS PharmD program will be phased out creating a one tier level of practicing pharmacist. If it is assumed that a similar proportion of entry-level students will continue to seek advanced training (educational or otherwise) in order to differentiate themselves, the elimination of the post-BS PharmD degree removes an opportunity for these students. Thus, the profession could see an increased demand for advanced training opportunities for entry-level PharmD pharmacists. A greater demand could arise for fellowship, residency and (or) other graduate degree programs (PhD Clinical Pharmacist), the benefits and costs of which remain unknown.

Beyond the specific findings of this study, the general discussion of IRORs to pharmacy are particularly intriguing given the proposed changes in pharmacy education. What potential effect could change in educational requirements have on the private IROR to the entry-level PharmD degree? In the short run, as schools begin the conversion to the entry-level PharmD, it is not likely that wages will increase. Thus, increasing the cost through an additional year of schooling could decrease the private IROR to the entry level degree. To what extent rates will decrease is purely speculative and may have no measurable impact on the decision to choose pharmacy as a career. However, some students may not perceive any marginal benefit (monetary or otherwise) to the investment in an additional year of pharmacy education and thus begin to consider other degree options requiring less schooling. What is especially troubling is that the best potential students, who have superior alternatives, are the ones most likely to decide against pursuing a pharmacy degree.

In the long run, however, wages may increase due to a decrease in the supply of pharmacists as schools reduce class sizes in order to educate students at the PharmD level(20). In this case, the increase in wages may offset the additional cost of education resulting in no measurable change or increases in the IROR. It is yet to be seen what effect the curricular changes will have on pharmacists’ wages. However, for nonmonetary benefits such as job satisfaction, evidence has already shown that entry level PharmDs are no more or no less satisfied than their BS counterparts(21-23).

While this study estimates private IRORs to the post-BS PharmD, discussion of the effect of educational change on the social rate of return is also of interest. A social perspective is indicated if the profession’s move to the entry level degree is partially a result of societal demand, and if public funds are to be used in supporting pharmacy education. Studies estimating the societal costs of educating PharmD students have provided interesting findings. One such study at the University of Minnesota College of Pharmacy in 1987 reported that the yearly instructional cost to educate a PharmD student was $19,711 compared to $6,843 for a BS pharmacy student(24). Campbell, in a presentation at the State University of New York at Buffalo (cited in Levy), reported the state formula at Auburn University for resource intensity (relative cost) of education to be 1.0 for liberal arts, 2.0 for engineering, 2.4 for pharmacy BS, and 10.0 for PharmD students(25). These and other concerns about the social costs of the entry-level PharmD program have already been expressed (public funding for student scholarships, additional faculty, internship sites); however, the perceived social benefits (decreases in drug related morbidity and mortality, and increases in patient quality of care) are also potentially high. With the literature, no well-controlled studies have attempted to estimate the social costs of educating all PharmDs, and an examination of the social benefits from training pharmacists at the PharmD level is sorely lacking.

Continued study of the IROR to pharmacy is warranted. Future studies could provide estimates of the IROR to the entry level PharmD with comparisons made to other health and nonhealth related occupations. Also, studies should continue to monitor the IROR to the post-BS degree compared to the BS and (or) entry-level PharmD degree.

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