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A corporation acquires the assets and liabilities of a securities brokerage firm for a price in excess of net book value. A Markov analysis is used in conjunction with human resource accounting to value a pool of account executives employed by the brokerage firm. The tax implications of imputing a portion of the purchase price premium to the pool of human assets (as opposed to goodwill) are discussed.

It is increasingly recognized that the United States is experiencing a qualitative transformation from an industrial, goods-producing economy to a service-based economy. In addition, the services being provided in the newly emerging economy often require a considerable amount of training and experience. Accordingly, a distinctive feature of the emerging economy is an increasing emphasis on the importance of human capital (the knowledge, skills, and experience of people) as opposed to physical capital.

One outgrowth of this economic metamorphosis has been the development of a field known as "human resource accounting" (HRA). HRA is concerned with identifying, measuring, and reporting (to management and investors) data relating to human resources in an organization. It involves measuring and accounting for the economic value of people as organizational resources [Flamholtz 1974].

A Markov analysis can be used in conjunction with human resource accounting to assign value to a pool of human assets.

The Problem

A corporation purchases the assets and liabilities of a securities brokerage firm for a price in excess of net book value. A por-

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tion of the purchase price premium was attributable to the (unmeasured) value of an intangible asset acquired by the purchaser, that is, the human capital or human assets represented by the acquired pool of account executives (registered representatives) employed by the brokerage firm.

If an asset can be depreciated for tax purposes, a corporation can generate a cash flow savings which represents a significant economic benefit. In order for an intangible asset to qualify for a depreciation allowance for tax purposes, it must be established that (1) the asset has a limited useful life which can be ascertained with reasonable accuracy, and (2) the asset has a value separate and distinct from goodwill (Revenue Ruling 64-465, 1974-2 CB 65).

Consequently, we designed this study to determine what portion (if any) of the purchase price premium represents payment for human assets as opposed to goodwill. Specifically, the following questions were answered:

(1) What is the fair market value of the asset associated with the acquired pool of account executives?
(2) What is the useful life of this asset?
(3) What is an appropriate schedule to use in the amortization of the asset?

Model Formulation

Our approach to this problem involved applying HRA concepts together with a Markov analysis. A finite stationary Markov process is assumed to describe the year-to-year movement in sales commissions generated by individual account executives (AEs). The necessary conditions and specifications for applying the model to the evaluation of the AEs are

(1) Each AE is in exactly one of four possible states during each year. Three of the states are transient and are defined by the relative amount of annual sales commissions produced. They are titled high, medium, and low producers. The fourth state is an absorbing state into which an AE enters when he leaves the firm. This fourth state is titled termination, and it is assumed that once an AE is terminated, he will never return to the firm.
(2) At the end of each year, each AE may remain in his present state or move to any of the other states. If his present state is that of termination, he must, of course, remain in that state.
(3) The transient state occupied by an AE during the current year depends only on the state he occupied during the immediately preceding year. If we assume that an AE generates sales because of his selling techniques, this specification then also requires us to assume that sales techniques not used or reinforced during the past year will not be helpful in generating sales during the current year.
(4) The transition probabilities of moving between states remain constant over time.
(5) The transition probabilities are the same for each individual AE.

Human Resource Valuations Generated

The most important output of the model is the cumulative (over time) discounted expected value of future profits attributable to the group of AEs with the firm at the time of acquisition. The sum of this discounted stream of future earnings may then be considered as an estimation of the total depreciable value of the human asset, D_T, at the time of acquisition and is represented by equation (1) in the appendix.

In order to calculate D_T, it is first necessary to determine the schedule by which that value will be amortized. Any acceptable method (straight line, double declining balance, and so forth) might be used over the *N* year life of the asset; however, a more rational method would be to amortize in each future year the discounted profit expected to be generated by the human asset in that year. This value for any year *n*, D_n, is calculated by equation (2) in the appendix.

Estimation of the Model's Parameters

The generation of a realistic amortization schedule requires an empirical estimation of the behavioral characteristics of the assumed Markov process. We must estimate the initial state probabilities (π_{io} values) and the one-step transition matrix probabilites ($P_{ij}^{(1)}$ values). For the purpose of estimating the transition probabilities, we defined four mutually exclusive and exhaustive "service states": (1) high, (2) medium, and (3) low sales performance (as measured by annual sales commissions), and (4) the exit state (termination). The high, medium, and low states were defined by the upper, middle, and lower third of annual sales commissions during each year. Next we tracked each AE by examining personnel records to determine which state an individual occupied for a period of six years prior to the firm's acquisition date. Thus, each AE was observed making five transitions between and within the four states of the process.

	State During Year *n* + 1			
State During Year *n*	High	Medium	Low	Terminated
High	0.7431	0.1927	0.0000	0.0643
Medium	0.0786	0.6900	0.1921	0.0343
Low	0.0042	0.1081	0.7500	0.1377
Terminated	0.0000	0.0000	0.0000	1.0000

Table 1: State-to-state changeover rate based on annual account executive performance changes averaged over the six-year study period (estimate of one-step Markovian transition probabilities).

The one step transition matrix shown in Table 1 was generated by aggregating year-to-year transitions for all AEs for all years.

If the acquisition occurred exactly at year-end, the values could be estimated by measuring the proportions of the firm's AEs in each of the four states at that point in time. However, it is difficult to measure these proportions when an acquisition occurs at other times of the

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year because the accounting records of AE sales performance are normally kept on a calendar year basis. Thus, measurement of the proportions and the associated flows would not be synchronous. In this problem it is assumed that the acquisition occurred two months prior to year-end and so to achieve synchronization we adjusted the proportions or forecast what their year-end values would be two months after acquisition. The adjustment is made by starting the process and allowing it to run only two-twelfths of a year under the assumption that, collectively, AEs gradually change from one state to another. The process is then restarted at the beginning of the first whole year with initial state probability (π_{io}) values in Table 2. Successive values of π_{io} are then generated by applying appendix equation (2).

State, i	Proportion at Acquisition Time	π_{io}
1. High	0.1163	0.1149
2. Medium	0.2425	0.2425
3. Low	0.6412	0.6222
4. Terminated	0.0000	0.0176

Table 2: Initial state proportions and probabilities. This shows that during the two months from acquisition to year-end, the expected number of high and low producers declines while the expected number of medium producers increases. It is also expected that 1.76 percent of all AEs will terminate during this time period.

Results

The human asset value acquired and the related schedule for amortization of the asset associated with account executives, calculated as D_n, $n=1, 2, \ldots N$, is shown in Table 3. The reported data is disguised by an unstated multiple and hence does not reflect actual amounts. Amortization in the first year reflects a partial year income stream reflecting the acquisition date. Note that the total value of the asset pool, as calculated from appendix equation (1) is simply the sum of the yearly amortizations or $8,208,254.

The theoretical maximum life of the asset was determined to be 40 years. (From an accounting viewpoint, the useful life of the asset for amortization purposes was determined to be 17 years. Ninety-five percent of the value of human assets will be realized by the end of the sixteenth year after the date of acquisition. Since less than five percent of the original asset's value will remain after the sixteenth year, and this amount in aggregate is not considered to be material, it should be "written off" in the seventeenth year.)

This 40-year life was selected for financial as well as practical reasons. From a financial point of view, the amount of amortization after year 40 was considered to be immaterial. From a practical point of view, 40 years is viewed as reasonable for the expected maximum tenure of an account executive.

Although the dollar amounts given in Table 3 are disguised, the acquiring corporation did use the method for human asset valuation described in this study for tax reporting purposes. (It should be noted that the actual amortization schedule used by the corporation for tax purposes involved a "switch over" to straight line amortization, the details of which are not reported here.)

The Study's Implications

The attribution of value to a pool of human assets obtained through an acquisition has obvious tax implications. Specifically, if the acquiring firm can depreciate the human assets acquired, it will generate significant cash savings.

The amortization allowance obtained by determining a value for the asset can be an important consideration in *Ex Ante* acquisition analysis and valuation, for if human capital can be depreciated, the effective cost of an acquisition is decreased.

The use of a Markov process in forecasting the future number of account executives in service states would seem to be a

Year	Amort. Per Yr.	Year	Amort. Per Yr.	Year	Amort. Per Yr.	Year	Amort. Per. Yr.
1	$ 228,348	11	$268,286	21	$35,635	31	$4,607
2	1,255,077	12	220,066	22	29,067	32	3,754
3	1,088,822	13	180,275	23	23,696	33	3,058
4	934,649	14	147,522	24	19,314	34	2,492
5	795,707	15	120,616	25	15,741	35	2,030
6	673,048	16	98,550	26	12,828	36	1,654
7	566,400	17	80,475	27	10,454	37	1,347
8	474,730	18	65,686	28	8,518	38	1,098
9	396,622	19	53,595	29	6,941	39	894
10	326,536	20	43,717	30	5,655	40	728

Total value of account executive pool $8,208,254

Table 3: Human asset value and related amortization schedule for stockbrokers acquired in acquisition.

major factor in meeting the Internal Revenue Service's criteria for depreciation allowance; that is, limited useful asset life that can be determined with reasonable accuracy and asset value separate and distinct from goodwill.

Given the growing appreciation of the importance of human assets in organizations, valuation of these assets seems not only reasonable, but necessary. In a human capital intensive economy much of the value of the firm is comprised of human, rather than physical or financial, assets.

References

Flamholtz, Eric G. 1974, *Human Resource Accounting*, Dickenson Publishing, Encino, California.

Hillier, Frederick S. and Lieberman, Gerald G. 1980, *Introduction to Operations Research*, Holden Day, San Francisco, California.

APPENDIX

The total depreciable value of the human asset is the discounted sum of future earnings,

$$D_T = \sum_{N=1}^{N} D_n \tag{1}$$

The annual depreciable value is then estimated to be

$$D_n = S\frac{\Sigma_{j=1}^{m} \pi_{jn} V_{jn}}{(1+d)^n} \tag{2}$$

where

π_{jn} = the probability of an AE being in state j during year n,

V_{jn} = the undiscounted value of the profit attributable to the sales effort of an AE who is in state j during year n,

d = the discount rate,

S = the number of AEs with the firm at the time of acquisition,

N = a practical upper limit on the number of years an AE might spend with the firm after acquisition,

M = the number of states.

The value of the π_{jn} are found by employing the one-step transition probabilities and the Chapman-Kolmogorov equations which may be found in Hillier and Lieberman [1980];

$$\pi_{jn} = \sum_{i=1}^{m} \pi_{io} P_{ij}^{(n)} \quad \text{for } j = 1, 2, \ldots, m \tag{3}$$

where

π_{io} = the probability of an AE being in state i at the beginning of the first year,

$P_{ij}^{(n)}$ = The n-step transition probability which is the conditional probability that an AE, starting in state i in the first year, will be in state j after n years.