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**VALUING INTANGIBLE ASSETS AND FINANCIAL REPORTING**

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**ABSTRACT**

Intangible Assets, Intellectual Property and Estimating Cash Flow and Rates of Return are concerned with the inability and inaccuracy of earnings and financial forecasts. Financial reporting is the major source of data utilized by economic forecasts, accountants and financial managers to predict future cash flow and earnings (whether per share or in aggregate). However, the records and studies of analyst forecasts have produced often dismal performance. Previous studies focused on historical analysis of past earnings forecast methodology or on generating evidence that accrual accounting justifies better forecasting performance. Objections to these areas of study come in several forms.

Justifying accrual accounting by concluding that they perform well is not appropriate when important factors going into earnings forecasts are absent from the methods utilized. Also, the financial reporting of intangible assets is often misleading or is not reported at all. Economic forecasters know that if the reporting of assets that greatly affect cash flow and in turn earnings forecasters is a serious source of error in forecasting. Using sophisticated models for forecasting with error adjustments may improve forecast accuracy as shown previously by others, the absence of studying intangible assets will still produce inaccurate results. Estimation theory will aid us in solving this problem and will induce accountants to properly report finding about Intellectual Property Rights and similar assets.

**KEYWORDS:** Intangible Assets; Intellectual Property; Estimation Theory; M&A; Earnings Forecasts

**INTRODUCTION AND PURPOSE**

Dechow (1994, and with Strand, 2004) postulated that the use of accrual based accounting methods increased the capability of accounting based forecasts to improve the ability to measure firm performance reflected in returns to equity investments. The argument was that cash flow accuracy is expected to suffer from matching, realization and other timing problems concerning the timing of the recognition of costs and revenues. Accuracy of financial reports was studied by many including (Brandon and Jarrett 1974; Jarrett; 1983, Jarrett and Khumawala, 1987; and Jarrett, 1992). They compared methods of forecasting accounting earnings seeking to learn how forecast models can be compared and possibly improved to produce more accurate results. Questions posed included sources of accuracy but accrual accounting was not considered the most important source of inaccurate results. However, no one established a theoretical link between sources of inaccuracy and the matching principle and the accuracy of financial analysts' forecasts although many studied the problem [Brandon and Jarrett, 1974, Clement, 1999, Gu and Wu, 2003, Ramnath, Rock and Shane, 2008 and Grosyberg et

al. 2011.

However, Gu and Wang (2005) brought up the possibility of another source of inaccuracy in the forecast of rates of return, cash flow and earnings. These researchers concluded that there is a substantial relationship between analysts' forecasts and the magnitude and value of intangible assets. Intangible assets were not considered in the forecasting method discussed by the researchers in their many and detailed studies. The value of intangible assets produces a great source of error if they are not considered in the forecasting methods utilized by analysts in the production of cash flow, rates of return earning per share forecasts. When adjustments for intangible assets are included in the analyst's forecasts, Gu and Wang stated that "The rise of intangible assets in size and contribution to corporate growth over the last two decades poses an interesting dilemma for analysts. Most intangible assets are not recognized in financial statement, and current accounting rules do not require firms to report separate measures for intangibles." (p.673, Gu and Wang, 2005). Intangibles include trademarks, brand names, patents and similar properties that have value but are generally not listed on financial reports of firms. Many of these items are technology based and are very important in financial decisions such as in mergers and acquisitions. They are an intricate in the growth of firms and therefore are shown to be related in the statistical sense to the overall estimates made by accounting and analysts.

In another study concerning forecasts, Matoesy and Wyatt (2015) found that the association between EPS forecast, growth rates forecast error and measures of technological conditions in the firm's industry. They found as the forecast horizon increases, the technological conditions and current EPS are statistically associated with analysts' forecasts. Long horizon creates the conditions for within one to conclude that interactions between technological conditions and current EPS are associated with analysts' EPS and growth forecasts. This conclusion align itself with Jung, Shane and Yang (2012) who suggested that analysts' growth forecasts effect efforts to evaluate analysts' forecasts may produce optimistically biased long-term forecasts. Since intangible assets which are often technology based are taken up more of the balance sheet of many firms, it is likely that analyst's forecasts may produce less accurate predictions of earnings, cash flow and rate of return.

The conclusions of Dechow (1992) become less important. Balance sheets usually have little or no involvement with the value of intangibles although there are some practices by accounting are still used. Furthermore, accounting firms followed specific rules for valuing intellectual property and other intangible by following a set of rules which govern their procedures in financial reporting.

These principles follow the generally established rules governing the role of evaluating the monetary value of intangible properties and similar items. First, they must be identifiable specifically with reasonable descriptive names and there should be some evidence of their existence. The intangibles

must be created in a specific time and be subject to termination at an identifiable time or event.

Second, the intangibles must be acquired through acquisition or developed internally. Paying for expert services would be included in this way. Third, the asset should have an identifiable life or the result of an identifiable event. A cash receipt is not required but should be determined by estimating the value of the intellectual property or intangible asset. Last, the intangibles can be purchased sold in both cash and noncash transactions, rented, or licensed to others. All of these may occur during a merger, acquisition of an entire firm or entity where one can estimate the value of the exchange.

There is a rich literature on the subject of adjusting the value of intangibles and how it affects net worth of a firm and the accuracy of financial forecasts. These include studies by Beneish, (1991), Beneish, (1999), Beneish, Lee and Nichols, (2013), Beneish, Lee and Nichols (2015), Beneish, Marshall and Yang (2016), Jarrett (2016), Jarrett (2017) and Jarrett (2018). This literature indicates that estimates of the value of intangible assets, intellectual property and similar assets need greater intention in financial reporting especially when acquisition mergers, capital budgeting and similar events are part of the decision making process involving financial events.

### **The literature on Estimation Theory in Financial Accounting and Traditional Accounting Methodology**

As noted by [Brief and Owen, 1968, 1969, 1970, 1977; Jarrett, 1971, 1974, and 1983; Roberts and Roberts, 1970; Bierman, 1971, Barnea and Sadan, 1974; Pappas, 1977 and Brief, 1978] the timing of recognition of revenue for intellectual property [IP, see WTO 2016] in financial statements often are not featured in merger and acquisition activity. The financial accounting standards board (FASB) provides for such activities, however, they are often ignored due to their evasiveness or are not fully informational in their normally structured rules. Non-profit entities often do not use accrual rules at all since the goal of these are related to achieving high rates of return. The purpose here is to consider IP as intangible assets as a product of intellect that law protects from unauthorized use by those not responsible for the IP rights. Hence, IP rights are characterized as the protection of distinguished signs such as trademarks for goods and services, patents, and other similar items which are under protection from unauthorized use, WTO, 2016. This includes art, music, creations by authors including the authorship of computer software and similar items such as discoveries, inventions, phrases, symbols and design. [To understand the gravity of ignoring or improperly valuing IP rights see Hagedorff, et al. 2012; and Jarrett, 2016, 2017 and 2018]. This result debated previously [Brief and Owen, 1969; Pappas' 1977' Brief, 1977, and Matolcsy, and Wyatt 2006] indicated that including earnings risk may

### **Contemporary Accounting Methods**

Presently, accounting suggests two methods to determine the value of IP rights to produce better

estimates of from accounting analysts' forecasts. The convention of the 'lower of cost or market' is based on the rule of conservatism in valuing assets to anticipate future losses instead of future gains. The policy tends to understate rather than overstate the value of net assets and could therefore lead to an understatement of income, cash flow, earnings and rates of return. The purpose of this study and its conclusive result is to neither understate nor overstate cash flow so as to produce a rate of return on cash flow that is commensurate with the goal producing accurate prediction of cash flow and its rate of return for financial and decision making purposes. Traditionally, when accounting writes policy about intangible assets as a residual. This value is often referred as Goodwill (White, et al., 1994) which is an imperfect method. This notion of goodwill is estimated as a residual value. If the valuation of intangible property is imperfect since it considers part of the solution of a bargaining process. In this case, the buyer and seller may have different market power which greatly affects the residual of the bargaining process and produces an imperfect or biased estimate of the value of the 9intangible assets.

Another solution suggested during the M&A process is to simply list the patents, trademarks, brands and similar items of IP in the financial reporting of the firm. Following this initiative and suggestion of the accounting principles board provide little aid concerning the economic value of IP rights and products for a firm during the M&A events (Hagendorff, Hernando, Nieto, and Wall,

(2012). In the final step of the problem the evaluation may conclude influence relating to the biases of the reading of the financial reports. Whereas, at least Einstein and Bohr received Nobel Prizes which did have wealth, but Meitner perhaps due to her gender and religious preference never received the award the others were given. The three conductors and composers of music there was no economic award from the Nobel Prize Committees. Accountants forecast the overall rate of return for a firm but do not ignore the convention of "conservatism." Accounting practice values the IP rights for a firm each year for each and every IP right under consideration. IP may induce greater asset values but also effects the rate of return on cash flow because the denominator of the rate of return will change

### **Estimating Cash Flow Attributable to Intangible Assets**

Estimation theory in accounting is consistent with traditional accounting and assumes the objective by becoming part of the foundation of modern account [Brief and Owen, 1968]. Estimation methods are cost based allocation procedures and are utilized to express the accounting rate of return. In using accounting information to predict the value of intangible assets and the cash flow associated with rates of return on cash flow. Based on the notion and observable evidence there is a relation between the increase in the value intangible assets and the cash flow associated with a firm's assets. The rate of return for a decision model, a method for relating information is estimation theory. [See Gordon and Halpern, 1974 and Jarrett, 1978)

Without repeating the general model developed by Brief and Owen (1968) and implemented in another allocation model by Jarrett (1978), we may observe the set of allocation methods,  $p_i$ , which the allocation system is as follows:

$$p_i = \frac{X_i}{C} - \frac{W_i}{\sum W_i} \left[ \frac{\sum W_i - C}{C} \right] \quad (1)$$

Where

$c$  = joint cost

$P_i$  = Proportion of  $C$  allocated to the  $i^{\text{th}}$  joint product, activity, division, etc.,

$X_i$  = A numerical characteristic or assigned to the  $i^{\text{th}}$  product, division, etc.,

$W_i$  = A numerical characteristic chosen to standardize the differences,  $(X_i - p_i C)^2$ , (4, p.194).

The actual cost assigned to the  $i^{\text{th}}$  product or division is the product of

$p_i$  and  $C$ . We can further show that the solution to  $P_i C$  is:

$$p_i C = X_i - \frac{W_i}{\sum W_i} \left[ \frac{\sum W_i - C}{C} \right] \quad (2)$$

We can now define the fraction

$$\frac{X_i - p_i C}{W_i} \quad (3)$$

as a constant equal to  $r_i$ , the rate of return for product asset. By substitution of (1) in (2) we can show

$$r_i = \frac{X_i - p_i C}{W_i} = \frac{X_i - X_i - \frac{W_i}{\sum W_i} (\sum X_i - C)}{W_i} \quad (4)$$

which reduces to

$$r_i = \frac{\sum X_i - C}{\sum W_i} \quad (5)$$

We should note at this point that the fraction

$$\frac{\sum X_i - C}{\sum W_i} \quad (6)$$

is the rate of return on cash flow of the firm denoted by  $r$ . Previously Brief and Owen (1968, p.195) indicated that it is difficult to interpret the equality (6) unless the characteristic chosen is a measure of value or is assumed to be highly correlated with such a measure. When measures of value, however, are chosen for  $X_i$  and  $W_i$ , profits assigned are related to value. Further, methods that establish a value equality among assets appear more reasonable than those that do not.

Similarly, methods for accounting for depreciation are essentially the same as those used to apportion joint costs to various assets of the firm. These methods result from specifying,  $W_i = X_i$ . Methods of allocating joint asset costs to individual assets divisions is thus similar to allocating depreciation on accruals. Additionally, this is true whenever profits are proportional to the value produced in each asset or portion of a firm.

At this point we note that whenever  $W_i = X_i$ , the problem of allocating costs and revenues to a product or segment of a firm is further compounded if we introduce uncertainty into the problem. Uncertainty enters the process whenever we are uncertain as to precisely how much of the joint expenses or revenues must be allocated to an individual asset. Introducing uncertainty into the process of selecting an allocation scheme transforms our problem into one of statistical estimation theory.

Let  $g_{jt}$  be the rate of growth in cash flow from firm  $j$  in period  $t$ ,  $g_{it}$  be the rate of growth in cash flow for asset  $i$  of firm  $j$  in period  $t$ , and  $g_{mt}$  be the rate of growth of a diversified portfolio of firms in period  $t$ . By regressing  $g_{jt}$  on  $g_{mt}$  over a given time period, we obtain

$$g_{jt} = \hat{\alpha}_j + \hat{C}_j g_{mt} \quad (7)$$

We estimate the growth in income attributable to a division by allocating the firm's joint expenses among the divisions. Thus, equation (1) could be rewritten for a division as follows.

$$g_{it} = \hat{\alpha}_{ij} + \hat{C}_i g_{mt} \quad (7A)$$

In (7A),  $\hat{C}_i$  is the estimator of the covariance-variance ratio of systematic risk of division of firm  $j$  based on the rate of growth in the income attributable to the asset.

The estimators of the systematic risk,  $\hat{C}_j$  and  $\hat{C}_i$ , from equations (7) and (7A), are hypothesized by Gordon-Halpern to be highly correlated with the measure of systematic risk from Markowitz-Sharpe CAPM (usually referred to as  $\beta$ ). To estimate the realized rate of growth  $g_{jt}$  for firm  $j$  in  $t$  period we let

$$\begin{aligned}
 Y_{jt} &= \text{earnings before interest and taxes during } t, \\
 I_t &= \text{interest payment on debt outstanding during } t.
 \end{aligned}$$

For simplicity we assume that the interest rate and the outstanding debt remain the same from period to period. Hence,  $I_t$  is the same in all periods, the rate of growth in earnings on common during  $t$  is

$$g_{it} = \frac{\hat{Y}_{jt} - \hat{Y}_{jt-1}}{Y_{jt-1} - I_t} \tag{8}$$

earnings  $Y_{jt}$  for a firm is simply defined as the residual of revenues minus expenses. For a firm, this is expressed as follows:

$$Y_{jt} = \sum_{i=1}^n X_i - C \tag{9}$$

where  $X_i$  = net cash flows (sales less variable, i.e., other direct costs) for a estimation theory to solve the problem of allocating joint costs or revenues to an asset.

Let us now solve the problem of allocating joint costs (and revenues) in the face of uncertainty when  $W_i = X_i$ . The proportion of joint values  $C$  allocated to asset  $i$  is given by the following allocation scheme:

$$p_i = \frac{E^{-1}(X_i)}{\sum_{i=1}^n E^{-1}(X_i)} \frac{M_i}{1 + b_i^2} \left[ \frac{1}{\sum_{i=1}^n (M_i / (1 + b_i^2))} \right] \tag{10}$$

Where  $M_i$  = expected cash flow for asset  $i$ , i.e., the mean  $X_i$  for an asset and  $b_i = (S_i / M_i)$  is the coefficient of variation of  $X_i$ ,  $S_i$  is the standard deviation of  $X_i$ . The above equation assumes that the coefficient of variation is the only relevant measure of variability for the distribution of cash flow.

Equation (10) indicates that if we are uncertain as to how much cash flow is attributable to each asset, the size of this uncertainty will affect the size of the allocation.  $p_j$  When uncertainty is greater, that division, product, or segment will be allocated less of the joint costs. The result is consistent with the goal of "conservatism" whereby accountants noted in the review of Thomas, 1974. Lev, 2001, and, also offer solutions to reporting problems associated with methods of estimation application in financial accounting. allocate less to an account when we are less certain about how much to allocate. In (10), we see that uncertainty is introduced by the coefficient of variation  $b_i$ . As  $b_i$  increases in value,  $p_i$  decreases which is consistent with how accountants operate.



### Estimation of Aggregate Cash Flow

The last step in estimating cash flow to find and develop the contribution of intangible assets to forecast analysts' earnings is to implement the estimate of an intangible asset's cash flow and find its total or aggregate. We define

$$(Y_{it,est}) = X_i - \beta_i C \quad (11)$$

Observe that larger values for  $\beta_i$  will underestimate income and smaller values overestimate income. When uncertainty is larger, i.e.  $\beta_i$  is large,  $\beta_i$  is small and income is larger. Obviously, when uncertainty is small, the reverse is true. Small values for  $Y_{it, est}$  [t= 1, 2, 3,] increases the realized rate of growth,  $g_{it, est}$ , for intangible asset I in period t. The reason for this response is that the numerator of (7A) remains the same as the denominator (7A) which becomes smaller. An upward bias in  $g_{it, est}$ , the realized rate of growth, naturally results in an upward bias in the rate of return for an individual asset. Thus, the use of accounting numbers for cash flow, incomes and others to estimate and predict the forecast of a rate of return becomes a very risky methodology, Underestimation of the cash flow attributable to estimating the value of intangible assets usually results in error in estimating the rate of return since the rate of growth is not predicted precisely.

### Example of Estimating the Value of IPR and other Intangible Assets

The three examples found in the appendix show the variation when one variable in the analysis changes. Table 1 we calculate the dollar value of intangible or intellectual property rights when  $S(X)$  changes. As the variation increases in value the IPR \$ will decrease in value. This is expected from other sources of decision modeling in financial accounting applications including G. Thornton, 2013, Kimouche and Rouabhi 2016 and many others discussed in these studies. Table 2 yields the results when the cost of debt (the interest rate) increase and again the IPR \$ will change in the negative direction. The decrease obviously is what one would expect from the interest rate increase. Finally, Table 3 illustrates the changes associated with the change in the debt/equity ratio. Estimating the value of IPR \$ is subject to changes in the variables associated with sound decision making and do effect analysts' forecasts which aid management in decision analysis and sound data analysis with full information. In the next section, an illustration of how intangibles can be valued using the estimation theory in financial accounting discussed above.

### Illustration of Estimating the Value of Intangibles

The three examples found in the appendix show the variation when one variable in the analysis changes. Table 1 calculates the dollar value of intangible or IPR when  $S(X)$  changes. As the variation increases in value, the IPR \$ will decrease in value. This is expected from other sources of decision modeling in financial accounting applications noted above by others discussed in these studies. Again Table 2 yields



the results when the cost of debt (the interest rate) increases, and again the IPR \$ will change in the negative direction. The decrease obviously is what one would expect from the interest rate increase. Finally, Table 3 illustrates the changes associated with the change in the debt/equity ratio. Estimating the value of IPR \$ is subject to changes in the variables associated with sound decision making and do effect analysts' forecasts, which aid management in decision analysis and sound data analysis with full information. To summarize, problems associated with analysts' forecasts of earnings, cash flow, and rates of return continue often because intangible assets are either not estimated properly or not even considered in the forecasting process at all. No matter that rules of accrual accounting are utilized or not utilized, error may exist in analysts' forecast even when one properly uses forecast methods. If the influence of intangible assets often referred to as intellectual property continue to grow and not be reported in financial statements, the error associated with the growth in these assets will correlate with the magnitude of errors in forecast. Even testing the finding that use of accruals will improve analysts' forecast accuracy is insufficient in recognizing that increases in cash flow is related to the growth and use of IP.

The purpose of this study is to employ estimation in financial accounting to permit analysis and financial reporting and analysts' forecasts, because to recognize the value of IPR (intellectual capital and other intangible assets) which are often the major source of error in prediction of rates of return, risk as measured by the CAPM and other variables that are part

of the problems associated with M&A and other business combinations including abandonment. Ignoring the estimation of non-monetary variables is a systematic error in analysts' forecasts of rates of return and earnings, which have a long history in financial reporting. The principles of matching and realization (shown to be the same problem in previous literature) created problems of the recognition of revenues and matching of costs with revenues. Timing and allocation problems are the same principle, and only elementary accounting textbooks would present them as different. We should note that the allocation problems in financial accounting are already known Note also that overestimation of cash flow resulting in the overestimate of income inflates rates of return for firms. Analysts' forecasts are particularly important in decisions concerning portfolio management as well.

## **CONCLUSIONS**

Problems associated with analysts' forecasts of earnings, cash flow and rates of return continue often because intangible assets are either not estimated properly or not even considered in the forecasting process at all. No matter that rules of accrual accounting are utilized or miss utilized, error may exist in analysts' forecast even when one properly uses forecast methods. If the influence of intangible assets often referred to as intellectual property continue to grow sand not be reported in financial statements, the error associated with the growth in these assets will correlate with the magnitude of errors in

forecast. Even testing finding that use of accruals will improve analysts' forecast accuracy is insufficient in recognizing that increases in cash flow is related to the growth and use of intellectual property

The purpose in this study is to employ estimation in financial accounting to permit analysis and financial reporting and analyst's forecasts because to recognize the value of intellectual property rights (intellectual capital and other intangible assets) which are often the major source of error in prediction of rates of return, risk as measured by the CAPM and other variables that are part of the problems associated with M&A and other business combinations including abandonment. Ignoring the estimation of non-monetary variables is a systematic error in analysts' forecasts of rates of return and earnings which has a long history in financial reporting. The principles of matching and realization (shown to be the same problem in previous literature) created problems of the recognition of revenues and matching of costs with revenues. Timing and allocation problems are the same principle and only elementary accounting textbooks would present them as different. We should note that the allocation problems in financial accounting are already known as matching and realization. Note, also, that overestimation of cash flow resulting in the overestimate of income inflates rates of return for firms. Analysts' forecasts are particularly important in decisions concerning portfolio management as well.

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