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Earnings Management Detection Modeling: A Methodological Review

Apedzan Kighir[1], Normah Omar[2] and Norhayati Mohamed[3]

This paper presents a methodological review of attempts made by researchers through accounting and financial modeling in detecting Earnings Management from 1945 to 2012. Most theoretical reviewers in the area of earnings management focus on recent models and specific perspectives, thus ignoring the contribution of our hero's past and throwing away the vast wisdom and past research knowledge that could be passed to future generation of accounting and finance researchers. In addition, most of the criticisms of prior research work are based on model misspecifications. The objective of this review is to reverse this trend by reminding us of importance of modeling in accounting and of past researchers' contributions, the current trend and prepare a way forward for future researchers. The research employs content analysis and reviewed articles particularly those that attempted at modeling earnings management behaviour. The research presents some contending paradigms on earnings management detection modeling – graphical modeling of specific accruals (Gordon 1964, Alchibald 1967). Mathematical modeling of specific accruals(Copeland 1968, Biedleman 1973), Total Discretionary Accruals modeling with time series data (Healy 1985, Jones 1991, Dechow et al 1995), Total Discretionary Accruals modeling with cross sectional data (DeFond and Jiambalvo 1994, Peasnell 2000), use of manipulation scores modeling (Beneish 1997,1999), Distribution of reported earnings and accruals modeling (Burgstahler and Dichev 1997, Degeorge et al. 1999), Real Activity Management (Roychowdhury 2006, Eldenburg et al 2011), use of Neural networks (Hoglund 2012). The review concludes that robust models have been discovered in detecting earnings management, but some of these models are on the shelves of academics without practical research commercialization and utilization by industries. The research recommend the designing of an auditing software or fraud detection software from these models especially discretionary accrual models and neural networks to be used by professionals and shareholders to test for earnings management before consideration of financial reports at AGM in order to deter earnings managers

1. Introduction

Earnings management is 'a process of taking deliberate steps within the constraints of Generally Accepted Accounting Principles (GAAP) to bring about a desired level of reported earnings' (Davidson et al, 1987). Earnings management is 'taking advantage of the flexibility in the choice of accounting methods to indicate the management decision-making on future cash flows' (Sankar & Subramanyam 2001). (Hepworth, 1953), stated…..'Smoothing is leveling the amplitude of periodic net income fluctuations'. (Schipper, 1989) stated that,

[1]Associate Professor of Accounting at Accounting Research Institute, Universiti Teknologi, MARA, Malaysia. On Visiting From Federal University, Dutsinma Nigeria. apedzankighir2007@yahoo.com
[2] Professor of Accounting at Accounting Research Institute, Universiti Teknologi, MARA, Malaysia. Normah645@salam.uitm.edu.my
[3] Associate professor, Accounting Research Institute, Universiti Teknologi, MARA, Malaysia. norha614@salam.uitm.edu.my

"By earnings management I really mean 'disclosure management' in the sense of a purposeful intervention in the external financial reporting process, with the intent of obtaining some private gain. Earnings management (creative accounting or accounting numbers game) may take the form of a) Income smoothing, b) Aggressive income smoothing and c) financial misrepresentation (Fraudulent financial reporting). Income smoothing is within the bounds and flexibility allowed by GAAP (within – GAAP earnings management), while financial misrepresentation is without GAAP.

Various reasons have been advanced for smoothing earnings. For many, stable earnings stream is capable of supporting a higher level of dividends than a more variable earnings prospect. Earnings variability is interpreted as an important measure of the overall riskiness of the firm and has a direct effect on investors' capitalization rates and thus has an adverse effect on the value of a firm's shares and investors' subjective expectations for possible outcomes of future earnings and dividends (Burgstahler and Eames 1998). In addition, the theory of market equilibrium under conditions of uncertainty agrees that smoothing represents an overt attempt to counter the cyclical nature of reported earnings, thereby tends to reduce the covariance of a firm's expected returns with returns on the market portfolio (Sharpe 1970). Some researchers are not convinced by managers' motives of wanting to manage earnings and have advanced alternative reasons other than those advanced on why managers manage earnings. These include Influencing potential managerial motivations/incentives, (Healy 1985) and taking off Pressure from affiliated parties.

Most theoretical reviewers in the area of earnings management focus on recent models in their reviews while others concentrate on specific perspectives, thus ignoring the contribution of our hero's past and throwing away the vast wisdom and past research knowledge that could be passed to future generation of accounting and finance researchers. A review of accounting literature has also shown that accounting modeling has been a challenge to many accounting researchers as most of the criticisms of prior accounting research work related to modeling are based on model misspecifications

The objective of this review is to reverse the trend by emphasizing the importance of modeling in accounting and keep reminding us of past researchers contributions, the current trend and prepare a way forward for future researchers. This review is also aimed at reminding us that the time for normative research in accounting has gone for good and in the words of (Watts and Zimmerman, 1978), it is time towards positive theory in accounting. We cannot achieve that if modeling remains a constraint particularly where modelers have an altruistic motive to apply the model characteristics to interpret the behavior of phenomena outside their disciplines without involving accounting researchers, believing that the underlying commonality of mathematical modeling will suffice.

This review is different from others, as it tries to capture both recent and past models thus appreciating the contribution of our hero's past and using the vast wisdom and past research knowledge that could be passed to future generation of accounting and finance researchers. The review also captured accounting modeling procedures as modeling has been a challenge to many accounting researchers.

The review employs content analysis as a research design to review journal articles from reputable databases such as Elsevier/Science Direct, Emerald, Ebscohost and Proquest from 1945 after the second world war to 2012.

The remaining part of the review covers theoretical and methodological analysis in section two; section three treats summary and conclusions.

2. Literature Review

2.1 Mathematical Modeling

A Model means to represent the realities belonging to physical life or real life situation with a number of meaningful symbols and to simplify what is complicated. There are many types of models, but our attention in this study is on mathematical models.

(Xavier, 2003) defines a mathematical model as a set of mathematical equations representing a process or a system. It is a mathematical idealization of a real-world phenomenon. It is a mathematical representation of the modeler's perception of some aspects of reality within the confines of a formal mathematical system.

The famous mathematician Hilbert, after a sojourn in the chemistry department at the University of Gottingen, said that chemistry is too difficult for chemists and I say, accounting research is too difficult for Accountants. Aristotle once said, "The primary question is not 'what do we know', but how do we know it". Mathematical modeling according to (Voskoglou, 2006) is the achievement in transforming a situation of the real-world phenomenon into a mathematical problem through the use of a mathematical model. This is achieved by using a simplified representation of the basic characteristics of the real situation through the use of a suitable set of mathematical symbols, relations and functions.

Process of Mathematical Modeling include: i) Observe real word phenomena. ii)Definition of the problem. These two steps require a lot of experience, intuition, intelligence, creativity and other non mathematical skills in bringing out a problem from observed phenomenon. iii) Make some assumptions and identify constraints, iv) Formulate a mathematical model. It is difficult to replicate the entire real life problem, but the modeler must identify the essential and significant features that need to be incorporated in the model to avoid model misspecification. v) Obtain solution from the model using mathematical solution techniques or software, vi) interpret in terms of accuracy and stability of the model, vi) Validate the model. If the solution meets the imposed limits of acceptability, the model is considered valid and then put into practice to predict a future event, or to make a decision Otherwise, the model is invalidated, and steps (ii -iv) are repeated by revising one or more ingredients in the process or scrutiny of the solution technique (step v). This means the process of mathematical modeling is iterative in nature.

Chaos in modeling: In deterministic physical and mathematical systems, when the model equations are nonlinear, the evolution of the system behavior becomes irregular and unpredictable and exhibits sensitive dependence on initial conditions. Such behavior is called chaos. Most accounting related problems are formulated into either linear or non linear models. Most linear problems are modeled using

mathematical equations while non linear problems need some conversions or use of simulation techniques and recently use of artificial neural networks.

Model Evaluation/validation: A crucial part of the modeling process is the evaluation of whether or not a given mathematical model describes a system accurately. In mathematical modeling, the goal of the modeler is to ensure that the model replicates the phenomena being modeled to an acceptable degree. The procedures followed are known as model validation. Usually the easiest way of model evaluation is by checking whether a model fits experimental measurements or other empirical data. In models with parameters, a common approach to test this fit is to split the data into two disjoint subsets: training data and verification data. The training data are used to estimate the model parameters. An accurate model will closely match the verification data even though these data were not used to set the model's parameters. This practice is referred to as cross validation in statistics.

2.2 Earnings Management (EM) Detection Modeling.

The first attempt at earnings management behaviour was observed by (Hepworth, 1953). Hepworth worked on ‘smoothing periodic income’. He surveyed and documented some of the accounting techniques (smoothing devices or specific accruals) which may be applied to affect the assignment of net income to successive accounting periods. No attempt was however made at detecting income smoothing.

2.2.1 Detecting EM through Specific Accruals by Graphical Methods Using Time Series Data.

(Gordon, 1964) presented a hypothesis that ‘managers select accounting measurement and reporting rules which smooth reported income’. The hypothesis is a classic research and generated reactions and researches in the field of accounting income smoothing. An operational test of smoothing was suggested by Gordon, graphical representation as follows: for each firm fit a curve to a stream of income calculated two ways, (a) excluding the manipulative variable, and (b) including it. "If the variations of the observations around the curve are smaller in the latter case, income smoothing has been the consequence of transactions in the account". (Dopuch and Drake, 1966) established a sample of twelve firms for which investments in non subsidiary companies were material over the period 1955-64. Total income and income from non subsidiary investment activity were plotted for each firm. The authors concluded that income smoothing by this means has not been a serious problem with the firms included in their sample, although some of the firms apparently did act to smooth income. (Archibald, 1967), investigated how and why a group of 55 firms changed from a form of accelerated depreciation to a form of straight-line depreciation for financial and tax reporting purposes, using tables and graphical illustrations and discovered a median improvement of about 10.18 percent in net earnings. He found that 22 of the 55 switch-back firms had lower profits in the year of the change, but offered no conclusion on whether it was meant for smoothing.

2.2.2 Detecting EM through Specific Accruals Using Mathematical Modeling.

(Gordon, Horwitz, and Meyer GHM, 1966) were the first to use a mathematical model to test income smoothing. The researchers selected the investment credit as

the smoothing variable by which to test Gordon's hypothesis that firms attempt to smooth income. The smoothing hypothesis "was tested by considering whether an accounting measurement rule was selected which tended to: (1) adjust the firm's percentage change in earnings per share to the average percentage change in the industry"-, or (2) smooth the firm's earnings per share toward a normal value, or (3) smooth the firm's rate of return on stockholder's equity." The introduction of double exponential smoothing to measure the first two criteria above produced more error than it eliminated, thus leaving open to question the validity of their evidence. The results remained inconclusive.

(Copeland and Licastro, 1968) tested the hypothesis that firms with unconsolidated subsidiaries reported at cost do not attempt to smooth income by varying their dividend payment. A chi-square contingency test was applied to the 169 sets of data. The evidence statistically supported the hypothesis that the dividend income technique was not used to smooth income. The research used one smoother variable.

(Copeland, 1968) attempted at empirically testing the existence of income smoothing using more than one smoother variable by the examination of financial statements and/or reports to governmental agencies to ascertain, ex post facto, if smoothing had occurred. He defined complete smoothed income for any period as an amount equal to reported net income for the preceding period with the added stipulation that three or more consecutive years are considered. An accounting variable (measurement rule or reporting procedure) is said to have smoothed income if year-to-year changes in the variable are such as to decrease year-to-year variances in income. A smoothing firm is defined as one which uses the variable to smooth in a majority of periods examined. Using Chi square test, he found no evidence of smoothing and reported that the results be taken as tentative because of the limited size of the sample, length of the time series and that the study excluded consideration of undisclosed manipulative variables.

(White, 1970) employed alternative tests that used values from a 10-year time trend as a measure of normal earnings, incorporated more accounting variables using regression for the first time as a method for detecting smoother companies. The research partitioned samples into two groups, random samples and smoother samples. The smoother samples were detected by running linear and logarithmic least-squares line to the EPS time series for each company in the two industry groups. The model yielding the highest R^2 for each firm was used as the applicable smoothing model for that company. The companies in each industry with the ten highest R^2 and positive growth trends were selected for the smooth samples. These tests were based on the effect of earnings per share of single-year discretionary accounting decisions as detected from annual reports. His findings suggest that firms with relatively smoother earnings did not achieve them by their choice of discretionary accounting alternatives. (Barefield and Comiskey, 1972) employed ten years of time series data to identify the variability and average absolute growth increments for companies that had an opportunity to use remitted earnings of unconsolidated subsidiaries to help smooth earnings. They reported that the result of the study with regard to smoothing was only modest and inconclusive. (Dascher and Malcom, 1972) conducted a research on chemical firms and produced results that they considered to be consistent with the smoothing hypothesis. Their tests utilized 6- and 11-year data spans and examined the reduction in variability about a semi

logarithmic trend attributable to discretionary smoothing variables. These findings support a research approach which uses time series data and all available smoothing devices.

(Beidleman, 1973) was the first to empirically confirm existence of smoothing among US firms. He stated that conventional techniques for disaggregating time-series data may be used to separate the time trend of normal earnings from the random and cyclical factors which are the objects of the smoothing process. That firms whose normal earnings (Et) are expected to change by a constant amount (g) each year can be described by equation (1).

$$Et = (E_o + g_{at}) \quad (1)$$

The normal level of earnings for firms which maintain a geometric progression or constant rate of growth (gr) is described by equation (2):

$$Et = (E_o + g_r)^t \quad (2)$$

The difference between observed earnings and normal earnings as defined represents random and/or cyclical factors and can be used to test for evidence of smoothing by management.

He used least-squares linear time trend regression for firms that were expected to grow at a constant rate using sample of firms which reported at least three discretionary items out of six for ten years or more.

$$E_{it} = a_{ei} + b_{ei}t + \mu_{eit} \quad (3)$$

Similar linear model was used for discretionary smoothing variables (Dit)

$$D_{it} = a_{di} + b_{di}t + \mu_{dit} \quad (4)$$

Semi logarithmic time trend regression was used for firms that were expected to grow at constant growth rate to test for smoothing using similar models. The test of the hypothesis is based on the correlation between the residuals from equations (3) and (4). Correlation coefficients and tests of the significance of the relationship between the time-series residuals are obtained by regressing the residuals.

$$\mu_{dit} = a_{si} + b_{si}\mu_{eit} + \mu_{sit} \quad (5)$$

Student *t* tests on bsi provide a measure of the statistical significance of the relationship.
The test results strongly suggest that firms employ certain devices over which they have discretion to normalize reported earnings.

2.2.3 Detecting EM through Total Discretionary Accruals by Mathematical Modeling Using Time Series Data.

Healy (1985) conducted a more holistic research using total accruals (scaled by lagged total assets) as proxy for discretionary accruals (DA) and hence earnings

management for the first time as against specific component accruals used by prior researchers as proxy for earnings management.

$$TA_t = DA_t \quad (6)$$

Where TA_t = Total Accruals in year t. DA_t is Discretionary Accruals in year t. The model implicitly assumed that there are no Non discretionary accruals in the estimation period. He concluded that accrual policies of managers are related to income reporting incentives of their bonus contract and that change in accounting procedures by managers is associated with adoption or modification of their bonus plan. This study which is a classic has also generated reactions and subsequent researches that have led to a new paradigm in earnings management detection modeling in accounting research. He was criticized by (Kaplan, 1985) for his stand on discretionary accrual and receivables effect on earnings instead of cash flow, his inability to present an expectation model for normal accruals and to clearly separate total accrual into non discretionary and discretionary implicitly assumed that in the absence of earnings maximization behavior of managers total accruals will be zero. Kaplan also noted that changes in several working capital accounts and thereby accruals depend upon the economic circumstances of the firm which should ordinary affect non discretionary accruals.

(DeAngelo, 1986) improved further on Healy's model by using prior period accrual (t-k) as a measure of 'normal'total accruals ($NA_{t-1)}$ (scaled by lagged total assets) as proxy for non discretionary accruals in year t.. According to the researcher, 'abnormal' total accrual (DA_t) is the difference between 'current' total accruals (AC_t) and prior period normal total accruals (NA_{t-1}), but failed to empirically partition normal total accruals into discretionary and non discretionary portions .

$$DA_t = AC_t - NA_{t-} \quad (7)$$

ACt is current total accruals calculated as current net income minus operating cash flows. The model assumes that there are no non-discretionary accruals in year t and uses prior period non discretionary accruals as proxy for current year non discretionary accruals.

(McNichols and Wilson, 1988) improved on DeAngelo's model by capturing the discretionary accruals as a measure of earnings management instead of the total accrual used by (Healy, 1985) and (DeAngelo, 1986), however they used specific component of discretionary accruals.

Jones Model

(Jones, 1991) investigated earnings management during import relief investigations by US government using two stage models. The researcher used firm-specific expectation model and a minimum of fourteen year time series data as estimation period. The research measured 'normal' total accruals (Non discretionary Accruals) in estimation period from financial statement data and used it to compute firm-specific parameters (coefficients) and the same model during event period (prediction period) to measure expected Non Discretionary Accruals(NDAt) using coefficients obtained in the estimation period. The Discretionary Accrual(DAt) which is the residue or prediction error is calculated by subtracting expected Non Discretionary Accruals (NDAt) from current or actual total accruals (TA_t) computed from financial statement data

Estimation Period Model

$$\mathbf{NDA_{\tau}/\ T_{\tau-1}} = \mathbf{\alpha_{oi}\,(1/T_{\tau-1}) + \alpha_{1i}\,(\Delta REV\tau/\ T_{\tau-1}) + \alpha_{2i}(PPE\tau/\ T_{\tau-1})} \quad (8)$$

Where $T_{\tau-1}$ = Lagged total assets in estimation period $(\tau-1)$, ΔREV_{τ} = Revenues in years τ less revenue in year τ-1 scaled by total assets in year τ-1, PPE = gross Property Plant and Equipment in year τ scaled by total assets in year τ-1, $\alpha_{0i,}$ α_{1i} and α_{2i} are firm specific parameters or coefficients τ = 1, 2, 3, …..T years index for estimation period and i = 1, 2, 3 ….N firm index.

Event Period Model

$$\mathbf{NDA_t/\ T_{t-1} = \beta_{0i}(1/T_{t-1}) + \beta_{1i}\,(\Delta REV_t/\ T_{t-1}\ ) + \beta_{2i}\,(PPE_t/T_{t-1})\ + \varepsilon_t} \quad (9)$$

Where NDA_t = expected non discretionary accruals in event year, T_{t-1} = Lagged total assets in event year $(t-1)$, ΔREV_t = Revenues in years t less revenue in year t-1 scaled by total assets in year t-1, PPE = gross Property Plant and Equipment in year t scaled by total assets in year t-1, $\beta_{0i,}$ β_{1i} and β_{2i} are firm specific parameters or coefficients from $\alpha_{0i,}$ α_{1i} and α_{2i} computed during estimation period t = 1, 2, 3, …..T years index for event period and i = 1, 2, 3…..N firm index.

$$DA_t = TA_t - NDA_t \quad (10)$$

or

$$\mathbf{\varepsilon_t} = DA_t = \{\mathbf{TA_t/\ T_{t-1}}\} - \{(\mathbf{\alpha_{oi}\,(1/T_{t-1})\ + \alpha_{1i}\,(\Delta REVt/\ T_{t-1}) + \alpha_{2i}(PPEt/\ T_{t-1})}\} \quad (11)$$

Where TA_t = Actual total accruals from financial statement data = {Δ Current assets – Δ cash – Δ current liabilities – Δ Current maturities of long term debt – Δ Income taxes payable - Depreciation and amortization expenses}.

Accruals (DA) derived from firm-specific expectations model is used to measure earnings management rather than discretionary component of a single accrual account used by (McNichols and Wilson 1988). According to the researcher total accruals should capture a larger portion of managers' manipulations than single accrual account. The expectation model according to the researcher should also control for economic conditions on the level of accruals. In this case change in revenues is used to control for economic environment of the firm because they are an objective measure of the firms operations before managers' manipulations. The model also included gross Property, Plant and Equipment as control for the portion of total accruals related to nondiscretionary depreciation expenses in the event period. The research concluded that managers decreased earnings through earnings management during import relief investigations.

Modified Jones Model

(Dechow, Sloan and Sweeney, 1995), took the profession unaware when the third female led a group of researchers in the accrual modeling algebra to propose a modification to (Jones, 1991) model. According to them the modification is to eliminate an error in the measurement of discretionary accruals from the standard Jones model. The Jones model implicitly assumed that discretion is not exercised over revenue in either the estimation period or the event period. The reasoning of

the modified model is that all changes in credit sales in the event period result from earnings management. The researchers corrected the error by incorporating the changes in credit sales (ΔREC) to the standard Jones model in the event period.
Event model

$$\mathbf{NDA_t = \beta_{0i}(1/T_{t-1}) + \beta_{1i}\,(\Delta REV_t - \Delta REC_t) + \beta_{2i}\,(PPE_t) + \varepsilon_t} \quad \text{Event period} \quad (12)$$

NDA_t , ΔREV_t , ΔREC_t , PPE_t All Scaled by lagged total assets in event period (T_{t-1}) and β_{0i}, β_{1i} and β_{2i} are from α_{0i}, α_{1i}, α_{2i} respectively computed during estimation period.

$$DA_t = TA_t - NDA_t \quad (13)$$

or

$$\varepsilon_t = DA_t = \{\mathbf{TA_t}\} - \{(\alpha_{oi}\,(1/T_{t-1}) + \alpha_{1i}\,(\Delta REV_t - \Delta REC_t) + \alpha_{2i}(PPEt)\} \quad (14)$$

Where DA= Discretionary accruals in year t
TA_t = Actual total accruals from financial statement data = {Δ Current assets – Δ cash – Δ current liabilities – Δ Current maturities of long term debt – Δ Income taxes payable - Depreciation and amortization expenses}.

Estimation model remains the same.

$$\mathbf{NDA_\tau = \alpha_{0i}(1/T_{\tau-1}) + \alpha_{1i}(\Delta REV_\tau) + \alpha_{2i}(PPE_\tau)} \quad \text{Estimation period} \quad (15)$$

NDA_τ , ΔREV_τ , PPE_τ All Scaled by lagged total assets in event period ($T_{\tau-1}$)

The research also evaluated alternative accrual based models for detecting earnings management and concluded that in terms of specification all the models appear well specified but the modified Jones model exhibits the most power in detecting earnings management.

The standard Jones model and modified Jones model was criticized by (Guay, Kathari and Watts (1996) using a market based procedure and concluded that neither procedure generates a reliable measure of accrual management, but could not suggest alternative. (Beneish, 1997) and (Young, 1999) queried the inclusion of depreciation charge in the measure of total accruals and opined that this can induce substantial measurement error in the resulting estimate of managed accruals.

2.2.4 Detecting EM through Total Discretionary Accruals by Mathematical Modeling Using Cross Sectional Data.

Other researchers decided to use cross sectional abnormal accruals for each industry-year combination in detecting earnings management instead of the usual time-series data employed in the standard Jones and modified Jones models. According to them the time series data makes the models too restrictive when implementing the procedures empirically (DeFond and Jiambalvo, 1994, Subramanyam, 1996). This is because of the need for a sufficiently long time-series of data to allow effective estimation of the first-stage regression parameters. In addition, the assumption that the coefficient estimates on ΔREV and PPE remain

stationary over time may not hold and the self-reversing property of accruals may introduce specification problems in the form of serially-correlated residuals.

Margin Model

(Peasnell, Pope and Young, 2000) introduced an alternative model for estimating abnormal accruals known as The 'Margin Model' to lessen the weaknesses associated with the use of Jones model and modified Jones model when using cross sectional data. The researchers also adopted a two-stage approach as in the other two models but used working capital accruals (WCA) as proxy for total normal accruals and different explanatory variables in the first-stage regression.

The new variables include sales (REV) and cash received from customers (CR).
Event Model

$$\mathbf{WCA_t = \lambda_o + \lambda_1 REVt + \lambda_2 CRt + \varepsilon_t} \quad (16)$$

WCA_t , REVt , CRt Scaled by total assets in the event period. Where REV is total sales, CR is cash received from customers and is equal to total sales minus the change in trade debtors, WCA is the difference between the change in non-cash current assets and the change in current liabilities excluding the current portion of long-term debt, λo, λ_1, λ_2 are coefficients They evaluated the specification and power of the Jones model, modified Jones model and the new Margin model using cross sectional abnormal accrual data to test their effectiveness at detecting earnings management. The research concluded that margin model appears to generate relatively better specified estimates of abnormal accruals when cash flow performance is extreme. In terms of their relative performance, the standard-Jones and modified-Jones models are found to be more powerful for revenue and bad debt manipulations. In contrast, the margin model appears to be more powerful at detecting non-bad debt expense manipulations. According to them the results suggest that different models may be required in different circumstances. Peasnell et al were heavily criticized for model misspecification for assuming that the relationship between cash flow and accruals is linear while in actual sense the relationship is non linear.

2.3 Detecting EM through Manipulation Scores by Use of Mathematical Model Using Financial and Proxy Statements.

Beneish Model

(Beneish, 1997, 1999), similar to Altman model of predicting corporate bankruptcy presented the profile of a sample of earnings manipulators, their distinguishing characteristics, and a suggested model for detecting manipulation. The model's variables are designed to capture either the financial statement distortions that can result from manipulation (M) or preconditions that might prompt companies to engage in such activity.

$$M_i = \beta X_i + \acute{\varepsilon} \quad (17)$$

The M score is based on a combination of the following eight different indices:

$$M = -4.84 + 0.92*DSRI + 0.528*GMI + 0.404*AQI + 0.892*SGI + 0.115*DEPI – 0.172*SGAI + 4.679*TATA – 0.327*LVGI, \quad (18)$$

DSRI = Days' Sales in Receivables Index, GMI = Gross Margin Index, AQI = Asset Quality Index, SGI = Sales Growth Index, DEPI = Depreciation Index, SGAI = Sales, General and Administrative expenses Index, TATA - Total Accruals to Total Assets and LVGI = Leverage Index

A score greater than -2.22 indicates a strong likelihood of a firm being a manipulator. In his out of sample tests, Beneish found that he could correctly identify 76% of manipulators, whilst only incorrectly identifying 17.5% of non-manipulators.

2.4 Detecting EM through Cross Sectional Distribution of Earnings and Accrual Models.

(Burgstahler and Dichev, 1997), conducted a research on earnings management to avoid earnings decreases and losses and presented graphically, evidence of earnings management to avoid reporting decrease in earnings or losses by mangers using cross sectional distribution of earnings by plotting charts, histograms and using binomial tests. They concluded that there is evidence that firms manage reported earnings to avoid earnings decreases and losses. In addition, two components of earnings, cash flow from operations and changes in working capital are used by managers to achieve increase in earnings. (Degeorge, Patel and Zeckhauser, 1999), conducted their research on Earnings Management to Exceed Thresholds- i.e. i) positive threshold (reported profit), ii) sustain recent performance, and iii) meet analyst expectations, using simulated distribution of reported earnings model and found that thresholds induce specific types of earnings management. The researchers concluded that Positive threshold proves predominant.

2.5 Detecting EM through Real Activities Manipulation

(Schipper, 1989) argued that the manipulating of operational activities in order to purposefully intervene in financial reporting and achieve personal gain should be defined as a type of earnings management. (Burgstahler and Dichev, 1997) found that corporations often used cash flows from operating activities and working capital to manage earnings. Managers changed operational activities or decisions in order to produce earnings that met specific targets. This type of earnings management is called real activities manipulation. (Dechow and Skinner, 2000) indicated that managers could manipulate earnings by moving forward the recognition of revenues, changing delivery schedules, or delaying the recognition of research and development to maintain expenses. According to (Graham, Harvey, & Rajgopal, 2005), the most commonly used method in earnings management is the manipulation of discretionary accruals analysis because it is easy to practice, has low manipulation costs, and is not easily identified by readers of financial reports.

However, as measurement models of discretionary accruals are becoming increasingly robust, the manipulation of discretionary accruals is increasingly easy to detect. (Roychowdhury, 2006), found that many companies have abandoned earnings management with discretionary accruals, and there is growing evidence that the manipulation of discretionary accruals is no longer the main method for earnings management. (Gunny, 2010), found that real activity management (RM) involves changing the firm's underlying operations in an effort to boost current-period earnings. Such activities include: overproduction to decrease cost of goods sold (COGS) expense, cutting desirable research and development (R&D) investments to

boost current period earnings, postponing or eliminating expenses such as hiring, advertising, travel and maintenance, cutting back on capital expenditures to avoid depreciation expense. (Penman and Zhang, 2002) suggested that under a conservative accounting regime, companies enhance earnings by reducing capital investments (Eldenburg, Gunny, Hee & Soderstrom, 2011) conducted their research on earnings management using real activities with evidence from nonprofit hospitals. The research found evidence of the use of real operating decisions to manage earnings.

2.6 Detecting EM through Artificial Neural Networks (ANN) Modeling.

Artificial neural network (ANN) computing is an approach that attempts to mimic certain processing capabilities of the brain. Artificial neural networks are widely used in production/operations, marketing/distribution, information systems, human resources, finance and recently in accounting/ auditing. In accounting they are used in audit judgement task supporting, Auditor's going concern uncertainty decision prediction, Fraud risk assessment, Preliminary control risk assessment, Quarterly accounting earnings forecasting and now earnings management detection. The ANN is composed of richly interconnected non-linear nodes that communicate in parallel. The connection weights are modifiable, allowing ANN to learn directly from examples without requiring or providing an analytical solution to the problem.

According to (Hoglund, 2012), due to the poor performance of the existing models which use a linear approach for modeling the accrual process even though the accrual process has in fact proven non-linear in several studies(Rees et al 1996, Ball and shivakumar 2006), an alternative way to deal with the non-linearity is to use various types of neural networks. He used neural network models based on a self-organizing map (SOM), a multilayer perceptron (MLP) and a general regression neural network (GRNN). The results show that the GRNN-based model performs best, whereas the linear regression- based model has the poorest performance. However, the results also show that all five models assessed in this study estimate discretionary accruals, a proxy for earnings management, with some bias

3. Research Methodology

The review employs content analysis as a research design to review journal articles from reputable databases such as Elsevier/Science Direct, Emerald, Ebscohost and Proquest from 1945 after the second world war to 2012.

4. Lessons Learnt

The review discovers that robust models have been discovered in detecting earnings management, but some of these models are on the shelves of academics without practical research commercialization and utilization by industries.

5. Summary and Conclusions

The research presents some contending paradigms on earnings management detection modeling – graphical modeling of specific accruals (Gordon 1964, Alchibald 1967). Mathematical modeling of specific accruals(Copeland 1968,

Biedleman 1973), Total Discretionary Accruals modeling with time series data (Healy 1985, Jones 1991, Dechow et al 1995), Total Discretionary Accruals modeling with cross sectional data (DeFond and Jiambalvo 1994, Peasnell 2000), use of financial and proxy statements modeling (Beneish 1997,1999), Distribution of reported earnings and accruals modeling (Burgstahler and Dichev 1997, Degeorge et al. 1999), Real Activity Management (Roychowdhury 2006, Eldenburg et al 2011), use of Neural networks (Hoglund 2012).

The review concludes that robust models have been discovered in detecting earnings management, but some of these models are on the shelves of academics without practical research commercialization and utilization by industries.

The research recommend the designing of an auditing software or fraud detection software from these models especially discretionary accrual models and neural networks to be used by professionals and shareholders to test for earnings management before consideration of financial reports at AGM. This will deter earnings managers from deliberately manipulating their financial statements to achieve predetermined objectives. This modest contribution I hope will educate would-be researchers and graduate students in the earnings management research which is one of the dreaded corporate ailments of our time.

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