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# Do accrual models effectively detect earnings management? A study in the Indian context

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## Abstract

Earnings management practices have been a concern for academicians and practitioners for decades now. It occurs when discretion is applied over accounting choices or real economic decisions. Most of the studies in this area concentrate around accrual manipulation. Several models have been developed to measure accruals, the Jones model being the first econometric approach to measure accruals. Over the years, the Jones model has consistently outperformed all other models in detecting earnings management. However, in recent times, this model has been critically examined in different economic settings and found to suffer from limitation such as model misspecification, omitted variables and so on. This paper makes an attempt to critically examine few of the most widely used earnings management models in the Indian context and determine the effectiveness of these models. Jones Model, Modified Jones Model, Kothari Model and Yoon Model are examined in this study.

**Keywords:** Earnings management, accrual earnings management, Jones Model, Modified Jones Model, Kothari Model, Yoon model.

## Introduction

Financial reporting is an effective method of communicating a firm's financial position and performance to the general public. Financial reports disseminate information about important firm indicators and highly influence economic decision-making. To allow managers to communicate effectively, the Generally Accepted Accounting Principles (GAAP), guidelines for financial reporting, allow certain flexibilities to managers. For example, managers can apply discretion over choosing the method of depreciation or inventory valuation. However, studies have shown that managers use such flexibilities to obtain private gains (Schipper, 1989). Such practice of applying discretion in financial reporting to obtain some personal gain or influence external contractual outcomes is called earnings management. Earnings management has been a major concern for academicians and practitioners in the past decades. Research interests on earnings management increased manifolds after a series of accounting scandals that took place in the 1990s such as Enron, WorldCom, Ahold, Satyam and so on. Such practices undermined the quality of financial reporting and reduced investors' trust on reported financial numbers.

Over the years, studies have constantly made attempts to examine the motivations behind earnings management, its determinants and consequences. One can also find a significant amount of literature dedicated towards measuring accruals in the most efficient way possible. Earnings management cannot be directly observed; hence several proxy measures are adopted to measure it. Studies of early days such as Healy (1984), DeAngelo (1987) took total accruals as a proxy for earnings management. However, studies of the recent past have tried to capture earnings management by following an econometric approach. Jones (1991), Dechow Sloan and Sweeny (1995), Kothari (2005) are some of the studies who segregated total accruals into two categories following an econometric approach. Total accruals were divided into discretionary accruals and non-discretionary accruals, taking the former as a proxy for earnings management.

The Modified Jones model has consistently outperformed all other accrual models in detecting earnings management. Nevertheless, this model is also subjected to limitations such as omitted variables, model-misspecification and errors-in-variables. Also, most of these studies were performed in developed country settings of US and UK which are very different from emerging economies.

Researches have made attempts to critically examine the existing models in different economic settings and develop new models that could address these issues and be applicable across economies. Many studies in the recent times have also concluded that the accrual models may not be very efficient in measuring earnings management in developing economies. Yoon( 2006) in his study conducted in the Korean market found that the Jones Model is a poor method of measuring earnings management. He also concluded that because these models were developed in the developed economies, they might fail to capture the dynamics of emerging economies. His study further proposed a model and claimed it to be a better technique of measuring earnings management in the Korean context. Similarly, Ali (2011) also conducted a study in the Bangladesh capital market and supported Yoon's argument. These studies suggested that there is a need to improve the existing models or develop new ones that can be globally applicable across developed as well as emerging economies.

This study aims to critically examine the application of accrual models in the Indian context. India being an emerging economy has distinct characteristics. It is also one of the fastest growing economies in the world after China. Earnings management studies in the Indian context are very new and there is immense scope for research. Literature evidence demonstrates that studies in the Indian context have also followed the existing models without much thought. To our knowledge none of the studies have tried to analyze which model best suits the Indian economy. Thus, this study makes an attempt to address this gap and critically examine some of the widely used models in earnings management literature. The study also shows how these models have performed across several sectors of the Indian economy.

The rest of the paper is organized as follows: literature review and gaps are discussed in the next section followed by the description of the empirical methodology. Subsequently, the results are presented, followed by the conclusion.

## Literature Review

Earnings management can be defined as "the purposeful intervention in financial reporting with the intent of obtaining some private gain" (Schipper, 1989, p.92). Healy and Wahlen (1984) defined earnings management as "the application of discretion in external financial reporting with the purpose of either misleading some stakeholders about the economic performance of the company or influencing contractual outcomes that depend on such reported numbers" (p. 368). The existing literature depicts that there is no consensus among authors when it comes to defining earnings management and authors over the years have tried to capture its essence in every way possible. Similarly, there is no consensus among authors when it comes to measuring earnings management. Since earnings management cannot be observed directly, authors have tried to capture it from different viewpoints. However, it is found that most of the studies concentrate around accrual earnings management models. Developing models to measure earnings management dates back to the early 1980s; Healy (1985) and DeAngelo (1986) are one of the first studies that tried to measure earnings management by developing a model. Healy's model used total accruals as a proxy for earnings management and projected that systematic earnings management exists across periods. He partitioned his sample into two: earnings increasing and earnings decreasing and computed a mean of total accruals for each subsample. The Healy model, thus, assumed that non-discretionary accruals remain constant between the subsamples. DeAangelo model (1986), on the other hand, computed a change in total accruals between two adjacent years. Also, he assumed that non-discretionary accruals are stable over years, and thus, any change in total accruals reflects discretionary

accruals being adjusted using accounting procedures. Therefore, the Healy model uses cross-sectional comparison, while the DeAngelo Model uses the prior year as a basis to estimated discretionary accruals.

Healy and DeAngelo models are considered to be similar because they both considered non-discretionary accruals to be constant over years or across firms. However, such strong assumption also questions the validity of their respective models. Healy (1985) and DeAngelo (1986) Models will be able to measure the nondiscretionary accruals accurately only if the non-discretionary accruals are constant in course of time. This seems to be an unrealistic assumption as depending on the economic conditions of the firms, the non-discretionary accruals are also most likely to change (Kaplan, 1985).

Jones (1991) tried to address the shortcomings of Healy's and DeAngelo's models by developing an econometric model to estimate discretionary accruals. It is the first model to follow an econometric approach. Unlike Healy and DeAngelo, who assumed non-discretionary accruals to be constant, Jones (1991) added the change in sales and the gross amount of fixed assets to the model, to control the effects of the changes that may occur in the nondiscretionary accruals as a result of the firm's economic position. The residuals obtained from the econometric model are used as a proxy for discretionary accruals. The residuals are assumed to be statistically independent to the regressors. If that is not the case, the residuals shall be biased proxy for discretionary accruals, specifically if it has a correlation with measurement errors in the regressors. Moreover, omission of any relevant variable from the regression model may make parameters biased, especially if the omitted variables are associated with the regressors or regressand in the model. Another shortcoming of the Jones model is that it assumes revenues to be entirely non-discretionary, whereas some part of revenue can be managed. For example, it is observed that managers apply discretion in revenues by bringing in accounts receivables. Further, sales return allowances are also subject to managers' discretion (Kang and Shivaramakrishnan, 1995).

The Jones model was further extended by DeFond and Jiambalvo (1994) and Dechow, Sloan and Sweeny (1995). DeFond and Jiambalvo (1994) suggested that instead of commonly using the regression coefficients for every firm in sectors, calculating them separately for every sector will improve the accuracy of the model. Dechow et al. (1995) brought in another variable, accounts receivable, into the model to account for changes made in the revenues. He established that the new model, named as modified-Jones model, provides a more powerful test of earnings management than the Jones model.

However, in spite of being powerful and popular models in the earnings management literature, these models have been criticized on several grounds. "Hribar and Collins (2002) stated that the estimations derived from cash flows are more reliable and criticized the Jones Model because it does not use cash flows, and that can mean that the model may make the mistake of classifying the accrual items as they contain intervention even if they do not. Moreover, the proposition that 'firms with high earnings own discretionary accruals towards increasing incomes' is not validated in the studies of Dechow et al. (1995). This reveals that earnings management can change depending on earnings or Jones Model (1991) may be defective. Other studies devoted to improve this model(for ex. Kothari, Leone, & Wasley, 2005; Teoh, Wong, & Rao, 1998) were done as well however these two models have been gained a more widespread acceptance and have been intensely used in the literature" (Yurt and Ergun, 2015, p.45).

Beneish (1997) critized both the Jones (1991) model and Modified Jones (Dechow et al.,1995) model for not including performance indicators. Young(1998) stated that these models, therefore, could not be used for companies with non-random performance. Thus, Barth (2001) suggested that further models should be developed that would also take into account the past and present economic performance of the company. Kothari et al. (2005) came up with a model to address this gap. Their model took into account the past and present performance of the company by including Return on Total Assets (ROTA) as an additional variable. Kothari et al. (2005) noted the misspecification of the Modified Jones (Dechow et al.,1995) model for firms

with extreme growth and cautioned its use unless the researcher is confident that credit sales represent accrual manipulation.

Yoon (2006) criticized all the above mentioned models because they have ignored several other aspects of accrual manipulation. He believes that management may utilize not only sales but also expenses in managing reported earnings. In such cases, the previous models will fail to detect earnings management accurately. He further explained that to capture the dual aspects of current accruals, both cash sales and cash expenses should be taken into account. . Therefore, Yoon (2006) proposed a new model taking into account the expenses as well which are subject to managerial discretion. His model has been tested in the Korean and Bangladesh context wherein it has outperformed the other models.

From the literature, we observed that most of the existing models suffer from some inadequacy. In such cases depending on a single model to measure earnings management might fail to give us the accurate picture. Also, we see that the most widely used model when tested in different economic setting have given different results. Thus, there is a need to extensively test these models before applying them in different economic settings. Therefore, this study makes an attempt to test four different accrual models in the Indian context and observe which model performs well across several Indian industries.

## Data and Variables

### Sample and Data

The sample consists of 1650 companies listed in the National Stock Exchange of India (NSE). The period taken into consideration is 10 years from 2007 to 2010. The data used in the study are obtained from the Prowess database of the Centre for Monitoring Indian Economy (CMIE). The study has further classified the sample on the basis of the industry classification. This was done to observe if the industry characteristics have

an influence on these detection models. Also, companies belonging to the banking and finance industry have been excluded due to their distinct reporting mechanisms. Table 1 describes the data selection procedure and table 2 shows the different industries taken into consideration.

**Table 1**: Sample Selection Procedure

| | |
|---|---|
| Total companies listed in NSE | 1932 |
| less: banking and financial companies | (223) |
| Non-financial companies | 1709 |
| less: firms with missing data | (59) |
| Firms included in the final sample | 1650 |

**Table 2**: Industry classification

| Industry classification | No. of firms |
|---|---|
| Manufacturing | 1042 |
| Electricity | 21 |
| Services | 441 |
| Mining | 15 |
| Construction | 131 |

**Variables**

This study makes a comparative analysis of four models, that is, Jones (1991) model, Modified Jones (Dechow et al., 1995) model, Kothari et al. (2005) model and Yoon (2006) model. Therefore all the variables included in these models have been taken into consideration. It includes profit after tax (PAT), cash flow from operations (CFO), total assets (A), revenues (REV) represented by the net sales value, accounts receivables (REC), property plant and equipment (PPE), expenses(EXP) represented by sum of cost of goods sold (COGS) and selling and general administrative expenses (SGA), accounts payables (PAY), depreciation (DEP), retirement benefits (RET) and return on total assets (ROTA). Table 3 shows the descriptive statistics of the variables used in the study.

**Table 3**: Descriptive statistics

| stats | N | mean | sd | median | max | min | skewness | kurtosis |
|---|---|---|---|---|---|---|---|---|
| PAT | 16687 | 1682.39 | 11104.23 | 152.8 | 314250 | -119062 | 12.65 | 228.04 |
| CFO | 16687 | 2447.61 | 15866.82 | 223 | 514500 | -231988 | 15.48 | 341.35 |
| REV | 16687 | 23018.14 | 141042.70 | 3788.7 | 4784565 | -179.1 | 19.54 | 477.00 |
| REC | 16687 | 4001.66 | 17283.05 | 703.7 | 498874.4 | -20.9 | 15.33 | 321.47 |
| EXP | 16687 | 19283.35 | 131234.1 | 3071.41 | 4971896 | -1550.6 | 21.21232 | 556.9886 |
| PAY | 16687 | 3126.48 | 16700.72 | 443.5 | 681610 | 0.1 | 19.82 | 551.08 |
| Dep | 16687 | 851.10 | 5161.80 | 112.4 | 175369.3 | -116.5 | 17.80 | 406.71 |
| ROTA | 16687 | 4.16 | 11.14 | 4.05 | 131.04 | -190.48 | -2.90 | 46.63 |
| RET | 16687 | 49.64 | 304.94 | 6.4 | 10198.3 | 0 | 19.39 | 490.86 |
| PPE | 16687 | 13012.78 | 77130.85 | 1694.3 | 2600000 | 0 | 17.81 | 420.77 |

## Methodology

The primary aim of the study is to examine the effectiveness of accrual models in the Indian context. For this purpose, four models have been taken into consideration. The following paragraphs describe each of the models in detail.

### Jones (1991) model

Jones(1991) model is the first model to follow an econometric approach. The model includes the change in sales and the gross amount of fixed assets to the model in order to control the effects of the changes that may occur in the nondiscretionary accruals as a result of the firm's economic position. The error term, $\varepsilon_{it}$ obtained from the regression equation is taken as the proxy for earnings management (DACC). His proposed model is as follows:

$TACC_{it}/ A_{it-1} = \alpha_1[1/ A_{it-1}] + \alpha_2[\Delta REV_{it}/A_{it-1}] + \alpha_3[PPE/A_{it-1}] + \varepsilon_{it}$---------- (1)

where, TACC= net income-cash flow from operations

TACC = total accruals; A = total assets; REV = net sales revenues

PPE = plant, property and equipment.

$\alpha_1$, $\alpha_2$, $\alpha_3$= firm-specific parameters

**Modified Jones model (Dechow et al.,1995)**

Dechow et al. (1995) extended the Jones model by bringing in a new variable, that was, accounts receivables. According to them the adjustment was made 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. But, in reality, that might not be the case. The researchers corrected the error by incorporating the changes in credit sales (ΔREC) to the standard Jones model. Their proposed model is as follows:

$TACC_{it}/ A_{it-1} = \alpha_1[1/ A_{it-1}] + \alpha_2[\Delta REV_{it} - \Delta REC_{it}/A_{it-1}] + \alpha_3[PPE/A_{it-1}] + \varepsilon_{it}$ ---------- (2)

where, TACC= net income-cash flow from operations

TACC = total accruals; A = total assets; REV = net sales revenues

REC= accounts receivables PPE = plant, property and equipment.

$\alpha_1$, $\alpha_2$, $\alpha_3$= firm-specific parameters

**Kothari Model (Kothari et al., 2005)**

Kothari criticized the Jones and modified Jones model for not including performance indicators. Thus, his model proposed to address this gap. Their model took into account the past and present performance of the company by including Return on Total Assets (ROTA) as an additional variable. Kothari et al. (2005) noted the misspecification of the Modified Jones (Dechow et al.,1995) model for firms with extreme growth. He

stated that firm performance could be related to accruals and hence excluding it might lead to biased results. Their proposed model is as follows:

$TACC_t/ A_{it-1} = \alpha_1[1/ A_{it-1}] + \alpha_2[\Delta REV_{it} - \Delta REC_{it}/A_{it-1}] + \alpha_3[PPE/A_{it-1}] + \alpha_4 ROTA_{it-1} + \varepsilon_{it}$ (3)

where, TACC= net income-cash flow from operations

TACC = total accruals; A = total assets; REV = net sales revenues

REC= accounts receivables PPE = plant, property and equipment.

ROTA= return on total assets

$\alpha_1, \alpha_2, \alpha_3, \alpha_4$= firm-specific parameters

**Yoon Model (2006)**

Yoon believes that management may utilize not only sales but also expenses in managing reported earnings. In such cases, the previous models will fail to detect earnings management accurately. He further explained, that, to capture the dual aspects of current accruals, both cash sales and cash expenses should be taken into account. . Therefore, Yoon (2006) proposed a new model taking into account the current expenses as well which are subject to managerial discretion. His proposed model is as follows:

$TACC_{it}/REV_i = \alpha_1 + \alpha_2 (\Delta REV_{it} - \Delta REC_{it})/ REV_{it} + \alpha_3(\Delta EXP_{it} - \Delta PAY_{it})/REV_{it} + \alpha_4 (DEP_{it}+RET_{it})/ REV_{it} + \varepsilon_{it}$ ---------- (4)

where, TACC= net income-cash flow from operations

TACC = total accruals; A = total assets; REC = receivables

REV = net sales revenues

EXP = sum of cost of goods sold and selling and general administration expenses excluding non-cash expenses

PAY= trade payables

DEP= depreciation expenses

RET= retirement benefits expenses

$\alpha_1, \alpha_2, \alpha_3, \alpha_4$= firm-specific parameters

## Results and discussion

Table 4 presents the results of testing the above mentioned models in the Indian context. This table shows the results of running all the four models in the NSE listed companies irrespective of their industry. To ensure that the $R^2$ is not driven by multicollinearity between the independent variables, variance inflation factor (VIF) test was also analyzed and it was found to be within limits, implying that there is no multicollinearity in the data.

**Table 4**: Summary of the four models

| **NSE Listed Companies** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Variables** | **Jones Model** | | **Modified Jones Model** | | **Kothari Model** | | **Yoon Model** | |
| | **Coef.** | **t-Stat.** | **Coef.** | **t-Stat.** | **Coef.** | **t-Stat.** | **Coef.** | **t-Stat.** |
| **inverse_lag_A** | 9.758 | 10.04** | 10.120 | 10.42** | 9.872 | 10.16** | | |
| **scaled_REV** | 0.014 | 6.22** | | | | | | |
| **scaledREV_REC** | | | 0.009 | 3.73** | 0.008 | 3.48** | | |
| **scaled_PPE** | 0.217 | 11.86** | 0.264 | 15.49** | 0.268 | 15.74** | | |
| **ROTA** | | | | | 0.005 | 4.84** | | |
| **scaledREV_REC_rev** | | | | | | | 4.154 | 151.13** |
| **scaledEXP_PAY** | | | | | | | -0.063 | 4.97** |
| **scaledDep_RET** | | | | | | | 2.244 | 20.04** |
| **cons** | -0.137 | 9.03** | -0.160 | 10.76** | -0.184 | 11.75** | 0.603 | 0.79 |
| **$R^2$** | **0.11** | | **0.11** | | **0.11** | | **0.59** | |
| **Adjusted $R^2$** | **0.1098** | | **0.1085** | | **0.1099** | | **0.5868** | |
| **F statistic** | 0.0000 | | 0.0000 | | 0.0000 | | 0.0000 | |

| | | | | |
|---|---|---|---|---|
| **No. of Obs.** | 16,687 | 16,687 | 16,687 | 16,687 |
| **VIF** | 4.07 | 3.55 | 2.92 | 1.06 |
| **Note: *, ** and *** indicate significance level at 10%, 5% and 1% respectively** | | | | |

From table 4 it can be inferred that the independent variables in all the four models explain the change in total accruals (TACC). However, their explanatory power differs across models. It is seen that the Yoon models outperforms the other models in detecting earnings management with an $R^2$ of 0.59. This implies that the Yoon model has an explanatory power of 59%.

The changes in the explanatory power can be due to the following reasons: Management may utilise not only sales but also expenses in managing reported earnings. Jones and modified Jones and Kothari model neglects that possibility while Yoon captures that in his model. Thus, unless we take into account cash sales and cash expenses we do not take into account the dual aspect of the current accruals. Management may sometimes use sales and receivables to manage earnings and at other times use expenses and payables. Further, Jones, Modified Jones and Kothari model have taken Property, Plant and Equipment (PPE) as an explanatory variable to total accruals which is a proxy for depreciation expense and depreciation expense on the other hand is a proxy for non-current accruals. However, they have ignored other non-discretionary and non-cash expenses such as retirement benefits which Yoon et al. (2006) has incorporated in his model. Moreover, Yoon has also taken into account the mismatch in the denominator and numerator of the third variable in Jones, Modified Jones and Kothari model. PPE is a stock variable while non-current accruals is a change variable. Thus, Yoon et al. (2006) has taken current period revenues as the denominator (i.e. DEP+RET/REV) as a proxy for non-current accruals. This has increased the explanatory power of the Yoon model.

Table 5 to 9 presents the results of sectoral variances in testing these models. Unlike what we saw in the previous table, applying the models across industries provides us mixed results. In many cases, we see that the Jones and Modified Jones model have outperformed the Yoon model. This implies that the accuracy of the

earnings management models can be industry specific. This is in line with DeFond and Jiambalvo's (1994) argument that measuring earnings management separately according to sector will give a more accurate picture of the scenario.

**Table 5:** Manufacturing sector companies

| **Variables** | **Jones Model** | | **Modified Jones Model** | | **Kothari Model** | | **Yoon Model** | |
|---|---|---|---|---|---|---|---|---|
| | **Coef.** | **t-Stat.** | **Coef.** | **t-Stat.** | **Coef.** | **t-Stat.** | **Coef.** | **t-Stat.** |
| **inverse_lag_A** | 30.573 | 29.31** | 29.268 | 28.75** | 29.525 | 29.40** | | |
| **scaled_REV** | 0.072 | 176.4** | | | | | | |
| **scaledREV_REC** | | | 0.082 | 182.46** | 0.081 | 183.08** | | |
| **scaled_PPE** | -0.226 | 77.93** | -0.198 | 72.97** | -0.194 | 72.32** | | |
| **ROTA** | | | | | 0.003 | 17.39** | | |
| **scaledREV_REC_rev** | | | | | | | -0.912 | 14.72** |
| **scaledEXP_PAY** | | | | | | | 0.078 | 1.56 |
| **scaledDep_RET** | | | | | | | 11.413 | 116.03** |
| **cons** | 0.090 | 34.99** | 0.075 | 30.57** | 0.059 | 22.85** | 0.662 | 2.13* |
| **$R^2$** | **0.95** | | **0.96** | | **0.96** | | **0.66** | |
| **Adjusted $R^2$** | **0.9534** | | **0.9557** | | **0.9569** | | **0.6639** | |
| **F statistic** | 0.0000 | | 0.0000 | | 0.0000 | | 0.0000 | |
| **No. of Obs.** | 10,811 | | 10,811 | | 10,811 | | 10,811 | |
| **VIF** | 8.60 | | 8.03 | | 6.31 | | 2.16 | |
| **Note: *, ** and *** indicate significance level at 10%, 5% and 1% respectively** | | | | | | | | |

**Table 6:** Electricity sector companies

| **Variables** | **Jones Model** | | **Modified Jones Model** | | **Kothari Model** | | **Yoon Model** | |
|---|---|---|---|---|---|---|---|---|
| | **Coef.** | **t-Stat.** | **Coef.** | **t-Stat.** | **Coef.** | **t-Stat.** | **Coef.** | **t-Stat.** |
| **inverse_lag_A** | 131.3287 | 5.49** | 125.071 | 5.17** | 129.879 | 5.22** | | |
| **scaled_REV** | .1359204 | 1.90 | | | | | | |
| **scaledREV_REC** | | | -0.022 | 0.29 | -0.036 | 0.45) | | |
| **scaled_PPE** | -.0722185 | 2.77** | -0.069 | 2.64** | 0.074 | 2.76** | | |
| **ROTA** | | | | | 0.001 | 0.86 | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **scaledREV_REC_rev** | | | | | | | 22.73067 | 24.38)** |
| **scaledEXP_PAY** | | | | | | | -3.992757 | 53.39)** |
| **scaledDep_RET** | | | | | | | -14.82783 | 1.98)* |
| **cons** | -.0139476 | 0.85 | | | | | .1271596 | 0.05 |
| **$R^2$** | **0.13** | | **0.12** | | **0.12** | | **0.96** | |
| **Adjusted $R^2$** | **0.1178** | | **0.1038** | | **0.1028** | | **0.9573** | |
| **F statistic** | 0.0000 | | 0.0000 | | 0.0000 | | 0.0000 | |
| **No. of Obs.** | 228 | | 228 | | 228 | | 228 | |
| **VIF** | 1.07 | | 1.08 | | 1.13 | | 1.25 | |
| **Note: *, ** and *** indicate significance level at 10%, 5% and 1% respectively** | | | | | | | | |

**Table 7:** Service sector companies

| **Variables** | **Jones Model** | | **Modified Jones Model** | | **Kothari Model** | | **Yoon Model** | |
|---|---|---|---|---|---|---|---|---|
| | **Coef.** | **t-Stat.** | **Coef.** | **t-Stat.** | **Coef.** | **t-Stat.** | **Coef.** | **t-Stat.** |
| **inverse_lag_A** | 1.379 | 0.84 | -0.155 | 0.09 | -0.387 | 0.22 | | |
| **scaled_REV** | -0.357 | 47.62** | | | | | | |
| **scaledREV_REC** | | | -0.298 | 40.54** | -0.298 | 40.59** | | |
| **scaled_PPE** | 1.002 | 20.12** | 0.541 | 11.23** | 0.544 | 11.29** | | |
| **ROTA** | | | | | 0.006 | 2.36* | | |
| **scaledREV_REC_rev** | | | | | | | 1.768 | 34.36** |
| **scaledEXP_PAY** | | | | | | | 0.040 | 4.74** |
| **scaledDep_RET** | | | | | | | -1.850 | 20.75** |
| **cons** | -0.295 | 7.52** | -0.169 | 4.13** | -0.194 | 4.60** | -0.153 | 0.18 |
| **$R^2$** | **0.37** | | **0.30** | | **0.30** | | **0.48** | |
| **Adjusted $R^2$** | **0.3695** | | **0.3006** | | **0.3014** | | **0.4835** | |
| **F statistic** | 0.0000 | | 0.0000 | | 0.0000 | | 0.0000 | |
| **No. of Obs.** | 4,078 | | 4,078 | | 4,078 | | 4,078 | |
| **VIF** | 1.40 | | 1.23 | | 1.17 | | 1.53 | |
| **Note: *, ** and *** indicate significance level at 10%, 5% and 1% respectively** | | | | | | | | |

**Table 8:** Mining sector companies

| Variables | Jones Model | | Modified Jones Model | | Kothari Model | | Yoon Model | |
|---|---|---|---|---|---|---|---|---|
| | Coef. | t-Stat. | Coef. | t-Stat. | Coef. | t-Stat. | Coef. | t-Stat. |
| inverse_lag_A | 18.917 | 2.77** | 30.458 | 4.38** | 36.787 | 5.45** | | |
| scaled_REV | 0.312 | 11.98** | | | | | | |
| scaledREV_REC | | | 0.368 | 10.05** | 0.325 | 8.99** | | |
| scaled_PPE | -0.030 | 1.45 | -0.031 | 1.40 | -0.028 | 1.35 | | |
| ROTA | | | | | 0.003 | 4.44** | | |
| scaledREV_REC_rev | | | | | | | -0.581 | 3.40** |
| scaledEXP_PAY | | | | | | | 1.284 | 4.07** |
| scaledDep_RET | | | | | | | -7.129 | 8.08** |
| cons | -0.031 | 1.92 | -0.033 | 1.89 | -0.055 | 3.16** | 0.370 | 2.10* |
| $R^2$ | **0.65** | | **0.60** | | **0.64** | | **0.33** | |
| Adjusted $R^2$ | **0.6455** | | **0.5899** | | **0.6306** | | **0.3148** | |
| F statistic | 0.0000 | | 0.0000 | | 0.0000 | | 0.0000 | |
| No. of Obs. | 174 | | 174 | | 174 | | 174 | |
| VIF | 1.43 | | 1.31 | | 1.30 | | 1.61 | |

**Note: *, ** and *** indicate significance level at 10%, 5% and 1% respectively**

**Table 9:** Construction sector companies

| Variables | Jones Model | | Modified Jones Model | | Kothari Model | | Yoon Model | |
|---|---|---|---|---|---|---|---|---|
| | Coef. | t-Stat. | Coef. | t-Stat. | Coef. | t-Stat. | Coef. | t-Stat. |
| inverse_lag_A | 12.717 | 5.21** | 14.490 | 5.90** | 14.872 | 6.02** | | |
| scaled_REV | 0.175 | 8.25** | | | | | | |
| scaledREV_REC | | | 0.153 | 7.05** | 0.156 | 7.15** | | |
| scaled_PPE | -0.119 | 0.82 | -0.106 | 0.72 | -0.093 | 0.63 | | |
| ROTA | | | | | -0.007 | 1.28 | | |
| scaledREV_REC_rev | | | | | | | 4.248 | 70.15** |
| scaledEXP_PAY | | | | | | | 10.894 | 26.61** |
| scaledDep_RET | | | | | | | -2.127 | 2.45* |
| cons | 0.085 | 1.58 | 0.095 | 1.75 | 0.114 | 2.02* | 0.367 | 0.07 |
| $R^2$ | **0.15** | | **0.13** | | **0.14** | | **0.83** | |
| Adjusted $R^2$ | **0.1432** | | **0.1323** | | **0.1327** | | **0.8338** | |
| F statistic | 0.0000 | | 0.0000 | | 0.0000 | | 0.0000 | |
| No. of Obs. | 1,396 | | 1,396 | | 1,396 | | 1,396 | |
| VIF | 1.40 | | 1.39 | | 1.33 | | 1.07 | |

**Note: *, ** and *** indicate significance level at 10%, 5% and 1% respectively**

In case of manufacturing firms the Jones model, Modified Jones model and Kothari model outperforms the Yoon model with explanatory power of 95%, 96% and 96% respectively, while the Yoon model presents an explanatory power of 66%.

The Yoon model seems to do well in sectors like electricity, service and construction with an explanatory power of 96%, 33% and 83%. On the other hand, the Jones model, Modified Jones model and the Kothari model does well in the manufacturing and mining sectors. In literature the Modified Jones model is considered to be the most powerful model in detecting earnings management. However, in the Indian context, we find that the Jones model, Modified Jones model and the Kothari models are very close when it comes to detecting earnings management. This implies that, taking into account the possibility of discretion in sales and firm performance indicators; do not have a significant impact on the explanatory power of the models.

Further, to help us in choosing the most robust model, we have also performed AIC (Akaike Information Criterion) and BIC (Bayesian Information Criterion). Tables 10 to 15 present the results.

**Table 10:** NSE listed Companies

| Model | Obs | ll(null) | ll(model) | df | AIC | BIC |
|---|---|---|---|---|---|---|
| **Jones** | 16,687 | -32272.95 | 31300.85 | 4 | -62609.69 | -62640.58 |
| **Modified Jones** | 16,687 | -32272.95 | 31313.21 | 4 | -62634.42 | -62665.31 |
| **Kothari** | 16,687 | -32272.95 | 31301.51 | 5 | -62613.02 | -62651.63 |
| **Yoon** | 16,687 | -107687.1 | 100154 | 4 | -200316 | -200346.9 |

**Table 11:** Manufacturing sector

| Model | Obs | ll(null) | ll(model) | df | AIC | BIC |
|---|---|---|---|---|---|---|
| **Jones** | 10,811 | -14354 | 2224.082 | 4 | -4440.164 | -4411.01 |
| **Modified Jones** | 10,811 | -14354 | 2499.93 | 4 | -4991.86 | -4962.71 |
| **Kothari** | 10,811 | -14354 | 2649.131 | 5 | -5288.263 | -5251.82 |
| **Yoon** | 10,811 | -58812.52 | -52917.11 | 4 | 105842.2 | 105871.4 |

**Table 12:** Electricity sector

| Model | Obs | ll(null) | ll(model) | df | AIC | BIC |
|---|---|---|---|---|---|---|
| **Jones** | 228 | 176.3922 | -192.1939 | 4 | -376.3878 | -362.67 |
| **Modified Jones** | 228 | 176.3922 | -190.4079 | 4 | -372.8158 | -359.099 |
| **Kothari** | 228 | 176.3922 | -190.7836 | 5 | -371.5671 | -354.42 |
| **Yoon** | 228 | -1491.205 | 1130.233 | 4 | 2268.466 | -2282.183 |

**Table 13:** Service sector

| Model | Obs | ll(null) | ll(model) | df | AIC | BIC |
|---|---|---|---|---|---|---|
| **Jones** | 4,078 | -10067.64 | 9125.795 | 4 | 18259.59 | -18284.84 |
| **Modified Jones** | 4,078 | -10067.64 | 9337.199 | 4 | 18682.4 | -18707.65 |
| **Kothari** | 4,078 | -10067.64 | 9334.407 | 5 | 18678.81 | -18710.38 |
| **Yoon** | 4,078 | -23362.66 | 22013.91 | 4 | 44035.83 | -44061.08 |

**Table 14:** Mining sector

| Model | Obs | ll(null) | ll(model) | df | AIC | BIC |
|---|---|---|---|---|---|---|
| **Jones** | 174 | -10.88646 | 80.86687 | 4 | -153.7337 | -141.098 |
| **Modified Jones** | 174 | -10.88646 | 68.18677 | 4 | -128.3735 | -115.737 |
| **Kothari** | 174 | -10.88646 | 77.79114 | 5 | -145.5823 | -129.787 |
| **Yoon** | 174 | -403.2565 | -368.8395 | 4 | 745.679 | 758.3153 |

**Table 15:** Construction sector

| Model | Obs | ll(null) | ll(model) | df | AIC | BIC |
|---|---|---|---|---|---|---|
| **Jones** | 1,396 | -2783.071 | 2673.707 | 4 | -5355.414 | -5376.38 |
| **Modified Jones** | 1,396 | -2783.071 | 2682.541 | 4 | -5373.081 | -5394.047 |
| **Kothari** | 1,396 | -2783.071 | 2681.717 | 5 | -5373.434 | -5399.641 |
| **Yoon** | 1,396 | -10619.41 | 9365.457 | 4 | -18738.91 | -18759.88 |

On an overall, the Yoon model is seen to be a more effective way of detecting earnings management. Therefore our observation are in line with Yoon (2006) and Ruhani et al. (2010) who documented that the Modified Jones Model is not effective in detecting earnings management in Korean firms and Bangladesh firms respectively. However, we also observe that the other models perform better in some sectors of the Indian economy. This implies that a single model for detecting earnings management might not give us accurate results in the Indian context. We need to constantly test the accuracy of the models before using them to detect earnings management.

## Conclusion

Jones and Modified Jones model have been considered to be the most powerful models in detecting earnings management (EM) in many countries. The Kothari Model, although new, has also been extensively used to detect earnings management. In this study we find that Jones, Modified Jones and Kothari model perform in the same way. The Yoon Model, on the other hand, has done the best in most of the cases. The Jones model explains earnings management in manufacturing and mining sectors of well, however, it fails in adequately explaining that for the NSE listed companies as a group and various sectors that constitute the NSE listed companies. Modified Jones model and Kothari model also performs similar to Jones model, doing well in manufacturing and mining sectors. But, the Yoon Model, which brings in depreciation expenses, retirement benefits, and current year payables, does well for all the sectors except for manufacturing and mining.

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