

Predicting Income-Decreasing Forced Financial Restatement

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Abstract This study explored the varied characteristics of misstatement firms, which serve as the foundation to develop a model that predicts income-decreasing forced restatement (IDFR). Multivariate logit regression was performed on 4,698 firm-years of Malaysian listed firms from 2002 to 2012. The results were tested for robustness using a stepwise logit model and a penalised likelihood logit model. Several factors, such as share price volatility, independent board of directors, company's internal fund, and political connection, emerged as the main predictors for IDFR. This study proposes a prediction model that synthesises financial and non-financial aspects in terms of scaled probability (F-score), which may function as a red flag of income-increasing misstatement firms that warrant further investigation.

Keywords Income-Decreasing Forced Restatement, Earnings Misstatement, Corporate Governance, Rare Event, Prediction Model

1. Introduction

Forced financial restatement incidences have continued to increase since the past decade [1; 2] and have caused earnings to decrease by billions (see 3). The occurrence of recent events involving Tesco, Green Mountain Coffee, and JP Morgan have raised public awareness on the

significance of forced restatement. Forced restatement which is due to misstatement of earnings should be taken seriously as it signifies violation of accounting standards and rules [4]. Forced restatement implies a poor quality financial reporting that may adversely influence the perception among investors regarding corporate reporting reliability, as well as firm trustworthiness and legitimacy as a market player.

It is crucial to examine forced restatement in light of the financial and economic aspects. The harm that forced restatement might inflict may not be confined to the adversarial impact of the affected company's stock price value, since forced restatement events are frequently symptomatic of significant issues related to a firm's business model, or corruption inside the organization. This may have far-reaching, long-term consequences that could lead to bankruptcy, as well as the risk of spreading problems to other relevant parties, such as customers or suppliers. The US General Accounting Office (GAO) revealed that the market capitalisation loss incurred by the US stock market as a consequence of earnings restatement was estimated to be at USD100 billion between January 1997 and June 2002 [5] and USD36 billion from July 2002 to September 2005 [6]. Notably, forced restatements affect not only the developed countries, but also the emerging ones.

This study examined the varying characteristics of income-decreasing forced restatement (IDFR) firms to build a model capable of predicting catastrophic IDFR. According to Ettredge et al. (2010), IDFR denotes

correction of intentional misstatement; whereas income-increasing forced restatements (IIFR) implies correction of unintentional errors [7], although it could also reflect the possibility of tax evasion attempt [8]. Past research work on managerial delinquency could wrongly hypothesize inferences if unintentional errors are not properly distinguished from intentional misstatements [9]. This becomes more critical since the reporting of erroneous misstatements becomes more frequent and more stringent regulations have currently been imposed on post-Enron accounting reporting [10]. Besides, past studies have failed to distinguish forced restatements that were caused by tax evasion or accounting errors from forced restatements that were caused by intentional misstatement of earnings (see 11; 1). Prior research has also attempted to predict earnings misstatements by using financial factors while neglecting corporate governance variables as possible key predictors. (see 12; 13; 10). This study differs as it assessed the predictive ability of a diverse set of financial and non-financial corporate governance predictors on the possibility of IDFR occurrences.

This study is performed within the emerging economy milieu of Malaysia. The unique characteristics of Malaysia are relevant for this study, in that it is featured with rapidly growing economy, high ownership concentration, poor investor protection, numerous firms with political connection (PCON), and weak enforcement of regulations [14]. Besides, Malaysia practices a distinctive economic policy that puts emphasis on economic participation by the Bumiputera population, hence minimizing economic rift with other ethnic groups dwelling in Malaysia [15]. Malaysia is also widely recognized for its relationship-based economy with very close connections between the government and companies, leading to a significant establishment of businesses with political connections. The Malaysian environment, distinguished by a mix of businesses controlled by family shareholders, typically dominated by owners of Chinese descent, and politics controlled by the Malays, offered a research setting different from that of other Asian developing countries. This signifies the significant impact that the institutional and structural setting in Malaysia might have on forced restatement.

2. Variables Tested

2.1. Set of Covariates

This study assessed a diverse collection of predictor variables that lead to misstatements in reported earnings. In precise, this study examines firm characteristics related to less aggressive but common misstatements so that it enables testing of samples that relate to frequent errors and fraudulent misstatements.

Two proxies representing the quality of firms' board of

directors were assessed. The first proxy is independent board of directors (BIND). The presence of independent directors minimises moral delinquency. Nonetheless, scepticism may spark in terms of the board's ability to monitor the management; mainly due to the assumptions that non-executive directors are hired for other reasons and merely function as 'rubber stamp' for management purposes [16]. Next, the second proxy is multiple directorships (MULTI) that may lead to IDFR. When directors serve on multiple boards, they may over-commit and spread themselves too thin, thus jeopardising their capacity to efficiently oversee financial reporting process [17].

The presence of family blockholder (FM) was examined. When owners take full control over a business, monitoring efficiency may deteriorate. They would prefer using their managerial positions to reap benefits of self-interest at the expense of minority investors, thus increasing IDFR risk [18; 19]. Other measures on ownership control, such as CEO duality (CEOD) and founders on board (FB), were assessed.

This study examined the effect of PCON and government-related institutional investors (INST) on forced restatement incidences. As controlling owners, INST may be motivated to accomplish public policy goals and work for the government instead of monitoring effectively [20]. PCON could also potentially increase the risk of IDFR. Typically, managers of firms with PCON conceal information on government/crony expropriation or benefits that are reaped from the government (see 21).

The corporate accounting quality variable was also examined as some managers may become deceitful and could distort earnings to disguise a firm's true performance, increasing the risk of IDFR and affects organisational performance. In addition to the Modified Jones (1995) discretionary accruals model (DAMJ) [see 22], this study analysed deferred tax accruals (DT). In comparison to tax regulations, flexibilities in the General Accepted Accounting Principles (GAAP) enable managers to report book income discretionally, leaving taxable income unaffected [23]. The variance between taxable income and book income effectively signifies manipulation of earnings. The measure of working capital accruals (WCAC) was assessed as well. The judgemental estimate embedded in working capital accruals that have no direct consequences on cash flow, provides managers with an appealing basis to manage earnings. Other relevant measures are inventory and receivable changes (CHIN and CHAR), as well as soft assets (SOFT) which are neither property, plant and equipment nor cash. Accumulation of inventories and receivables are red flags that signify earnings misstatement, which can be used by managers to boost asset and revenue values in an artificial manner [24; 25]. A high fraction of soft assets reported on the balance sheet indicates the management is prone to discretionarily changing assumptions towards meeting

short-term earning objectives (26; 27).

Proxies that determine opportunistic behaviour among managers based on real earning management activities (ABNCFO, ABNPRO and ABNDIX) were assessed. Manipulation in real activities may be done with the intention to deceive shareholders on the achievement of specific financial performance objectives in running the ordinary course of business activities [28].

Firm performance variables were further explored. One of them is change in earnings (CROA), which signifies the likelihood of IDFR as managers conceal deteriorating firm performance by boosting reported earnings [29]. The next proxy is price earnings ratio (PE) that indicates the growth potential of a firm. Managers are motivated to highlight excellent prospects by reporting favourable progress in firm performance. Otherwise, firms may be forced to pay a heavy price if firm performance declines [30]. Financial distress (DIST) is the last firm performance proxy. Typically, managers of financially troubled firms have a propensity towards concealing poor business performance [31]. Thus, managers are prone towards reporting higher earnings that fulfils expectations of the market, although the contrary is true [31].

External financing variable was explored in this study, mainly because such funding enhances capital base that ascertains growth performance in a firm [13]. In such cases, managers may tend to declare high profits in the expectation to easily penetrate the capital market at a lower cost. The intention to distort earnings is intensified as a firm's internal fund (INTF) depletes, causing the firm's capital base to become drained. This justifies the action taken by managers to report growth in earnings upon the demand of raising external funds, thus increasing IDFR risk. Measures including actual issuance (AIS), free cash flow change (CHFCE) and firm incentive to increase new capital (INTF) were further examined in this study.

The final variable refers to share price volatility (SVW). This variable signifies perceived risk of a firm and implies uncertain future earnings [32]. The SVW signals emerging firm problems that warrant close monitoring by regulators, thus succumbing to IDFR.

Whilst firms reporting behaviour are also impacted by other firm-specific characteristics, this study controls for leverage (LEV), size (LNTA), and age (LAGE).

2.2. Variable Measurement

Table 1. Variable Measurement

Variable	Operationalisation
BIND	The fraction of independent directors on the board.
MULTI	The fraction of directors on the board with multiple directorships in other firms.
FM	Dummy variable with a value of 1 if family members hold at least 20% of firm equity (otherwise 0).
FB	The fraction of founders on a firm's board of directors.
CEOD	Dummy with a value of 1 if the chief executive officer chairs the board (otherwise 0).
INST	Percentage of equity shares held by governmental-related institutional investors from the top 10 largest equity shareholders.
PCON	Dummy variable is coded 1 if a firm has a political connection (otherwise 0).
DAMJ	$U_{it} = (\text{Total accruals}/\text{Lagged total assets}) - [\alpha + \beta_1(1/\text{Lagged total assets}) + \beta_2((\Delta\text{Revenue} - \Delta\text{Accounts receivables})/\text{Lagged total assets}) + \beta_3(\text{Property plant and equipment}/\text{Lagged total assets})]$ <p>Where U_{it} equals to discretionary accruals.</p>
DT	Deferred tax expenses deflated by lagged total assets
WCAC	$[(\Delta\text{Current assets} - \Delta\text{Cash and short term investments}) - (\Delta\text{Current liabilities} - \Delta\text{Debt in current liabilities} - \Delta\text{Tax payable})] / \text{Average total assets}$
CHAR	$\Delta\text{Accounts receivables} / \text{Average total assets}$
CHIN	$\Delta\text{Inventories} / \text{Average total assets}$
SOFT	$(\text{Total assets} - \text{Property plant \& equipment} - \text{Cash and cash equivalent}) / \text{Total assets}$
ABNCFO	$\text{Net cash flow from operations} / \text{Lagged total assets} = \beta_1 [1 / \text{Lagged total assets}] + \beta_2 [\text{Revenue} / \text{Lagged total assets}] + \beta_3 [\Delta\text{Revenue} / \text{Lagged total assets}] + \epsilon_{it}$ <p>Where ϵ_{it} represents the abnormal cash flow from operations as a residual term</p>
ABNPRO	$\text{Cost for sold goods} / \text{Lagged total assets} = \alpha_0 + \alpha_1(1 / \text{Lagged total assets}) + \alpha_2 (\text{Revenue} / \text{Lagged total assets}) + \alpha_3 (\Delta \text{Revenue} / \text{Lagged total assets}) + \alpha_4 (\Delta \text{Lagged revenue} / \text{Lagged total assets}) + \epsilon_{it};$ <p>Where ϵ_{it} represents the abnormal production cost as a residual term</p>
ABNDIX	$\text{Selling, general and administrative expenses, and research and development expenditures} / \text{Lagged total assets} = \alpha_0 + \alpha_1(1 / \text{Lagged total assets}) + \alpha_2 (\text{Lagged revenue} / \text{Lagged total assets}) + \epsilon_{it}$ <p>Where ϵ_{it} represents the abnormal discretionary expenses as a residual term</p>
CROA	$[\text{Net income prior to extraordinary items}(\Delta\text{Total assets}/2)] - [\text{Lagged net income prior to extraordinary items} / (\Delta\text{Lagged total assets}/2)]$
PE	$\text{EXI}_{it} \text{ refers to net income prior to extraordinary items, TASI}_{it} \text{ is total assets}$ $(\text{Outstanding common shares} \times \text{Year-end market price}) / \text{Net income prior to extraordinary items.}$
DIST	Following Altman's (1993) Z-score model: $Z'' = 6.56 (\beta_1) + 3.26 (\beta_2) + 6.72 (\beta_3) + 1.05 (\beta_4).$ <p>Where $\beta_1 = \text{working capital} / \text{Total assets}; \beta_2 = \text{Retained earnings} / \text{Total assets}; \beta_3 = \text{Earnings prior to tax and interest} / \text{Total assets}; \beta_4 = \text{Book value equity} / \text{Total assets}$ </p>
AIS	Dummy variable with a value of 1 if net proceed from sale/issue of preferred and common equity exceeds zero (otherwise 0).
CHFCF	$\Delta(\text{Net income prior to extraordinary items} - \text{RSST Accruals}) / (\Delta\text{Total assets}/2)$
INTF	$(\text{Net cash flow from operations} - \text{Lagged capital expenditures}) / \text{Lagged current assets}$
SVW	Yearly standard deviation of monthly stock return
LEV	Long-term debt deflated by total assets
LNTA	Log of total assets
LAGE	Log of the years a company has been listed

3. Research Design

This study examined public listed Malaysian firms from 2002 to 2012 by focusing on four sectors that represented 72% of the target population: industrial products, trading & services, properties, and consumer products. These four sectors account for a significant number of forced restatement incidents, which is consistent with their relative size.

IDFR firms as the treatment group were manually identified from the corporate annual report. Past scholars [see 33; 34] evidenced forced restatement by seeking the following keywords from annual reports: prior year adjustments, restate, restatement, and restated. With no Malaysian restatement database, steps prescribed by Abdullah et al. (2010) were adhered to, by examining financial statements considered to have been restated based on the definition outlined by GAO. “Aggressive” accounting practice as defined by GAO is the “intentional and unintentional misuse of facts applied to financial statements, oversight or misinterpretation of accounting rules, and fraud (2002, p.76).

The sample data for the study consists of 6,052 firm-year observations from 634 firms (~ 72% of the publicly listed firms on Bursa Malaysia). Refinement of data was done by first screening for missing value. Negative earnings (inclusive of negative PE) were discarded as they had no net worth value. After removing 1,354 firm-year observations because of negative earnings and missing values, the remaining sample was 626 firms with 4,698 firm-year observations.

Multivariate logit regression models were examined to determine the link of specific corporate governance and financial attributes with IDFR. The IDFR sample is used to build the prediction model due to its destructive nature and excludes the IIFR which is unlikely to be as disastrous. The IDFR multivariate logit model outcomes were compared with those retrieved from penalised likelihood logit regression model (PLLM) and stepwise logit regression model (SLM) to determine model robustness.

A three-year lag period of misstatement prior to the forced restatement event was deployed for regression purpose. The approach prevents reverse causality and

endogeneity issues. Equation (1) displays the empirical model.

$$\begin{aligned} \text{RESTATE}_i(0,1) = & \alpha + \beta_1\text{BIND}_i + \beta_2\text{MULTI}_i + \beta_3\text{FM}_i + \\ & \beta_4\text{FB}_i + \beta_5\text{CEOD}_i + \beta_6\text{INST}_i + \beta_7\text{PCON}_i + \beta_8\text{DAMJ}_i + \\ & \beta_9\text{DT}_i + \beta_{10}\text{WCAC}_i + \beta_{11}\text{CHAR}_i + \beta_{12}\text{CHIN}_i + \beta_{13}\text{SOFT}_i + \\ & \beta_{14}\text{ABNCFO}_i + \beta_{15}\text{ABNPRO}_i + \beta_{16}\text{ABNDIX}_i + \beta_{17}\text{CROA}_i \\ & + \beta_{18}\text{PE}_i + \beta_{19}\text{DISTRESS}_i + \beta_{20}\text{AIS}_i + \beta_{21}\text{CHFCE}_i + \\ & \beta_{22}\text{INTF}_i + \beta_{23}\text{SVW}_i + \beta_{24}\text{LEV}_i + \beta_{25}\text{LNTA}_i + \beta_{26}\text{LAGE}_i \\ & + \sum_{k=1}^{56} \beta_k \text{IND}_{i \in K} + \sum_{t=1}^{11} \beta_t \text{YEAR } t + \varepsilon_{it-1} \quad (1) \end{aligned}$$

4. Results and Discussion

4.1. Univariate Analysis

The descriptive statistics of firm-years are presented in this section. Unusual characteristics of IDFR firm relative to control firms (CF) were examined and Table 2 lists the outcomes. Dichotomous and discrete/continuous variables are presented in separately.

Based on the rank-sum test, variables that include board quality, family control, and corporate reporting quality revealed no significant difference. Nevertheless, the mean rank variance for INST is significantly higher at 18.40 for IDFR, compared to 11.33 for CF. It establishes early evidence to indicate that INST is positively related to forced restatement. Notably, government-controlled firms produce substandard financial reporting to conceal potential expropriation activities [see 37] by reporting artificial positive earnings, which can lead to IDFR.

The mean of PE for IDFR is higher at 2.73, when compared to 2.51 for CF (significant at 10% level). This result is in agreement with past studies that managers prefer providing positive earnings reporting to display exceptional firm performance [see 38; 39], thus increasing the likelihood of IDFR occurrences.

Contradicting results with prior studies revealed that IDFR had a lower potential to raise external finance and a lower level of free cash flow. This is shown from the lower mean-rank of 0.046 (CHFCE) and 0.095 (INTF) for IDFR, when compared to 0.073 and 0.153 respectively for CF. Consistently, the level of issuance of debt or equity (AIS) is also lower at a mean of 0.455 among IDFR firms compared to 0.562 for CF.

Table 2. Descriptive Statistic for IDFR and CF

		N	Mean	Median	Std Dev.	z-statistic (p-value)
Continuous Variables - PANEL A						
Board quality:						
BI	IDFR	60	.407	.375	.123	1.413
	CF	4420	.423	.4	.110	(.158)
MULTI	IDFR	60	.635	.667	.266	-.441
	CF	4420	.619	.667	.270	(.660)
Family control:						
FB	IDFR	60	.062	0	.016	1.554
	CF	4420	.083	0	.002	(.120)
Government institutional ownership:						
INST	IDFR	60	18.400	7.31	23.356	-1.673**
	CF	4420	11.329	5.985	15.795	(.094)
Corporate reporting quality:						
DAMJ	IDFR	42	.019	.016	.085	-.714
	CF	3041	.008	.006	.159	(.475)
DT	IDFR	58	.018	.010	.024	1.337
	CF	4416	.023	.014	.030	(.181)
WCAC	IDFR	58	.037	.015	.047	-.147
	CF	4403	.045	.016	.068	(.884)
CHAR	IDFR	58	.011	.002	.045	.785
	CF	4409	.017	.009	.085	(.432)
CHIN	IDFR	58	.013	.002	.039	.388
	CF	4409	.016	.005	.074	(.698)
SOFT	IDFR	60	.506	.501	.181	-.604
	CF	4632	.494	.493	.186	(.546)
ABNCFO	IDFR	42	-.024	-.020	.071	2.502
	CF	3041	.009	.009	.110	(.012)
ABNPRO	IDFR	42	.039	.016	.050	-.375
	CF	3041	.039	0	.055	(.708)
ABNDIX	IDFR	42	-.006	.005	.112	-.813
	CF	3041	-.005	-.001	.084	(.416)
Firm performance and firm's funding:						
CROA	IDFR	60	.029	.006	.082	-.464
	CF	4638	.036	.005	.096	(.643)
PE	IDFR	60	2.728	2.491	1.006	-1.938*
	CF	4355	2.513	2.382	.948	(.053)
DIST	IDFR	60	5.044	3.940	3.632	1.005
	CF	4638	5.771	4.773	4.697	(.315)
CHFCF	IDFR	56	.046	0	.087	2.287**
	CF	4146	.073	.002	.100	(.022)
INTF	IDFR	60	.095	0	.221	3.416***
	CF	4638	.153	.061	.241	(.001)
Share price volatility:						
SVW	IDFR	53	11.422	9.581	6.370	-1.719*
	CF	4158	10.084	8.635	6.267	(.086)
Dichotomous Variables - PANEL B						
		N	Mean	Median	Std Dev.	Diff. (Chi ² statistic)
FM	IDFR	60	.500	1	.504	
	CF	4420	.585	.5	.493	1.754
CEOD	IDFR	60	.083	0	.279	
	CF	4420	.115	0	.319	.583
PCON	IDFR	60	.250	0	.437	
	CF	4420	.107	0	.310	12.346***
AIS	IDFR	60	.455	0	.500	
	CF	4420	.562	1	.496	5.534**

Table 2 (see Panel B) lists the outcomes of chi-square for dichotomous variables. An insignificant difference was noted for FM and CEOD. However, PCON displayed a higher frequency for IDFR (mean: 0.250 versus 0.107). High PCON can adversely affect monitoring efficacy, while discouraging managers from maximising returns for shareholders. Contrarily, IDFR firms show a relatively lower mean of AIS.

4.2. Multivariate Analysis

The multivariate logit analysis was performed to determine the impact of financial factors and corporate governance factors on the possibility of IDFR. Table 3 tabulates the findings.

First, BIND is negatively related to the likelihood of IDFR at a 10% significance level. The result is due to the limited fraction of independent directors on the board of IDFR companies that restricts the capability to effectively monitor the managers, hence increasing IDFR likelihood.

PCON is positively related to the probability of IDFR at a 1% statistically significant level. Similarly, past studies in Malaysia revealed that firms with PCON are operationally inefficient and demonstrate high financial misstatement risk [see 14; 40].

Firms that are on the verge of draining their internal funding are also vulnerable to IDFR. This is supported by

the significant result where INTF has a negative relationship with the likelihood of IDFR. Dechow et al. (2011) also reported that lower INTF (with higher financial need) increased IDFR risk.

The SVW recorded a positive relationship with IDFR likelihood at 5% significance level. The result indicates that SVW alerts authorities and regulators about firms' enduring problems, thus prompting intense monitoring and triggering IDFR.

Table 3 shows the model's goodness of fit (GoF) displays log likelihood $\chi^2 (X^2 (2149) = 435.22, df = 62, p < 0.000)$, signifying the importance of the model. Notably, the independent variables enabled IDFR prediction.

The outcomes revealed that BIND, PCON, INTF, and SVW were significantly related to the occurrence of IDFR. The variables that relate to family ownership and control, as well as firm performance, are found to be insignificant. Additionally, DAMJ, the working capital accruals and real earnings management variables documented insignificant relationship; suggesting that IDFR firms did not participate in manipulative income-increasing reporting. However, it is possible that IDFR firms are subject to reporting material accounting errors as a result of poor board monitoring and weak operational efficiency due to the presence of PCON.

Table 3. Multivariate Logit Regression to Examine the Determinants of IDFR

Variable	IDFR	
	Odds Ratio	p-value
BIND	.014*	.056
MULTI	.969	.519
FM	1.223	.307
FB	.158	.119
CEOD	.907	.441
INST	.987	.186
PCON	4.459***	.007
DAMJ	8.062	.229
DT	.499	.455
WCAC	.005	.121
CHAR	.104	.154
CHIN	.013	.939
SOFT	2.477	.164
ABNCFO	1.179	.528
ABNPRO	.560	.442
ABNDIX	6.830	.763
CROA	1.217	.477
PE	1.029	.436
DIST	.999	.511
CHFCF	.410	.621
INTF	.001***	.049
AIS	.443	.930
SVW	1.037***	.037
Industry dummies	Included	
Year dummies	Included	
Observations	2,149	
Chi-square	435.22	
p-value	.0000	
Deg. of freedom	62	

Table 4. Stepwise versus Penalised Likelihood Logit Models to Assess Determinants of Forced Restatement

Variable	IDFR			
	Stepwise		Penalised Likelihood	
	Odds ratio	P-value	Odds ratio	P-value
BIND	.027*	.061	.136*	.075
PCON	2.788**	.011	2.280***	.008
CHIN	.027	.940	.177	.862
AI	.390	.986	.524	.989
INTF	.001***	.006	.083***	.032
SVW	1.030**	.034	1.030*	.056
Observations	2,181		4,137	
Chi-square	700.38		20.06	
p-value	.000		.003	
Deg. of freedom	21		69	

4.3. Robustness Test

The robustness test for the study was performed by comparing the outcomes of IDFR logit regression model with SLM and PLLM. Table 4 tabulates the comparative findings.

Table 4 shows fairly consistent results from the multivariate logit model and SLM. The explanatory variables (BIND, PCON, INTF, & SVW) remained to be significant. The GoF for SLM revealed enhancement at log-likelihood Chi2, $X^2 = 700.38$ ($p < 0.000$), in comparison to the original multivariate logit model with log-likelihood Chi2, $X^2 = 435.22$ ($p < 0.000$). This improvement shows better prediction power, indicating that the model is capable of predicting the probability of IDFR by using the predictor variables.

Upon comparing the outcomes of PLLM and SLM for robustness test, the GoF for the former model was lower, such that $X^2 = 20.06$ ($p < 0.001$). Despite lower GoF, PLLM showed evidence that the prediction model itself is significant. Evidently, the models can be deployed to predict the likelihood of IDFR.

Overall, the robustness test based on the SLM and PLLM signified that BIND, PCON, INTF, and SVW were important predictors of IDFR occurrences. Despite the absence of evidence indicating opportunistic accounting practice, there was potential for IDFR to occur amidst the sample firms due to income-increasing accounting errors. Notably, IDFR imposes exorbitant costs on investors (low/negative stock returns), auditors (legal suit), and regulators (reputation damage).

4.4. Predictive Analysis

Accuracy of classification was analysed to ascertain model performance in predicting the likelihood of IDFR among sample firms. In precise, the predictability of PLLM of IDFR was examined.

The PLLM is preferred over conventional logit models

due to its robustness, as well as its ability to address overestimation of coefficient in explanatory variables and underestimation of probability in rare events, such as IDFR. The PLLM enables the penalty function to penalize against model intricacy and estimated coefficients size. Therefore, PLLM is deemed more reliable due to low-biased outcomes in samples with small data properties.

Variables included in IDFR predictive model were selected from SLM. The SLM selects variables that adhere to inclusion and exclusion criteria, hence generating a stable subset of predictor variables. Selection of variables using SLM addresses attenuation bias due to numerous proxies in a logit model.

In adherence to Dechow, Larson & Sloan (2011), a predictive ability test was executed by assessing the estimated probability of every observation that was assigned via PLLM. First, the predicted values were determined using estimated coefficient yielded when each firm attribute is embedded into PLLM. The predicted probability formula is given below:

$$\text{Probability} = e^{(\text{Prediction value})} / (1 + e^{(\text{Prediction value})})$$

Next, the predicted probability was scaled using IDFR unconditional probability to obtain F-score. Unconditional probability = the sum of IDFR firms divided by the sum of all firms. The F-score calculation for KMN Group that issued IDFR in 2008 is given as follows:

$$\begin{aligned} \text{Prediction value} &: -3.360 + 0.824 \times (\text{PCON}) + \\ &(-1.993) \times (\text{BIND}) + \\ &(-1.732) \times (\text{CHIN}) + (-2.486) \\ &\times (\text{INTF}) + (-0.646) \times (\text{AIS}) + \\ &0.030 (\text{SVW}) \end{aligned}$$

$$\begin{aligned} \text{Prediction value} &: = -3.360 + 0.824 \times (1) + \\ &(-1.993) \times (0.3) + (-1.732) \times \\ &(0.117) + (-2.486) \times (0) + \\ &(-0.646) \times (1) + 0.030 \end{aligned}$$

(16.451)

Prediction value : -3.489

Probability : $e^{(-3.489)} / (1 + e^{(-3.489)})$
 where $e = 2.71828183$

Probability : 0.0296

Unconditional probability : $52 / (52 + 4085) = 0.01257$

F-score : $0.0296 / 0.01257$

KMN Group Berhad's F-Score = 2.358

An F-score equals 1 would mean that both IDFR predicted probability and unconditional probability are similar. If the F-score exceeds 1, IDFR probability is higher than unconditional probability. Since the F-score = 2.358 in the above calculation, KMN Group had higher potential for issuing IDFR than other firms.

Table 5 displays the rank of firm-years in quintiles using F-score. Apart from the frequencies of IDFR and non-IDFR firms, minimum F-scores are reported for every quintile. Exceptional model performance that identifies IDFR firms very well is classified in quintile 5. Referring to Table 5, 40.38% of IDFR firms are in quintile 5, relative to the expectation level of 20.00%. Since quintile 5 minimum value is 1.478, KMN Group is positioned in quintile 5 (F-score = 2.358).

Table 5. Detection Rates of IDFR

	No of observation	Minimum F-Score	Percentage (of total)
Quintile 1			
IDFR	3	0.14	5.77
Non-IDFR	824	0.04	20.17
Quintile 2			
IDFR	3	0.59	5.77
Non-IDFR	824	0.57	20.17
Quintile 3			
IDFR	8	0.80	15.38
Non-IDFR	819	0.78	20.05
Quintile 4			
IDFR	17	1.04	32.69
Non-IDFR	811	1.02	19.85
Quintile 5			
IDFR	21	1.48	40.38
Non-IDFR	807	1.45	19.76

5. Conclusions

An IDFR prediction model that can indicate warning signals of firms at risk of forced restatement is crucial for developing countries, specifically in Malaysia. Determining opportunistic reporting behaviour with pernicious motive is indeed not easy, mainly because managers would eventually point their fingers to poor GAAP regulations. Besides, predicting a rare, forced restatement event is almost not possible stemming from event uncertainties in light of economic activities [41]. Similarly, predicting forced restatements is difficult due to multiple intricate correlations of various factors that lead to such rare occurrence. In spite of forecasting shortcomings, building a prediction model is still useful for future strategic planning. This is probable as the characteristics of IDFR committed by firms were determined using logit model (e.g., corporate governance, quality of accruals, & performance of firm). These attributes may be construed as warning signs of misstating firms and raise awareness at an earlier stage to those concerned. In this case, auditors, for instance, can manage their audit procedures and minimise potential legal risk. Investors and financial institutions can adjust their exposure level to the hazardous forced restatement firms beforehand. Regulators, on the other hand, could be better equipped to devise stricter accounting rules and policies to effectively curb delinquent managerial behaviour. Despite the robustness of the results, future studies are called for to conduct a comparative analysis by employing alternative data mining methods using the same set of covariates to determine a more effective technique for predicting IDFR within the milieu of an emerging economy.

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