

## **ESTIMATION FINANCIAL INFORMATION MANIPULATION BY NEGATIVE BINOMIAL HURDLE MODEL**

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### **—Abstract —**

Manipulation is one of the important issues in securities markets because manipulative actions send false signals to investors and make them buy or sell securities. There are different types of manipulations that can deceive investors, one type of which called financial information manipulation. Manipulators, who use this kind of manipulation, distort information on financial statements in order to give false information about the prospects of the issuing firms. The aim of the manipulators is to deceive the investors and gain advantage at their expense.

In this study, it is aimed to develop an appropriate model in order to determine the factors affecting the number of companies which has published false financial statements at Istanbul Stock Exchange in 2010 year. Zero-inflated count data is analyzed with Negative Binomial Hurdle Model in order to determine the effective financial ratios.

**Key Words:** *Financial Information Manipulation ,Negative Binomial Hurdle model, Caunt data*

**JEL Classification: C51,C58,G10**

### **1. INTRODUCTION**

Manipulation of financial information is intended at users of financial information with the aim of influencing their perceptions of a business' financial status and operational outcomes. The most important target audience for manipulation are investors who are also the most important users of financial information. Managers aim at creating an “optimistic expectation for profits” in investors'

minds by manipulating accounting operations, and lead investors to purchase new company stocks.

Due to the manipulation of financial information, companies' real financial statuses and operational outcomes are misrepresented for users of financial information; and investors who purchase stocks suffer losses and lose their trust in the system. Further, investment decisions made by both companies and investors on misinformation result in the allocation of resources in wrong or unproductive areas, and thus create additional costs on the economy.

The basic method of discovering any manipulation of financial information is auditing by responsible authorities (and by sometimes independent audit institutions). Besides, in academic studies, certain conditions for manipulation of financial information are tested by using publicly disclosed information and statistical methods. Thus, such studies can also speculate about existence of manipulation.

In this study, the number of companies with any untrue statement of financial information for the 2010 period was identified in light of the data available in Capital Markets Board and Istanbul Stock Exchange bulletins. As the data were based on zero weight value count, they were analysed with a Negative Binomial Hurdle Model. Further, the study aims at revealing financial ratios with which the number of manipulated transactions could be identified and which could be put forward as an indicator.

## **2. THE PURPOSES, TECHNIQUES AND RESULTS OF MANIPULATION OF FINANCIAL INFORMATION**

Manipulation of financial information is intended at users of financial information to influence their perceptions of a business. It aims at creating an "optimistic expectation for profits" in investors, leading them to purchase new shares and thus, increasing the market value of the shares and the business. Apart from this type of "manipulation for business", there are also types of "manipulation against business" which result from managers' efforts to give investors a head start by providing them with undisclosed information. The aim of this type of manipulation is to increase managers' earnings and bonuses (Lev, 2003).

The incentives for manipulating financial information include increasing stock prices, improving the credibility of the business, reducing costs of borrowing and increasing managers' bonuses from profits (Kirschenheiter and Melumad, 2002). In addition, an incentive for accounting manipulation in big firms is to reduce

political costs by avoiding further regulations and higher taxes (Wilson and Shailer, 2007).

**Table 1:** Incentives and rewards for accounting manipulation

Category	Rewards
Share-price effects	Higher share prices Reduced share-price volatility Increased corporate valuation Lower cost of equity capital Increased value of stock options
Borrowing cost effects	Improved credit quality Higher debt rating Lower borrowing costs Less stringent financial covenants
Bonus plan effects	Increased profit-based bonuses
Political cost effects	Decreased regulations Avoidance of higher taxes

**Source:** Mulford and Comiskey, 2002.

### 2.1. Techniques for Manipulating Financial Information

There are many techniques employed in accounting manipulation. Some of these are:

- Changing accounting policies
- Accounting for research and development expenses (capitalised or expensed as period cost)
- Transition from accelerated to straight-line depreciation method
- Capitalisation or registration of borrowing expenses (as period costs)
- Changing the inventory valuation method
- Registering a purchased business with fair value or book value
- Purchase versus pooling decisions for business mergers (Stolowy and Lebas, 2006)

## **2.2. Results of Manipulating Financial Information**

The most important result of manipulating financial information is that it prevents the allocation of economic resources to productive areas. Other results can be summarized as:

- Loss of company value due to decline in stock prices
- Increase in borrowing costs
- Financial loss for investors who in turn lose trust in markets
- Drop in the number of analysts following companies manipulating financial information
- Less correct estimations about companies by analysts
- Deterioration of capital markets' role in the allocation of resources to productive areas
- Dismissal of and/or litigation against managers in manipulator companies
- Independent audit institutions' withdrawal from auditing operations or client loss and very high compensation costs

One of the major costs of manipulation of financial information to capital markets is the fall of stock prices, hence a decrease in companies' market value. Such losses may also lead company stocks to be completely valueless, as seen in the cases of Enron and Parmalat (Mulford and Comiskey, 2002).

## **3. UNCOVERING MANIPULATION OF FINANCIAL INFORMATION**

The basic method for unravelling financial information manipulation is auditing by responsible authorities (and sometimes by independent audit institutions). Besides, in academic studies, certain conditions for manipulation of financial information are tested by using publicly disclosed information and statistical methods. Thus, such studies can also speculate about existence of a manipulation. Some of the findings obtained with descriptive methods are below (Mulford and Comiskey, 2002):

- Small reported losses are rare,
- Small reported profits are common,
- Small declines in profits are rare,
- Small increases in profits are common,

- Large number of consensus forecasts are either just met or exceeded by a small amount
- Small numbers of just-missed consensus forecasts are rare

The methods for uncovering manipulations of financial information are based on the assumption that there should be symmetry in the distribution of the abovementioned measures (profit/loss reports, profit-per-stock forecast and variances in forecasts). In other words, the main assumption is that small profits, small losses and exceeding or missing forecasted profits should be of *similar incidence*.

#### 4. NEGATIVE BINOMIAL HURDLE MODEL

Data obtained based on count could have too many zero values. In this cases, the hurdle model is one of the methods used in the modeling the dependent variable having too many zero data. Hurdle model constitutes of two parts. First part includes binary response demonstrating positive counts (1) in opposition to zero counts (0). A second part includes only positive count. While binary responds use binary model, positive counts use zero-truncated count model. Binary part is modeled using logit, probit, or complementary loglog (Cameron and Trivedi, 1998; Ridout et al., 2001; Sheu et al., 2004). The part based on positive counts is modeled using Poisson, geometric, and negative binomial distributions. In the present study, Poisson and negative binomial hurdle models for positive counts. The 81.6 % of manipulator firm that considered as dependent variable had zero values. The obtained Akaike Information criteria and overdispersion criteria showed that negative binomial hurdle model was better than Poisson hurdle model.

In Negative Binomial Hurdle, binomial probability model determining the zero or non zero results of based on count dependent variable and truncated count model based on positive count truncated count model are conjoined using the following log-likelihood.

$$L = \ln(f(0)) + \{ \ln[1 - f(0)] + \ln P(j) \} \quad (1)$$

In equation (1).  $f(0)$  represents the probability of the binary part and  $P(j)$  represents the probability of positive count. In the case where logit model is used. The probability of zero is.

$$f(0) = P(y = 0; x) = \frac{1}{(1 + \exp(xb1))} \quad (2)$$

and  $1 - f(0)$  is,

$$\frac{\exp(xb)}{(1 + \exp(xb))} \quad (3)$$

The log likelihood function for both parts of negative binomial hurdle model can be written as:

$$L = cond \left\{ y = 0, \ln \left( \frac{1}{1 - \exp(xb)} \right), \right. \\ \left. \ln \left( \frac{\exp(xb)}{(1 + \exp(xb))} \right) + y^* \ln \left( \frac{\exp(xb)}{(1 + \exp(xb))} \right) \right. \\ \left. - \ln \left( \frac{1 + \exp(xb)}{\alpha + \ln \Gamma \left( y + \frac{1}{\alpha} \right)} \right) - \ln \Gamma(y+1) - \ln \Gamma \left( \frac{1}{\alpha} \right) - \ln \left( 1 - (1 + \exp(xb)) \left( \frac{-1}{\alpha} \right) \right) \right\} \quad (4)$$

(Mullahy, 1986).

## 5. EMPIRICAL ANALYSIS

In order to differentiate between companies that make false statements and that do not, ISE bulletins (from 01.01.2010 to 31.12.2010) and weekly CMB bulletins were studied using such key words as financial statement, balance sheet, income statement, profits, loss, income, expenditure, independent audit report, capitalisation, revision, etc. Companies that made false statements were coded (1) and that did not were coded (0) in the study. As the majority in the sample of 119 industrial companies traded in ISE were valued zero, it was appropriate to employ the Hurdle model in identifying the factors which affect the number of companies that make false statements. As the number of manipulation cases showed overdispersion, negative binomial hurdle regression model was implemented. The key purpose of this study is to reveal which ratios (indicators) affect the number of cases financial information was manipulated in the aftermath of a global financial crisis. A rise in the number of companies that manipulate financial information was observed in the course of the financial crisis. The study tries to

look into the financial factors which led companies to manipulate information. R software environment was used in computing the results of the analysis.

In order to identify the companies that make false statements, many resources were reviewed in search of variables. A total of 18 variables were identified as potential indicators in studies by Spathis et al. (2004), Küçüksözen (2004), Spathis (2002), Beneish (1999), Green and Choi (1997), Hoffman (1997), Hollman and Patton (1997), Zimbelman (1997), Beneish (1997), Beasley (1996). However, the number of ratios was limited to 9 after highly-correlated financial ratios were removed from the analysis.

- Debt to equity ratio, (D/E)
- Sales to total assets ratio, (S/TA)
- Net profits to sales ratio, (NP/S)
- Trade receivables to sales ratio, (R/S)
- Net profit to total assets ratio, (NP/TA)
- Gross profit to total assets ratio, (GP/TA)
- Inventory to sales ratio, (INV/S)
- Total debt to total assets ratio, (TD/TA)
- Total financing expenses to operational expenses ratio, (FE/GE)

The estimate parameters in the regression binomial model are shown in Table 2 for the number of manipulator companies with a value greater than zero (dependent variable).

**Table 2:** Parameter estimation results for regression negative binomial hurdle model with positive count.

Variables	Parameter estimation	p value
D/E	1.2067	0.012*
S/TA	-0.9831	0.003*
NP/S	-1.342	0.324
R/S	0.8465	0.033*
NP/TA	-2.312	0.028*
GP/TA	4.9675	0.285
INV/S	-2.390	0.040*
TD/TA	5.3645	0.034*
FE/GE	5.6848	0.027*
Intercept	0.7564	0.009*

\* 0.05 statistical inference level

**Table 3:** Parameter estimation results in regression negative binomial hurdle model with binary outcome

Variables	Parameter estimation	p value
D/E	1.9671	0.004*
S/TA	-0.8653	0.022*
NP/S	-2.3076	0.278
R/S	1.6328	0.039*
NP/TA	-2.9034	0.014*
GP/TA	6.3528	0.365
INV/S	-5.3622	0.030*
TD/TA	4.9936	0.0232*
FE/GE	5.0081	0.0115*
Intercept	0.0368	0.0120*

\* 0.05 statistical inference level



As a result of this study with 9 independent variables, debt to equity (D/E), sales to total assets (S/TA), receivables to sales (R/S), net profit to total assets (NP/TA), inventory to sales (INV/S), total debt to total assets (TD/TA) and total financing expenses to operating expenses (FE/GE) ratios have an effect on manipulation of false financial information. On the other hand, net profit to sales (NP/S) and gross profit to total assets (GP/TA) ratios do not represent statistical inference.

## **6. CONCLUSION**

Information provided for investors should be comprehensible enough to convey any relevant data that would affect the values of capital market instruments. Also, it should be available for a period of time that would allow investors to change their decisions if needed. It should be correct and reliable enough not to misguide investors. If otherwise, the information is neither beneficial nor useful. Such information criteria can also help to prevent any unequal opportunity among investors. Hence, providing correct information useful to investment decisions in the shortest possible time will get rid of the privileges exclusive to a certain fraction.

Manipulation is an important issue in capital markets because by giving off incorrect information manipulative actions lead investors to invest in stocks that they would otherwise avoid. There are different types of manipulation. One is manipulation of financial information. Manipulators of financial information make false financial statements that misrepresent their companies. Such manipulators intend to seek personal gain by misleading investors.

In many countries, new capital market regulations were put into force regarding companies' internal audit systems, independent audit systems, and responsibilities and conduct of independent audit institutions. Sanctions were made heavier for those who contribute to manipulation of financial information. However, making regulations to prevent manipulation is not enough. It is also important that the rules of the regulations be implemented wholly, equally and in time. In this respect, regulatory authorities, intermediary institutions, investors and all relevant actors in the market are equally responsible for the implementation of regulations.

Hurdle model is frequently used when zero values are abundant in a data cluster. In case of positive counts that are greater than zero the hurdle model is mainly based on Poisson and negative binomial distribution. Overdispersion was observed in the data cluster because the variance was greater than average. In case of overdispersion, it is more appropriate to employ negative binomial regression. The study analyses 2010 data.

As a result of the negative binomial hurdle model, debt to equity (D/E), sales to total assets (S/TA), receivables to sales (R/S), net profit to total assets (NP/TA), inventory to sales (INV/S), total debt to total assets (TD/TA) and total financing expenses to operating expenses (FE/GE) ratios have an effect on manipulation of false financial information. On the other hand, net profit to sales (NP/S) and gross profit to total assets (GP/TA) ratios do not represent statistical inference. It is suggested that ratios from such extreme periods are indicators of manipulation of financial information. It is possible to obtain different results with a larger set of ratios in the future.

Apart from the abovementioned variables used to identify false financial statements, there are other variables that can be used in estimating manipulation of financial information, such as the number of board members, the frequency at which financial managers are replaced, the quality and type of independent auditors, the frequency at which they are replaced, their perspectives, company size, the number of its branches, depreciation and inventory valuation methods, the period and rate at which a company publicly traded, partnership structure, place of trade registry, etc.

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