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ADAPTATION OF THE FINANCIAL FRAUD DETECTION MODEL (BENEISH MODEL) TAKING INTO ACCOUNT THE ANALYTICAL CAPABILITIES OF UKRAINIAN COMPANIES' OPEN FINANCIAL STATEMENTS

The distortion of financial statements makes it difficult to make investment and other management decisions. Therefore, it is very important to provide stakeholders with effective tools to identify such distortions. The problem is the limited information capabilities of open financial reporting, which is available to external interested parties (investors, customers, government, etc.). Therefore, it is very important to adapt the existing methods for diagnosing financial fraud in such a way that they can be used with only the information contained in the companies' open financial statements.

Beneish model (1999) allows you to detect earnings manipulation. As you know, the complex indicator of the Beneish model (M-score) is formed on the basis of eight indicators: Days Sales in Receivables Index (DSRI); Gross Margin Index (GMI); Asset Quality Index (AQI); Sales Growth Index (SGI); Depreciation Index (DEPI); Sales, General and Administrative Expenses Index (SGAI); Leverage Index (LVGI); Total Accruals to Total Assets (TATA). The formula of the complex Beneish indicator has the form [1]:

$$M - Score = -4.84 + 0.92DSRI + 0.528GMI + 0.404AQI + 0.892SGI + \\ + 0.115DEPI - 0.172SGAI + 4.679TATA - 0.327LVGI \quad (1)$$

M-score <–2 indicates the unlikely earnings manipulation («green flag»); –2.22 <M-score <–1.78 indicates the possible manipulation («yellow flag»); and M-score > –1.78 indicates the likely earnings manipulation («red flag»).

By the way, in addition to its direct purpose, the Beneish model is useful for the analysis of respectable companies, as it allows you to stably predict their profitability [2]. The Beneish model is a quite effective tool for identifying falsification of financial statements [3; 4]. Table 1 presents the formulas for calculating the Beneish model indicators based on the open financial statements of Ukrainian companies.

Table 1

Formulas for calculating the indicators of the Beneish model

Indicator	Conceptual formula	Calculation based on open financial statements of Ukrainian companies, row codes
DSRI	$\frac{\left(\frac{Accounts\ Recerivable}{Revenue}\right)_t}{\left(\frac{Accounts\ Recerivable}{Revenue}\right)_{t-1}}$	$\frac{\left(\left((1125)+(1130)+(1135)+(1140)+(1145)+(1155)\right)/(2000)\right)_t}{\left(\left((1125)+(1130)+(1135)+(1140)+(1145)+(1155)\right)/(2000)\right)_{t-1}}$
GMI	$\frac{\left(\frac{Revenue}{Revenue-Cost\ of\ Goods\ Sold}\right)_t}{\left(\frac{Revenue}{Revenue-Cost\ of\ Goods\ Sold}\right)_{t-1}}$	$\frac{\left(\frac{(2000)}{(2000)-(2050)}\right)_t}{\left(\frac{(2000)}{(2000)-(2050)}\right)_{t-1}}$
AQI	$\frac{\left(\frac{Total\ Assets-Current\ Assets-Fixed\ Assets}{Assets}\right)_t}{\left(\frac{Total\ Assets-Current\ Assets-Fixed\ Assets}{Assets}\right)_{t-1}}$	$\frac{\left(\frac{(1300)-(1195)-(1010)}{(1300)}\right)_t}{\left(\frac{(1300)-(1195)-(1010)}{(1300)}\right)_{t-1}}$
SGI	$\frac{(Revenue)_t}{(Revenue)_{t-1}}$	$\frac{(2000)_t}{(2000)_{t-1}}$
DEPI	$\frac{\left(\frac{Depreciation+Fixed\ Assets}{Depreciation}\right)_t}{\left(\frac{Depreciation+Fixed\ Assets}{Depreciation}\right)_{t-1}}$	$\frac{\left(\frac{(1012)+(1010)}{(1012)}\right)_t}{\left(\frac{(1012)+(1010)}{(1012)}\right)_{t-1}}$
SGAI	$\frac{\left(\frac{Selling\ and\ Management\ Costs}{Revenue}\right)_t}{\left(\frac{Selling\ and\ Management\ Costs}{Revenue}\right)_{t-1}}$	$\frac{\left(\frac{(2150)+(2130)}{(2000)}\right)_t}{\left(\frac{(2150)+(2130)}{(2000)}\right)_{t-1}}$
LVGI	$\frac{\left(\frac{Long-term\ and\ Short-term\ Liabilities}{Total\ Assets}\right)_t}{\left(\frac{Long-term\ and\ Short-term\ Liabilities}{Total\ Assets}\right)_{t-1}}$	$\frac{\left(\frac{(1595)+(1695)}{(1300)}\right)_t}{\left(\frac{(1595)+(1695)}{(1300)}\right)_{t-1}}$
TATA	Ukrainian companies' open financial statements are not enough for calculation; additional data are needed, in particular, arrears in the payment of income tax, and the short-term part of long-term loans and borrowings.	

Source: compiled by the author based on [1]

As you can see (table 1), not all indicators of the classic Beneish model can be obtained on the basis of Ukrainian companies' open financial statements, therefore, the complex M-score indicator can be calculated only with the use of additional data. So, in order for the model to be accessible to external interested parties, it must be adapted.

It should be noted that it is possible to analyze the individual components of the Beneish models based on the assessment of their boundary values [5; 6]. Table 2 presents the Beneish indicators for respectable and dishonest companies, as well as the results of the analysis for some Ukrainian hospitality companies.

Table 2

Beneish model indicators for Ukrainian hospitality companies, 2016-2018

Company	Years			Unlikely fraud	Likely fraud
	2016	2017	2018		
1	2	3	4	5	6
Days Sales in Receivables Index, DSRI					
PJSC «Kharkivtourist»	0,934	0,732	0,499	<1,031	>1,465
PJSC «New Engineering Technologies»	1,313	0,146	0,576		
PJSC «Dnister»	1,984, red flag	0,177	1,356		
PJSC «Hotel Salute»	0,596	0,821	0,971		
PJSC «Hotel Dnipro»	0,826	0,517	1,042		
PJSC «Premier Palace Hotel»	0,743	2,137 red flag	0,349		
PJSC «Ternopil-Hotel»	0,945	0,788	0,492		
Gross Margin Index, GMI					
PJSC «Kharkivtourist»	4,168 red flag	0,052	1,180	<1,014	>1,193
PJSC «New Engineering Technologies»	0,770	0,932	1,016		
PJSC «Dnister»	0,924	0,932	0,766		
PJSC «Hotel Salute»	8,083 red flag	-0,570	3,784 red flag		
PJSC «Hotel Dnipro»	0,976	1,359 red flag	0,749		
PJSC «Premier Palace Hotel»	0,487	0,694	0,683		
PJSC «Ternopil-Hotel»	0,880	1,138	1,213 red flag		
Asset Quality Index, AQI					
PJSC «Kharkivtourist»	0,482	0,910	0,737	<1,039	>1,254
PJSC «New Engineering Technologies»	1,798 red flag	1,066	1,038		

Continuation of table 2

1	2	3	4	5	6
PJSC «Dnister»	2,167 red flag	1,315 red flag	0,887		
PJSC «Hotel Salute»	1,005	0,992	1,013		
PJSC «Hotel Dnipro»	1,013	0,999	0,992		
PJSC «Premier Palace Hotel»	2,177 red flag	0,042	0,753		
PJSC «Ternopil-Hotel»	0,925	0,840	1,012		
Sales Growth Index, SGI					
PJSC «Kharkivtourist»	0,805	1,596	1,111		
PJSC «New Engineering Technologies»	1,125	1,253	1,101		
PJSC «Dnister»	1,256	1,184	1,341		
PJSC «Hotel Salute»	1,674 red flag	1,198	1,038	<1,411	>1,607
PJSC «Hotel Dnipro»	1,349	1,246	1,111		
PJSC «Premier Palace Hotel»	1,238	1,225	1,106		
PJSC «Ternopil-Hotel»	1,099	1,309	1,226		
Depreciation Index, DEPI					
PJSC «Kharkivtourist»	0,962	1,057	1,025		
PJSC «New Engineering Technologies»	0,913	0,930	0,926		
PJSC «Dnister»	0,956	1,007	0,948	≈ 1	significant difference from 1
PJSC «Hotel Salute»	0,803	0,850	0,856		
PJSC «Hotel Dnipro»	0,997	0,987	1,005		
PJSC «Premier Palace Hotel»	0,931	0,933	0,976		
PJSC «Ternopil-Hotel»	0,992	1,083	1,119		
Sales, General and Administrative Expenses Index, SGAI					
PJSC «Kharkivtourist»	0,760	1,380	0,929		
PJSC «New Engineering Technologies»	1,533	0,959	0,930		
PJSC «Dnister»	0,892	1,842	0,894	≈ 1	significant difference from 1
PJSC «Hotel Salute»	0,943	1,029	0,814		
PJSC «Hotel Dnipro»	1,080	0,710	1,400		
PJSC «Premier Palace Hotel»	1,049	1,155	0,857		
PJSC «Ternopil-Hotel»	1,203	0,819	1,002		
Leverage Index, LVGI					
PJSC «Kharkivtourist»	1,201	1,595	1,010		
PJSC «New Engineering Technologies»	0,852	1,285	0,806		
PJSC «Dnister»	1,178	0,465	0,936	≈ 1	significant difference from 1
PJSC «Hotel Salute»	1,250	1,227	1,177		
PJSC «Hotel Dnipro»	0,985	1,007	1,211		
PJSC «Premier Palace Hotel»	1,145	0,583	1,039		
PJSC «Ternopil-Hotel»	0,983	1,004	0,887		

Source: compiled by the author

So, four companies (PJSC «Kharkivtourist», PJSC «New Engineering Technologies», PJSC «Hotel Dnipro», PJSC «Ternopil-Hotel») for the period 2016-2018 have only one «red flag». We are not working with the Beneish

model complex indicator (M-score), but with its individual components. Therefore, the single deviations of individual indicators should not be taken too strictly, they can be caused by random reasons.

Two companies have two «red flags» each (PJSC «Dnister» and PJSC «Premier Palace Hotel»). At the same time, PJSC «Premier Palace Hotel» received its «red flags» according to various indicators and in different years. But PJSC «Dnister» has two «red flags» (DSRI, AQI) in the same 2016. An unusual increase in receivable (DSRI) and deterioration in the quality of assets (AQI) may indicate the probability of earnings manipulation.

And, finally, another company (PJSC «Hotel Salute») has three «red flags» at once – one (GMI) in 2016, and two (GMI, SGI) in 2018. Worsening in gross profit margin (GMI) and disproportionate increase in revenues (SGI) may indicate the probability of earnings manipulation too.

Given the importance of financial statements fraud detection, we consider it appropriate to propose supplementing the open financial statements with indicators that allow us to fully analyze the Beneish model (in particular, we propose adding data on arrears in the payment of income tax, and on the short-term part of long-term loans and borrowings).

In addition, given the companies' industry specifics, the Beneish model would have been more effective while comparing its indicators with industry average values. Unfortunately, the open statistical information by the State Statistics Service of Ukraine is currently insufficient to calculate the indicators of the Beneish model. In this regard, we consider it appropriate to make proposals to increase the granularity of open statistics in this direction.

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