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Introduction

Contemporary management control and reporting both face challenges. Consequently, a new and more sophisticated scientific approach is needed. From one point of view, interdisciplinary studies and theories are necessary. From another point of view, empirical research and practical issues call for a more specific and specialized approach. This complexity is reflected by the content of this book, which covers topics that emerge from present world's complexity. Therefore, the authors focus on ever-important issues (such as the strategic approach and its support by management control and reporting, survival of companies), and more modern issues (e.g. cultural aspects, measurement and reporting adjusted to branches, spheres and organizations and specific issues of management control and reporting).

The strategic approach to managerial control and financial statements and their role for company's survival is presented in papers by J. Dyczkowska (who addresses the question whether annual reports communicate strategic issues and focuses her study on reporting practices of high-tech companies), A. Bieńkowska, Z. Kral, A. Zabłocka-Kluczka (who explain the role of responsibility centers in strategic controlling), P. Kroflin (who explores the value-based management and management reporting examining impacts of value reporting on investment decisions and company value perception) and A. Reizinger-Ducsai (who discusses bankruptcy prediction and financial statements). The problems of management control and reporting and their adjustment to specific conditions and organizations are undertaken by T. Dyczkowski (who introduces his NGO performance model), Z. Kes and K. Nowosielski (who present the case study of the process of cost assignment in a local railway company providing passenger transportation services), S. Łęgowik-Świącik, M. Stępień, S. Kowalska and M. Łęgowik-Małolepsza (who analyse the efficiency of the heat market enterprise management process in terms of the concept of the cost of capital), and M. Pietrzak and P. Pietrzak (who discuss the problem of performance measurement in the public higher education). The cultural aspect of managerial control and reporting is explored in papers written by M. Nowak (who presents cultural determinants of accounting, performance management and costs problems showing the issue from Polish perspective using G. Hofstede and GLOBE cultural dimensions) and P. Bednarek, R. Brühl and M. Hanzlick (who provide a literature overview of planning and cross-cultural research). The specific problems and concepts of managerial control and reporting are investigated by M. Ciołek (who discusses the lean thinking and overhead costs), E. Nowak (who analyses the role of costs control role in controlling company operation), Ü. Päril, R. Koyte,

S. Näsi (who examine middle managers' mediating role in MCS implementation), R.L. Sichel (who discusses the relevance of intellectual property for management control), J. Paranko and P. Huhtala (who analyse the productivity measurement at the factory level).

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BANKRUPTCY PREDICTION AND FINANCIAL STATEMENTS. THE RELIABILITY OF A FINANCIAL STATEMENT FOR THE PURPOSE OF MODELING

PREDYKCJA BANKRUKTWA A SPRAWOZDANIA FINANSOWE. WIARYGODNOŚĆ SPRAWOZDAŃ FINANSOWYCH DLA POTRZEB MODELOWANIA

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Summary: Experts representing not only management and organization science, but also the assessment of investments, even some other fields within the science of economic management for a long time have had a focus on the profitable subsistence and safe operation of companies and business associations. The interest-bearing groups primarily take the analysis of the balance sheet, the profit and loss statement and the cash flow statement as a basis to assess solvency and the condition of economic management. An analysis of the publicly available data and financial statements can help get a picture of the property, financial and income position of companies. Analysts and researchers convert the data set from the financial statements into financial indices and attempt to learn “useful” information from them. The study is intended to demonstrate if the above predictive models can be used with greater safety in case the rules taken as a basis upon making the report are clearly understood or in case the presentation criteria required by these rules and presented in the accounting reports are reconsidered on account of the reliability of the prediction. My aim was to present that the rearrangement of a financial statement is required for the models to show reliable results.

Keywords: bankruptcy models, financial statements, Altman, liquidity indices, corporate solvency, Hungarian Accounting Act.

Streszczenie: Nie tylko eksperci reprezentujący nauki o zarządzaniu i organizacji, ale również ci z innych dziedzin ekonomii, włączeni w proces oceny inwestycji, od dawna skupiają uwagę na trwałej rentowności oraz bezpieczeństwie działania przedsiębiorstw i grup jednostek. Interesariusze prowadzą przede wszystkim analizy bilansu, rachunku wyników oraz rachunku przepływów pieniężnych, będące podstawą oceny wypłacalności i kondycji ekonomicznej. Analiza ogólnodostępnych danych i sprawozdań finansowych pozwala uzyskać obraz sytuacji majątkowej, finansowej i dochodowej jednostki. Analitycy i badacze przekształcają zbiory danych ze sprawozdań finansowych we wskaźniki finansowe, starając się wydobyć z nich użyteczne informacje. Niniejsze badanie ma na celu stwierdzenie czy stosowanie wspomnian-

nych modeli predykcji staje się bardziej skuteczne w sytuacji, gdy zasady leżące u podstawy sporządzania sprawozdania są jasne i zrozumiałe, czy też wówczas, gdy zasady dotyczące ujawnień nakładane przez regulacje i stosowane w sprawozdaniach są dostosowane pod kątem wiarygodności predykcji. Wskazano, że przekształcenie sprawozdania finansowego jest konieczne, aby modele dostarczały wiarygodne wyniki.

Słowa kluczowe: modele bankructwa, sprawozdania finansowe, model Altmana, wskaźniki płynności finansowej, wypłacalność, Węgierska Ustawa o Rachunkowości.

1. Introduction

Experts representing not only management and organization science, but also the assessment of investments, even some other fields within the science of economic management for a long time have had a focus on the profitable subsistence and safe operation of companies and business associations.

The interest-bearing groups primarily take the analysis of the balance sheet, the profit and loss statement and the cash flow statement as a basis to assess solvency and the condition of economic management. An analysis of the publicly available data and financial statements can help get a picture of the property, financial and income position of companies.

Analysts and researchers convert the data set from the financial statements into financial indices and attempt to learn “useful” information from them.

Mentioning analysts and researchers together is not a mere coincidence. Analysts use the algorithms of an already existing bankruptcy model and rely on the financial indices to calculate a single, well-defined predictive value, and then use this value as a “watershed” to qualify the company or business association as one with good or bad performance.

The Basel II Capital Treaty [Basel Committee 2006] brought forth the prominence of specific bankruptcy prediction methods based on multivariate statistics, given that estimating the trade debtors’ non-paying probability is a key factor for credit institutions. Yet we cannot know if the rules related to Basel III and intended to be introduced until 2019 would provide guidance for the estimation method; still, in recent years a number of studies have focused on testing the models.

The methods developed, then analysed by researchers (i.e. discriminant analysis, logistic regression analysis, recursive partitioning algorithm or neural networks) all point at differences in algorithms [Virág, Kristóf 2006]. Researchers assessed what type of explanatory variables is significant [Kristóf 2008], what estimation methodology is adequate, what elements are relevant, if any main component needs to be emphasized during the investigation [Felfalusi 2014] or if the predictive capability of the simulation procedures surpasses the traditional mathematical-statistical methods [Virág, Nyitrai 2014].

There is still a single factor that the literature has not yet gone into: this is nothing else but the reliability of data from the reports underlying modelling.

The study is intended to demonstrate if the above predictive models can be used with greater safety in case the rules taken as a basis upon making a report are clearly understood or in case the presentation criteria required by these rules and presented in accounting reports are reconsidered on account of the reliability of the prediction.

My research is based on the Hungarian Accounting Act. Some regulations of the Hungarian Accounting Act are similar to IFRS, but there are several substantial differences.

2. The history of bankruptcy models – literature review

No developed statistical methods and computers were at hand for those making bankruptcy predictions in the early phase of bankruptcy prediction, i.e. the first two thirds of the 20th century. The financial indices of the companies, both surviving and going bankrupt, were compared subsequently and the conclusion was that the most frequently used indices of indebtedness, liquidity, profitability and circulation velocity were lower or less favorable for the bankrupt companies [Fitzpatrick 1932].

The research scientist making the first factual prediction was W. H. Beaver, who in his study tried to define a single index which can help make a distinction between bankrupt and surviving companies [Beaver 1966]. He used the data of 79 bankrupt and 79 surviving companies for his analysis. He created 30 indices from the financial statements of the companies and compared them one by one in the two groups. He concluded that the data mostly differed with regard to the below indices:

- cash flow/total assets,
- cash flow/debt,
- net sales/debt.

As early as at this point he reached 90% reliability in indicating insolvency one year before bankruptcy.

We evidently find this calculation model embryonic; still, Beaver was the first to raise ratio analysis into the rank of bankruptcy prediction methods, which thus defined the trends of research with the models.

The first genuine researcher in bankruptcy models was Edward I. Altman, whose discriminant analysis-based model in 1968 was already a real multivariate analysis and who achieved significant results [Altman 1968]. He analyzed altogether 66 medium-sized industrial companies, including 33 that went bankrupt in 1946–1965 and 33 that were still operational in 1966. He surveyed 22 potential financial indices from the group of liquidity, return, leverage, asset compliance and asset utilization indices in the sample companies. He chose the indices according to their popularity and potential significance in literature.

Finally, Altman set up a linear formula of five variables:

$$Z = 0.012 A + 0.014 B + 0.033 C + 0.006 D + 0.999 E$$

The variables in the formula are as follows:

- *A*: working capital/total assets,
- *B*: retained earnings/total assets,
- *C*: earnings before interest and taxes (EBIT)/total assets,
- *D*: market value of equity/debt,
- *E*: net sales/total assets.

The variables and the accompanying weights conclude the bankruptcy formula which facilitated the reliable ranking of companies, with regard to the threat of bankruptcy. In the course of evaluation the value of the indices is multiplied with the weights, and all this adds up to a *Z* score. This *Z* score is compared with the discrimination points defined by Altman (1.81 and 2.99), which leads to ranking the specific company in a classification group:

- if the calculated *Z* score is below 1.81, a company can definitely be ranked in the category threatened by bankruptcy;
- the companies reaching the *Z* score of 2.99 at the least can, with great likelihood, be considered to survive;
- the ratio of erroneous categorizations is rather high in the range between the two scores, so the result of the model in this category should be assessed with reservations.

In his subsequent research, Altman improved his model also by sectors [Altman 2000]. This concluded the following linear functions:

- In non-public enterprises the variables include the book value of equity capital; however, this diverts the weight of the other factors versus the original bankruptcy function. Here the bankruptcy function is the following:

$$Z = 0.717 \times A + 0.847 \times B + 3.107 \times C + 0.42 \times D + 0.998 \times E,$$

where *A*, *B*, *C*, *E* are identical with the variables of the original function, whereas *D* is the book value of equity capital.

- The sales/total assets index is not taken into account in non-production enterprises, considering that these companies are less capital intensive. The bankruptcy function underlying the classification is as follows:

$$Z = 0.656 \times A + 0.326 \times B + 0.672 \times C + 0.105 \times D$$

Deakin [1972] and Blum [1974] developed their models from Altman's research. Both relied on the discriminant analysis: Deakin placed stronger emphasis on liquidity indices [Deakin 1972] and Blum on return indices [Blum 1974].

Altman created the improved variant of the original *Z* model with Haldeman and Narayanan about one decade after publishing his breakthrough model, in 1977 [Altman 2002]. There were an increasing number of corporate bankruptcies registered in the preceding 10 years, accounting regulations changed considerably, which all called for the revision and improvement of the model.

The new model was developed from a sample of 111 companies, including trading and industrial companies in a fifty-fifty split. Moreover, the authors expanded the range

of the indices surveyed: versus the 22 indices in the original research 27 indices were used from the annual reports of the companies, and the model was set up on this basis.

The ZETA model included altogether seven financial indices which were published lacking their weights in the model. The indices were as follows:

- *X1*: asset profitability: EBIT/assets;
- *X2*: profitability stability: deviation from the 10-year trend;
- *X3*: debt service: EBIT/logarithm of interest payment;
- *X4*: cumulative profitability: retained earnings/assets;
- *X5*: liquidity: current assets/short-term liabilities;
- *X6*: capitalization: subscribed capital/equity capital;
- *X7*: size: logarithm of total assets.

In making a non-exhaustive summary, we should also mention logistic regression analysis which came out in the 1980s and one of whose representatives was Ohlson [1980]. Having recognized that the ratio of solvent companies must be higher in the multitude during model building, Ohlson established a negative correlation between size and insolvency.

Starting from the 1990s, neural networks within the family of artificial intelligence methods gave a new impetus to improving the reliability of bankruptcy prediction. Odom and Sharda proved that their predictive capability (based on Altman's five financial indices) surpasses the result of discriminant analysis [Odom, Sharda 1990].

Alongside the multivariate statistical methods, Merton had a major impact on credit risk management and the corporate classification systems as he indicated significant correlations between credit risk and capital structure (quoted from [Benyovszki, Kibédi 2008]).

The theory of options pricing has also been used in bankruptcy predictions for decades now [Damodaran 2002]. Following the basic idea of standard options pricing, the equity capital of a company can be considered a European call option to produce the value of corporate assets, based on the anticipated settlement at maturity of the nominal value of the debt. Damodaran developed various methods for sector specific, start-up, declining and even nearly bankrupt companies in his assessment recommendations [Damodaran 2002].

Bankruptcy prediction-related research was launched in Hungary relatively late compared to international literature, in the early 1990s [Imre 2008]. The market economic environment developed only after the political changes, and the legal rules were adopted in connection therewith. The legal frames of bankruptcy regulation were formed with the entry into force of Act XLIX of 1991 on Bankruptcy Proceedings, Liquidation Proceedings and Voluntary Dissolution, which facilitated research in the investigation of economic bankruptcy [Act XLIX of 1991 on Bankruptcy Proceedings and Liquidation Proceedings].

3. Value components in bankruptcy models

Whichever of the above-mentioned researchers' bankruptcy predictive models you choose, their model variables will rank among the liquidity, circulation velocity, indebtedness and profitability indices that are proven to be in connection with solvency.

The liquidity indices define the rate of reliability whereby the creditors of a specific company can expect to enforce their claim. Higher value means better liquidity. The acid test ratio is intended to foretell quick solvency as the current assets in the counter do not include the warehouse stock which in theory can be sold over a relatively long time. The liquid assets ratio is also necessary as it does not include trade debtors. The customers' willingness to pay can considerably influence liquidity, so it is essential to have an understanding of the pure liquid assets ratio.

The three indices above take a static approach to corporate solvency. Any change thereto can also be traced from the report(s), though we should also note that bankruptcy models are based on operating enterprises or, in other words, continually operating units whose analysis requires a survey of the various dynamic liquidity indices, too. The best known among them are cash flow and total debt ratio [Bartha, Beavera, Landsmanb 2001].

Alongside indebtedness indices, capital adequacy represents a kind of capital structure index in the models, due to its hardly mobilized assets (potentially inc. stocks) to equity ratio.

The circulation velocity indices can help assess the activity of the company in using its assets. The circulation velocity of assets measures the efficiency of the total asset portfolio. The circulation velocity of stocks or of trade debtors indicates velocity in the chain of purchased and self-produced stocks and receivables from customers, respectively, and this latter can support the solvency of a company when realized as cash.

In the group of debt indices, the indebtedness index representing the gearing ratio and the net assets ratio are of fundamental importance. They do not define solvency, but still are an efficient index of indebtedness, through the payment ratio and the debt/equity ratio.

The coverage of fixed assets with long-term loans and of current assets with short-term loans is represented in an index that can accurately describe the property position and efficiently characterize balance among the relevant asset groups.

For the description of profitability, the well-proven ROS (return on sales) and ROE (return on equity) indices represent profitability and the ownership approach, respectively.

Researchers use various corrections in building the models. They correct with the sector-specific rates [Virág, Kristóf 2006; Platt, Platt 1990], manage zero and negative dividers and replace any unknown variables with mean values [Jacobs 2000]. But what guarantees the accuracy of the known variables and the reliability of the classification made with them?

Table 1. Indices of financial statements

Type of index	Name of index	Calculation method
Profitability	Return on equity (ROE)	Profit/loss after tax/average Equity
	Return on assets (ROA)	Profit/loss after tax/average balance sheet footing
	Return on sales (ROS)	Operating profit/loss /net sales revenue
	EBITDA on sales	(Operating profit/loss + amortization)/net sales revenue
Circulation velocity	Sales revenue on assets	Net sales revenue/(average balance sheet footing/365)
	Circulation velocity of stocks	Net sales revenue /(average inventory/365)
	Trade debtors' circulation velocity	Net sales revenue/(average trade debtors/365)
Indebtedness	Equity ratio	Equity capital/balance sheet footing
	Long-term indebtedness	Long-term liabilities
	Self-financed fixed assets	Equity capital/fixed assets
	Indebtedness ratio	Liabilities/balance sheet footing
	Debt/equity ratio	Liabilities/equity capital
Capital structure	External funded fixed assets	Long-term liabilities/fixed assets
	Capital adequacy	(Fixed assets + stocks)/equity capital
	Current assets ratio	Current assets/balance sheet footing
	Liquid assets ratio	(Liquid assets + securities)/current assets
	Net current assets ratio	(Current assets – short-term liabilities)/balance sheet footing
Liquidity	Liquidity ratio	Current assets/short-term liabilities
	Acid test ratio	(Current assets – stocks)/short-term liabilities
	Cash ratio	(Liquid assets + securities)/short-term liabilities
	Dynamic liquidity	Trading profit/loss/short-term liabilities
	Trade debtors/creditors ratio	Trade debtors/trade creditors
Cash Flow	Dynamic profitability ratio	(Profit/loss after tax + depreciation)/average balance sheet footing
	Cash flow/total debt	
	Cash flow/net sales	
Growth	Sales revenue growth rate	
	Operating profit/loss growth rate	
	Profit/loss after tax growth rate	

Source: own elaboration based on Virág, Nyitrai [2014].

4. The impact of the Hungarian regulatory environment on the content and adaptability of the reports

Here and now, we will naturally assess the reliability of reports (that comply with the statutory requirements and fulfil the definitions of reliable and realistic as per the Accounting Act) in terms of bankruptcy prediction.

My aim was to present that the rearrangement of a financial statement is required for the models to show reliable results. My research based on the sample of the announcement of Hungarian financial statements [Czupy 2014].

Any researcher intending to analyse the interpretation of bankruptcy predictive models in Hungary will face a major obstacle in the very first step. Considering the reports published in the past few years, just 4–6% of them has the form of an annual report, whereas the rest are simplified annual reports.

Table 2. The balance sheet of the simplified annual report comes with the following lines

A. Fixed Assets	D. Equity
I. INTANGIBLE ASSETS	I. SUBSCRIBED CAPITAL
Inc. Revaluation of Intangible Assets	Inc. owners' share repurchased at nominal value
II. TANGIBLE ASSETS	II. SUBSCRIBED BUT UNPAID CAPITAL (-)
Inc. Revaluation of Tangible Assets	III. CAPITAL RESERVE
III. FINANCIAL INVESTMENTS	IV. PROFIT RESERVE
Inc. Revaluation of Financial Investments	V. TIED-UP RESERVE
B. Current Assets	VI. REVALUATION RESERVE
I. STOCKS	VII. BALANCE SHEET PROFIT/LOSS
II. RECEIVABLES	E. Provisions
III. SECURITIES	F. Liabilities
IV. LIQUID ASSETS	I. SUBORDINATED LIABILITIES
	II. LONG-TERM LIABILITIES
	III. SHORT-TERM LIABILITIES
C. Prepayments and Accrued Income G	G. Accruals and Deferred Income
TOTAL ASSETS	TOTAL SOURCES OF FUNDS

Source: own elaboration.

The breakdown of stocks, receivables and short-term liabilities cannot be detailed from the lines of the simplified annual report, and the cash flow statement is not a compulsory element in the supplement of the report.

Any change in the liquid assets portfolio of an enterprise can be established even without a cash flow statement. But this is not the main message. The analyst also likes to know its internal structure; the important factor is not the end result but

the relationship of the components to one another and to the end result [Veit 2005]. Without the operating cash flow no answer can be given to the following questions:

- Is the enterprise capable of making a positive cash flow?
- Does it have enough free internal funds to finance the investments?
- Is it creditworthy?
- Did it have any financial income with no profit in the accounting year?
- Did it have any expenditures with no monetary movement?
- Is it capable of unblocking its liquid assets tied in its stocks and receivables?

Such and similar questions can be answered in the knowledge of the operating, investment and financial cash flow values produced by the enterprise [Veit 2005].

I will hereinafter emphasize neither the deficiencies of the simplified annual report, nor the difference among the valuation bases (although this latter can likewise significantly influence the classification result), but will present the factors whereby the presentation criteria of the annual report can modify the predictive capability of the models.

What presentation criteria might call for modifications?

1. Receivables from affiliated companies
 - Trade debtor or other receivable? The trade debtors' circulation and liquidity term cannot be established accurately in lack of adequate sorting.
2. Subordinated liabilities
 - Based on content, they could reasonably be managed as a part of equity and not as liability.
3. Long-term liabilities
 - The instalment due after long-term loans, credits and other debts in the subsequent period must be stated among short-term liabilities in the balance sheet, in accordance with the regulations. The proper presentation of capital structure and financing calls for re-sorting them.
4. Long-term liabilities to affiliated companies
 - Due to consolidation, the exact content of this item and its relationship with the part of this same liability due in the subsequent period (which is in fact stated among short-term liabilities) cannot be seen.
5. Short-term loans and short-term credits
 - If the instalment of an investment loan was also recategorized, this balance sheet line will not comprise the liquidity loans, so its size will be misleading.
6. Short-term liabilities to affiliated companies
 - If the instalment of some investment loan was also recategorized, this balance sheet line will not comprise the liquidity loans, so its size will be misleading.
7. Provisions
 - The time-span of any reserve reversing on the profit/loss side and accumulated for some future cost or liability supplies relevant information for profitability planning.

8. Prepayments and accrued income

- Some elements have receivables characteristics (incomes accrued), whereas others definitely influence profitability (costs and expenses prepaid; postponed expenditures), so its cumulated management or non-management leads to distortion.

9. Accruals and deferred income

- Similar to prepayments and accrued income, a distinction must be made between liability-type items (costs and expenses accrued) and incomes deferred or postponed incomes which influence profitability.

This kind of modification in the presentation criteria significantly influences the result of calculations [Czupy 2014].

During the research we proved that the rearranged financial statements' reliability was improved.

Modifications can be split into two big groups. The first one includes the financial elements where fewer assumptions need to be made for their content or where the sorting mode is clear-cut. Such are the provisions and, provided proper information is available from the supplement, the sortings relevant to receivables and liabilities. The elements of the second group include accruals and deferrals. Several combinations could be reasonable in sorting them, but coming up with two solutions might be satisfactory now:

1. Accruals and deferrals modify the profit/loss figure only. The balance sheet profit/loss figure changes but will better resemble actual cash flow. The principle of matching is contravened here, though the fact that the going concern principle is basically queried when close to bankruptcy can reason its waiver. The influence of funds can be valued over profit in a nearly bankrupt enterprise, and no cash flow statement is available.

2. When sorting by actual accounting content and peculiarities, some of the accruals and deferrals influence a specific line in the balance sheet (i.e. receivable or liability) and another part influences the profit/loss figure (income, cost or expenditure).

The model based on the Hungarian accounting reports [Czupy 2014] made the following transformations, in addition to the above sortings, in the balance sheets and the profit and loss statements:

3. Securities and liquid assets are stated in a cumulated form. The reason for this action is that companies tend to approximate their indices to the sector-specific average, so the market considers them a desirable value. In the meanwhile, their value is presumed to refer to balanced operation. If the acid test ratio of an average company registered in Hungary is higher than that of a bankrupt average company, the latter can attempt to have liquid securities beside its liquid assets.

4. The accumulation and release of accruals and deferrals modifies the profit of the business association in the specific business year. Although they need to be accumulated and then reversed in a number of cases, they modified the balance sheet and the profit and loss statement after some typical events, in accordance with Articles 32–33 and Articles 44–45 of the Accounting Act.

The model set up could not consider the information potentially available from the cash flow, even so it proved that the accounting figures with no transformation did not prove reliable for classification, the results were overridden by the reconsideration of the presentation criteria.

5. Conclusion

The study was aimed at drawing attention to the importance of input data for analysis procedures applying mathematical-statistical methods. Accounting reports are basically expected to give a reliable and realistic picture of the business association; still, the information from the report will only be “half information” without any knowledge of the regulatory system. If we do not know the bases of assessment and are not aware of the presentation criteria, we cannot draw proper conclusions.

In addition to the priority of input data, we should not forget that the data series of a report always provide a facility for the developers of the models, the analysts and the users of the analysis data. The presented financial and income elements do not show the actual content and potential falsity of the underlying economic events. Consequently, they cannot be reproached about the near-bankruptcy status and insolvency of business associations that have deliberately been concealing the anomalies in their economic management.

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