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Article

Enterprise Profitability and Financial Evaluation Model Based on Statistical Modeling: Taking Tencent Music as an Example

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Abstract: In today’s diversified development model, the combination of modeling and business decision development is particularly important. The advanced theoretical business model established by modeling enables more efficient and accurate financial analysis. In the original enterprise profit evaluation model, the DuPont analysis method cannot take into account the development capability of the enterprise very well. This article takes Tencent Music as an example, and improves it on the basis of DuPont analysis. The Enterprise Capital Profit Model was proposed. At the same time, the LASSO regression based on cluster analysis is used to screen, analyze, and diagnose the financial data of Tencent Music in recent years, which verifies the validity and feasibility of the model. This paper uses the report data combined with statistical modeling to optimize the traditional financial evaluation method of enterprises, better find problems, and provide a reference for future development.

Keywords: enterprise financial evaluation; financial data application; mathematical statistical modeling; theoretical model analysis

MSC: 62-08

1. Introduction

With the entry into the digital age [1], the scale and growth rate of China’s music industry have been in a steady growth trend [2]. The emergence of cutting-edge technologies such as 5G [3] and the integration and development of online music [4] have spawned new development momentum for the development of the music industry and provided strong technical support [5]. Judging from the current development situation, China is the world’s largest online music platform market [6]. Although the user penetration rate and penetration rate have not reached a relatively ideal number, in the future development, China’s music industry still has a broad market and great development potential.

In the current international market environment, Tencent Music ranks fourth in the world with a market share of 8%, becoming the first Chinese music platform in China to rank at the forefront of the world, and a well-deserved leader in China’s online music platform [7]. Among the current online music platforms in China, the top four are Kugou Music [8], QQ Music [9], Kuwo Music [10], and NetEase Cloud Music [11]. Among them, Kugou Music has a market share of about 50.2%, QQ Music has a market share of 21%, and Kuwo Music has a market share of about 13.1%. All three belong to Tencent Music’s brands and products, and the combined market share of the three has exceeded 80%.
Tencent Music Entertainment Group covers a wide range of business types, provides more diverse music services, and has a broad mass base. It is currently the largest Internet music company in China. Tencent Music has been listed successfully in the United States, and its financial data are open and transparent. The audited financial report is also comprehensive, and its financial analysis is representative to a certain extent. Therefore, this paper takes Tencent Music as an example to carry out the analysis.

The COVID-19 pandemic has brought to the forefront the factors that could create financial risk, as shown in Figure 1. At present, Xiami Music has officially announced its closure, and other music platforms are also facing huge competitive pressure. However, Tencent Music went public in the United States on 12 December 2018 [12]. In just two years, its share price has doubled and achieved outstanding performance, which has attracted widespread attention from global music platforms. In the case that the development prospects of other music platforms are not optimistic, Tencent Music Online Platform can still show a steady development trend as a leader. Its development model and financial situation have research value and significance; for the development of major music companies and others, the development of the industry also has reference significance.

Figure 1. The current economic situation will lead to the kinds of financial risk.

This paper first introduces the development of Tencent Music Entertainment Group according to the analysis of financial data indicators. Taking Tencent Music as an example, on the basis of existing research, a set of company profit models and financial evaluation systems based on computational modeling is creatively proposed. This system adopts the cluster analysis method [13], Lasso regression method [14], and DuPont financial analysis method combined system integration analysis and evaluation system. Then, the financial data of Tencent Music from recent years are analyzed by the integrated evaluation system proposed in this paper. Combined with its current development advantages and existing problems, we put forward effective optimization and improvement strategies.

The structure of this paper is arranged as follows: In the Related Work section, the relevant research results on the integrated evaluation system are summarized and sorted out. In the Methods and Materials, the principle and data processing of the integrated analysis and evaluation system are presented. In the Results, the results of Tencent’s online music platform are explained. In the Discussion, the development, development direction, and prospects of Tencent Music and the industry are prospected. We help the sustainable and healthy development of corporate finance, stimulate the development potential of the industry, and expand the development space of the industry.
2. Relative Work

There are relatively few studies on the development of the music industry in the existing research. Most of these studies are mainly based on financial indicators and only analyze the solvency, profitability, operating capacity, and development capacity of the company according to the company’s balance sheet, income statement, and cash flow statement [15].

2.1. Analysis of Financial Statements

The concept of financial statement analysis originated in the United States at the end of the 19th century and the beginning of the 20th century [16]. At first, in order to ensure the safety of loans and the healthy development of credit business, banks conducted credit analysis on enterprises so as to timely understand the status quo of enterprise development. Later, with the continuous development of society, financial statement analysis began to be applied in various fields and aspects.

DuPont analysis method was proposed and first adopted by the manager of the DuPont Finance Company in 1919 [17]. It is a method to analyze and evaluate the financial status and economic benefits of an enterprise by using various main financial ratios and internal relations among indicators.

In 1978, Walter B. Goth believed that financial analysis could be summarized in the following three steps [18]: First, select the financial information provided by the enterprise to facilitate decision-making. Second, integrate the selected information to understand the internal relationship between financial information. Third, conduct in-depth research on various financial information and understand the financial results reflected behind the information through information integration [19].

In 1996, Hopkins Patrick E believed that the analysis of financial statements should not only rely on the data in the statements but should comprehensively consider the potential impact of environmental factors outside the enterprise on the future development of the enterprise [20]. The analysis of the report should also pay more attention to the business model [21] adopted by the enterprise and the competitive strategy of the enterprise. In this way, more accurate analysis conclusions can be drawn, and then the accuracy of business decisions can be truly helped by business managers [22].

In 2001, John J. Wild, Leopold A. Bernstein, and K.R. Subramanyam pointed out that the analysis of financial statements should start from a strategic point of view [23]. Combining financial statement analysis with enterprises and applying the theory of financial management to practice can reflect the integrity of financial analysis [24].

In 2003, Leopold A. Ber Steph and John J. Wild further enriched the structure of financial analysis [25]. The financial analysis structure proposed this time included six parts, which are mainly aimed at the solvency analysis and profitability analysis in the financial ratio analysis. It further explained how the company should conduct financial analysis [26].

In 2014, Clyde P. Stockney pointed out that financial analysis methods can not only be limited to financial data analysis; accounting analysis is also conducive to discovering the current situation of enterprises [27].

In 2019, Dorisz Taws and Andrea Rozsa established a new field of analysis in financial statement analysis by analyzing the profitability, solvency, and financial competitiveness of enterprises [28].

2.2. Profit Model

The profit model is an important basis for analyzing enterprise management. As early as 1939, Joseph began to study the profit model [29]. In 1985, the concept of “value chain” was put forward, and Micheal confirmed that the value chain was the core part for enterprises to achieve profitability [30]. From the perspective of value transmission, Teece discussed the impact of value transmission on profitability through internal resource allocation [31].
Entering the 21st century, a relatively complete profit model theory [32] was proposed by Adrian. They believe that differences in industry profits lead to differences in profit models and conduct systematic analysis and elaboration. In 2005, Michael, Morris, and others proposed the main components of the profit model, which are divided into product, environment, strategy, and other elements [33].

2.3. Financial Risk and Diagnosis

The purpose of the financial diagnosis is to find out the risks and problems in the financial aspects of the enterprise [34] and propose corresponding improvement measures. Different scholars have different perceptions of financial risk [35]. Ross et al. defined financial risk as the risk of corporate liabilities [36]. Christopher J. Clarke explored the ongoing inquiry from the perspective of external environmental changes and time [37]. Financial risk is defined as one of the indicators to measure many potential financial changes [38]. In addition, Beaver began to use univariate models to predict financial risks and formed a complete univariate model [39]. Edward Altman used the multivariate financial risk prediction model to score risks from five financial perspectives and further improved the evaluation model of financial risks [40]. In 2021, J. Pospíšil et al. proposed a prediction model for financial risk, which has become a powerful research tool for economic behavior theory [41].

3. Materials and Methods

3.1. Financial Data Preprocessing

The data used in this paper are mainly from the balance sheet, income statement, and cash flow statement of Tencent Music in the past three years. The data of financial statements are used to calculate the short-term debt-paying ability, long-term debt-paying ability, operation ability, profitability, and development ability reflecting the financial situation of the enterprise. Different categories of competencies focus on reflecting different content. The comprehensive presentation of specific index values under these capabilities enables people to have a relatively macro grasp of the actual situation of the enterprise.

The primary selection of financial indicators is based on financial ratios that are widely applicable to various industries. In the process of measuring the relevant indicators of the four capabilities of the enterprise, we have conducted a relevant analysis of the capital structure of the enterprise and the cash flow generated from operating activities. We considered the importance of Brusov–Filatova–Orekhova Theory (BFO Theory) and Modigliani–Miller Theory (MM Theory) in the rating [42]. The BFO theory believes that for companies with limited lifespans, the time factor is included in the discussion scope, and the discount of capital flow is introduced and applied to the rating. MM theory holds that, under the three assumptions of a perfect market, rational behavior, and complete certainty, dividend policy has no effect on company value, and company value actually depends on its investment policy and profitability. Coverage and leverage are for liabilities and can be used to measure financial risk [43–45]. In this paper, we represent the debt coverage ratio and financial leverage ratio by using the gearing ratio indicator of long-term solvency. Combined with the specific situation and current situation of Tencent’s music industry, 19 related financial indicators were selected that can better reflect short-term solvency, long-term solvency, operating capacity, profitability, and development capacity. Through the calculation formula in Table 1, the amount of relevant indicators in the three years from 2018 to 2020 is obtained. Indicators and data are listed in Table 1. The processing and analysis of the model [46] described in this paper will be expanded based on Table 1.
### Table 1. Primary selection sample of financial indicators.

<table>
<thead>
<tr>
<th>Categories of Abilities</th>
<th>Code</th>
<th>Related Indicators</th>
<th>Calculation Formula</th>
<th>2018Y</th>
<th>2019Y</th>
<th>2020Y</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Short-term solvency</strong></td>
<td>K1</td>
<td>Current ratio</td>
<td>Current Assets/Current Liabilities</td>
<td>3.19</td>
<td>2.84</td>
<td>3.31</td>
</tr>
<tr>
<td></td>
<td>K2</td>
<td>Quick ratio</td>
<td>Quick assets/Current liabilities</td>
<td>3.19</td>
<td>3.16</td>
<td>3.30</td>
</tr>
<tr>
<td></td>
<td>K3</td>
<td>Cash flow ratio</td>
<td>Net cash flow from operating activities/Current liabilities</td>
<td>0.90</td>
<td>0.73</td>
<td>0.56</td>
</tr>
<tr>
<td><strong>Long-term solvency</strong></td>
<td>K4</td>
<td>Asset-liability ratio</td>
<td>Total Liabilities/Total Assets</td>
<td>0.15</td>
<td>0.17</td>
<td>0.23</td>
</tr>
<tr>
<td></td>
<td>K5</td>
<td>Debt coverage ratio</td>
<td>Total liabilities/Net cash flow from operating activities</td>
<td>1.17</td>
<td>1.43</td>
<td>2.85</td>
</tr>
<tr>
<td></td>
<td>K6</td>
<td>Shareholders’ Equity Ratio</td>
<td>Total Shareholders’ Equity/Total Assets</td>
<td>0.85</td>
<td>0.83</td>
<td>0.77</td>
</tr>
<tr>
<td></td>
<td>K7</td>
<td>Financial Leverage</td>
<td>Total assets/Total shareholders’ equity</td>
<td>1.18</td>
<td>1.21</td>
<td>1.29</td>
</tr>
<tr>
<td></td>
<td>K8</td>
<td>Property right ratio</td>
<td>Total liabilities/Total shareholders’ equity</td>
<td>0.18</td>
<td>0.21</td>
<td>0.29</td>
</tr>
<tr>
<td><strong>Operating capacity</strong></td>
<td>K9</td>
<td>Interest coverage ratios</td>
<td>EBIT/Interest charges</td>
<td>-2416.27</td>
<td>71.26</td>
<td>46.57</td>
</tr>
<tr>
<td></td>
<td>K10</td>
<td>Accounts receivable turnover (times)</td>
<td>Operating Income/Average Accounts Receivable Balance</td>
<td>13.28</td>
<td>12.76</td>
<td>10.53</td>
</tr>
<tr>
<td></td>
<td>K11</td>
<td>Inventory turnover rate (times)</td>
<td>Operating cost/Average inventory balance</td>
<td>372.19</td>
<td>556.49</td>
<td>897.15</td>
</tr>
<tr>
<td></td>
<td>K12</td>
<td>Current asset turnover rate (times)</td>
<td>Operating Income / Average Balance of Current Assets</td>
<td>1.37</td>
<td>1.06</td>
<td>0.96</td>
</tr>
<tr>
<td></td>
<td>K13</td>
<td>Asset turnover rate (times)</td>
<td>Operating Income/Total Average Assets</td>
<td>0.44</td>
<td>0.52</td>
<td>0.47</td>
</tr>
<tr>
<td></td>
<td>K14</td>
<td>Accounts payable turnover ratio(times)</td>
<td>Operating Cost/Average Accounts Payable</td>
<td>33.76</td>
<td>49.14</td>
<td>32.69</td>
</tr>
<tr>
<td><strong>Profitability</strong></td>
<td>K15</td>
<td>Net interest rate of assets</td>
<td>Net Profit/Average Total Assets</td>
<td>0.04</td>
<td>0.08</td>
<td>0.07</td>
</tr>
<tr>
<td></td>
<td>K16</td>
<td>Return on Shareholders’ Equity</td>
<td>Net profit/Average total shareholders’ equity</td>
<td>0.06</td>
<td>0.10</td>
<td>0.08</td>
</tr>
<tr>
<td></td>
<td>K17</td>
<td>Gross profit margin on sales</td>
<td>Gross sales/Operating income</td>
<td>0.37</td>
<td>0.33</td>
<td>0.31</td>
</tr>
<tr>
<td></td>
<td>K18</td>
<td>Net profit margin on sales</td>
<td>Net profit/Operating income</td>
<td>0.10</td>
<td>0.16</td>
<td>0.14</td>
</tr>
<tr>
<td><strong>Development capacity</strong></td>
<td>K19</td>
<td>Sales growth rate</td>
<td>Current year’s revenue growth/last year’s total revenue</td>
<td>0.77</td>
<td>0.28</td>
<td>0.15</td>
</tr>
<tr>
<td></td>
<td>K20</td>
<td>Growth rate of assets</td>
<td>Total asset growth of the year/total assets at the beginning of the year</td>
<td>0.01</td>
<td>0.16</td>
<td>0.38</td>
</tr>
<tr>
<td></td>
<td>K21</td>
<td>Equity capital growth rate</td>
<td>Increase in equity this year/total equity at the beginning of the year</td>
<td>0.37</td>
<td>0.14</td>
<td>0.29</td>
</tr>
</tbody>
</table>
3.2. Cluster Analysis

The indicators under the capability category in Table 1 inevitably have similarities and repetitions in reflecting the content. Moreover, the redundant indicators not only increase the difficulty of the work of the relevant staff, but also make the results of the analysis appear scattered. Therefore, we used the cluster analysis model to simplify the processing of indicators.

Similar indicators were screened out by the clustering analysis method, and the principle of substitutability was followed in combination with the actual situation and industry characteristics of enterprises. Similar indicators were deleted to enhance the effectiveness and accuracy of financial analysis.

3.2.1. Applications of System Clustering

This paper adopts the method of systematic clustering. The above operations can simplify the complexity of indicators and enhance the effectiveness of indicators by screening out indicators with strong similarities and reserving more representative indicators. At the same time, the data foundation was laid out for the next step of the Lasso regression analysis.

We used IBM SPSS Statistics 25 software. The ability categories in Table 1 and the calculated three-year calculation results were imported into SPSS as data, and systematic cluster analysis was used. The data from 2018 to 2020 were used as variables, the specific indicators were used as the basis for case labeling, and the clustering method of the nearest neighbor element and the measurement interval of Chebyshev were selected. Since the units of the indicators are different, Z scores were selected for standardization, and the option by case was selected. Finally, the dendrogram shown in Figure 2 was generated.

![Figure 2. Cluster analysis lineage diagram.](image)

3.2.2. Clustering Results and Analysis

As shown in Figure 1, the Financial Leverage (K7), property right ratio (K8), asset-liability ratio (K4), current asset turnover ratio (K12), and sales growth rate (K19) began to converge first. After that, the Financial Leverage (K7), property right ratio (K8), asset-liability ratio (K4), and debt coverage ratio (K5) were aggregated. Inventory turnover rate (K11) and growth rate of assets (K20) were aggregated, as were net interest rate of
assets (K15) and return on shareholders’ equity (K16); shareholders’ equity ratio (K6) and accounts receivable turnover (K10); and current asset turnover (K12) rate and sales growth rate (K19). After that, various indicators continued to merge.

According to the aggregation results, the 19 indexes were divided into 12 categories. Financial Leverage (K7), property right ratio (K8), asset-liability ratio (K4), and debt coverage ratio (K5) were the first category. Because these four indicators all reflect long-term debt capacity and have excessive overlap, they were deleted. Since Financial Leverage (K7) can reflect the return on equity of shareholders of a company and can positively stimulate stock value, property right ratio (K8), and asset-liability ratio (K4) were excluded from K7, K8, and K4. In addition, the aggregation time of the debt coverage ratio (K5) was later than that of K7, K8, and K4, indicating that there are some differences between K5 and K7, K8 and K4, so the index of debt coverage ratio (K5) was selected.

Inventory turnover rate (K11) and growth rate of assets (K20) were the second major categories. Inventory turnover rate (K11) is an indicator of operating capacity, while the growth rate of assets (K20) is an indicator of development capacity. At present, the music industry adopts the mode of copyright payment and requires less inventory. Focusing on the future development of ongoing concern is also more consistent with the basic assumptions of accounting. Therefore, the growth rate of assets (K20) can better reflect the ability of enterprises to continue operations. Therefore, we decided to exclude the inventory turnover rate (K11) and select the growth rate of retained assets (K20).

Net interest rate of assets (K15) and return on shareholders’ equity (K16) were the third major category. Both the net interest rate of assets (K15) and the return on shareholders’ equity (K16) are indicators of profitability, both of which can reflect the ability of an enterprise to obtain profits, so one can be selected for retention. Since the DuPont analysis method was used to calculate the return on shareholder equity index after dismantling, we chose to filter out the return on shareholder equity (K16) index and retain the net interest rate of assets (K15) index.

Shareholder’s equity ratio (K6) and accounts receivable turnover (K10) as the fourth category. Stockholders’ equity ratio (K6) and accounts receivable turnover ratio (K10) are both indicators of long-term debt-paying ability, which can reflect an enterprise’s ability to bear debt and guarantee debt repayment to a certain extent, with repeatability. Because stockholders’ equity ratio (K6) is the reciprocal of Financial Leverage (K7), both can be used to measure financial risk and are substitutable. However, we chose to keep the index of Financial Leverage (K7) above. Therefore, after comparing the ratio of shareholders’ equity (K6) and accounts receivable turnover (K10), we decided to eliminate the index of shareholders’ equity ratio (K6) and leave the index of accounts receivable turnover (K10).

Current asset turnover rate (K12) and sales growth rate (K19) were the fifth category. The current asset turnover rate (K12) is an indicator of operating capacity, while sales growth rate (K19) is an indicator of development capacity. As the indicator of development capacity was selected in the comparison above, the indicator of operation capacity was selected based on the requirements of comprehensiveness. Therefore, we decided to exclude sales growth rate (K19) and current asset turnover rate (K12) indicators.

Due to the late clustering time of the other indicators, they were respectively taken as their own categories.

Through the above analysis, we selected current ratio (K1), quick ratio (K2), cash flow ratio (K3), debt coverage ratio (K5), Financial Leverage (K7), interest coverage ratio (K9), accounts receivable turnover ratio (K10), current asset turnover ratio (K12), asset turnover ratio (K13), accounts payable turnover ratio (K14), net interest rate of assets (K15), gross profit margin on sales (K17), net profit margin on sales (K18), growth rate of assets (K20), and equity capital growth rate (K21) as representative financial indicators, as shown in Table 2.
Table 2. System analysis screening results.

<table>
<thead>
<tr>
<th>Categories of Abilities</th>
<th>Code</th>
<th>2018Y</th>
<th>2019Y</th>
<th>2020Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short-term solvency</td>
<td>K1</td>
<td>3.19</td>
<td>2.84</td>
<td>3.31</td>
</tr>
<tr>
<td></td>
<td>K2</td>
<td>3.19</td>
<td>3.16</td>
<td>3.30</td>
</tr>
<tr>
<td></td>
<td>K3</td>
<td>0.90</td>
<td>0.73</td>
<td>0.56</td>
</tr>
<tr>
<td>Long-term solvency</td>
<td>K5</td>
<td>1.17</td>
<td>1.43</td>
<td>2.85</td>
</tr>
<tr>
<td></td>
<td>K7</td>
<td>1.18</td>
<td>1.21</td>
<td>1.29</td>
</tr>
<tr>
<td></td>
<td>K9</td>
<td>−2416.27</td>
<td>71.26</td>
<td>46.57</td>
</tr>
<tr>
<td>Operating capacity</td>
<td>K10</td>
<td>13.28</td>
<td>12.76</td>
<td>10.53</td>
</tr>
<tr>
<td></td>
<td>K12</td>
<td>1.37</td>
<td>1.06</td>
<td>0.96</td>
</tr>
<tr>
<td></td>
<td>K13</td>
<td>0.44</td>
<td>0.52</td>
<td>0.47</td>
</tr>
<tr>
<td></td>
<td>K14</td>
<td>33.76</td>
<td>49.14</td>
<td>32.69</td>
</tr>
<tr>
<td>Profitability</td>
<td>K15</td>
<td>0.04</td>
<td>0.08</td>
<td>0.07</td>
</tr>
<tr>
<td></td>
<td>K17</td>
<td>0.37</td>
<td>0.33</td>
<td>0.31</td>
</tr>
<tr>
<td></td>
<td>K18</td>
<td>0.10</td>
<td>0.16</td>
<td>0.14</td>
</tr>
<tr>
<td>Development capacity</td>
<td>K20</td>
<td>0.01</td>
<td>0.16</td>
<td>0.38</td>
</tr>
<tr>
<td></td>
<td>K21</td>
<td>0.37</td>
<td>0.14</td>
<td>0.29</td>
</tr>
</tbody>
</table>

3.3. Lasso Regression Analysis

Serious multicollinearity may exist because the sample size of regression exceeds the number of variables in the indicators and data results screened after cluster analysis. Therefore, we used a Lasso regression model to select variables and identify and judge the correlation between variables. Indicators with high correlation were generally considered to be relevant substitutes, so we retained indicators with low correlation and removed indicators with high correlation. In this way, multicollinearity between variables is removed, thereby reducing dimensionality.

The Lasso regression model was proposed by Robert Tibshirani in 1996 [47]. Lasso regression adds penalty terms composed of regression coefficient functions to the loss function of the OLS regression model [48]. By compressing regression coefficients of unimportant variables to 0, unimportant indicators were identified and screened out to achieve simplification. The expression of Lasso regression [49] is shown in Formula (1):

\[
\hat{\beta} = \arg\min_{\beta} \left[ \sum_{i=1}^{n} (y_i - x_i' \beta)^2 + \lambda \sum_{i=1}^{k} |\beta_i| \right]
\]  

We used StataSE 15 software to implement Lasso regression by performing k-fold cross-validation with the cvlasso subcommand under the lassopack command. Here, k-fold cross-validation was used. Using the data in Table 2, the current ratio (K1) was reserved as the validation set, and the remaining evaluation indicators were used as the training set to estimate the model to calculate the mean squared prediction error [50] of the current ratio (K1). Then, the quick ratio (K2) was used as the remaining evaluation indicators of the validation set as the training set to calculate the mean squared prediction error of the quick ratio (K2). By analogy, the indicators in Table 2 show the respective mean squared prediction errors, and the parameters were adjusted after summing up so that the model could exert the best prediction ability.

We imported the Table 2 data into Stata. Due to the dimensionality of the independent variable, the standardized treatment was carried out (the K indicator is converted into the standardized F indicator). Lasso regression was performed on the data in Table 2, and the results were summarized. \( \lambda \), which obtained the least MSPE, was found to be the minimum adjustment parameter for MSPE, as shown in Table 3.

According to the Lasso regression model, indexes with non-zero coefficients were screened out as more representative indexes.
When using the current ratio (F1) as a validation set, F2, F3, F5, F7, F9, F11, F12, F13, F15, F16, F18, and F19 as the training set, the indicators with non-zero coefficient of this variable were F2 and F12. We then used F2 as a validation set, the rest as training sets, and so on. (Since F2, F11, F15, and F16 were used as validation sets and did not screen out any representative indicators, we will not discuss them here.)

Table 3. Summary of Lasso regression data results.

<table>
<thead>
<tr>
<th>Index</th>
<th>Lambda</th>
<th>MSPE</th>
<th>st. dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>3.4838</td>
<td>0.9598</td>
<td>0.4433</td>
</tr>
<tr>
<td>F2</td>
<td>3.4975</td>
<td>1.2089</td>
<td>0.4082</td>
</tr>
<tr>
<td>F3</td>
<td>4.4454</td>
<td>1.5047</td>
<td>0.3514</td>
</tr>
<tr>
<td>F5</td>
<td>4.0649</td>
<td>1.4062</td>
<td>0.4002</td>
</tr>
<tr>
<td>F7</td>
<td>4.4612</td>
<td>1.4410</td>
<td>0.3765</td>
</tr>
<tr>
<td>F9</td>
<td>4.0649</td>
<td>1.4243</td>
<td>0.3938</td>
</tr>
<tr>
<td>F11</td>
<td>4.8624</td>
<td>1.4302</td>
<td>0.3817</td>
</tr>
<tr>
<td>F12</td>
<td>1.9288</td>
<td>1.3186</td>
<td>0.3679</td>
</tr>
<tr>
<td>F13</td>
<td>4.4008</td>
<td>1.4837</td>
<td>0.3610</td>
</tr>
<tr>
<td>F15</td>
<td>4.8624</td>
<td>1.4764</td>
<td>0.3641</td>
</tr>
<tr>
<td>F16</td>
<td>4.8299</td>
<td>1.4320</td>
<td>0.3805</td>
</tr>
<tr>
<td>F18</td>
<td>4.4454</td>
<td>1.4905</td>
<td>0.3579</td>
</tr>
<tr>
<td>F19</td>
<td>2.3232</td>
<td>1.3704</td>
<td>0.3561</td>
</tr>
</tbody>
</table>

The results of the Lasso regression estimation are shown in Table 4. Column 2 of Table 4 is the Lasso estimated variable coefficients, and column 3 reports the results of the post-Lasso estimators.

Table 4. Preliminary results of Lasso regression estimation.

<table>
<thead>
<tr>
<th>Validation Set</th>
<th>Selected</th>
<th>Lasso</th>
<th>Post-Est OLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>F2</td>
<td>0.0510</td>
<td>0.5613</td>
</tr>
<tr>
<td>F3</td>
<td>F12</td>
<td>−0.1254</td>
<td>−0.6357</td>
</tr>
<tr>
<td>F5</td>
<td>F18</td>
<td>0.0885</td>
<td>−0.9959</td>
</tr>
<tr>
<td>F7</td>
<td>F9</td>
<td>−0.1697</td>
<td>−0.9994</td>
</tr>
<tr>
<td>F9</td>
<td>F7</td>
<td>−0.0843</td>
<td>−0.4996</td>
</tr>
<tr>
<td>F12</td>
<td>F19</td>
<td>−0.0405</td>
<td>−0.9982</td>
</tr>
<tr>
<td>F13</td>
<td>F16</td>
<td>0.0876</td>
<td>0.9859</td>
</tr>
<tr>
<td>F18</td>
<td>F3</td>
<td>−0.0885</td>
<td>−0.9959</td>
</tr>
<tr>
<td>F19</td>
<td>F12</td>
<td>−0.3240</td>
<td>−0.9982</td>
</tr>
</tbody>
</table>

After dimensionality reduction processing according to the Lasso regression model, the final selected indicators were K2, K3, K5, K7, K9, K12, K16, K18, and K19. The relevant data of each index are shown in Table 5.

Table 5. Summary of Lasso regression screening results.

<table>
<thead>
<tr>
<th>Categories of Abilities</th>
<th>Code</th>
<th>2018Y</th>
<th>2019Y</th>
<th>2020Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short-term solvency</td>
<td>K2</td>
<td>3.19</td>
<td>3.16</td>
<td>3.30</td>
</tr>
<tr>
<td></td>
<td>K3</td>
<td>0.90</td>
<td>0.73</td>
<td>0.56</td>
</tr>
<tr>
<td>Long-term solvency</td>
<td>K7</td>
<td>1.18</td>
<td>1.21</td>
<td>1.29</td>
</tr>
<tr>
<td>Operating capacity</td>
<td>K9</td>
<td>13.28</td>
<td>12.76</td>
<td>10.53</td>
</tr>
<tr>
<td></td>
<td>K12</td>
<td>0.44</td>
<td>0.52</td>
<td>0.47</td>
</tr>
<tr>
<td>Profitability</td>
<td>K16</td>
<td>0.10</td>
<td>0.16</td>
<td>0.14</td>
</tr>
<tr>
<td>Development capacity</td>
<td>K18</td>
<td>0.01</td>
<td>0.16</td>
<td>0.38</td>
</tr>
<tr>
<td></td>
<td>K19</td>
<td>0.37</td>
<td>0.14</td>
<td>0.29</td>
</tr>
</tbody>
</table>
4. Results

4.1. Analysis of Enterprise Solvency

The solvency of an enterprise refers to the ability to repay long-term and short-term liabilities with the assets of the enterprise. In Lasso regression, there are four indicators that represent the solvency of enterprises. These four indicators are quick ratio (K2), cash flow ratio (K3), debt coverage ratio (K5), and Financial Leverage (K7), which represent the short-term solvency of enterprises. This paper selects these four indicators to analyze the solvency of Tencent Music. The data of specific indicators are shown in Table 6.

Table 6. Selected indicators of solvency.

<table>
<thead>
<tr>
<th>Index</th>
<th>Code</th>
<th>2018Y</th>
<th>2019Y</th>
<th>2020Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quick ratio</td>
<td>K2</td>
<td>3.19</td>
<td>3.16</td>
<td>3.30</td>
</tr>
<tr>
<td>Cash flow ratio</td>
<td>K3</td>
<td>0.90</td>
<td>0.73</td>
<td>0.56</td>
</tr>
<tr>
<td>Financial</td>
<td>K7</td>
<td>1.18</td>
<td>1.21</td>
<td>1.29</td>
</tr>
<tr>
<td>Leverage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As can be seen from Table 6, Tencent Music has a higher quick ratio. The company occupies too much capital in quick assets, and the assets are more liquid and more secure. The main reason is that the company has increased cash flow by issuing stocks, stable cash flow, and a strong ability to repay short-term debt.

From the value of the cash flow ratio, the value of 2018 was the largest, and it will gradually decline in the next three years. The reason is mainly due to the reduction of net flow generated by operating activities after the company went public in 2018 for equity financing. Another reason may be the impact of the epidemic and paying high content usage fees. The capital structure still needs to be further optimized in terms of future cash flow.

Tencent Music’s Financial Leverage shows a trend of slow increase, especially the change between 2019 and 2020, which was more obvious. The Financial Leverage reflects the size of an enterprise’s financial leverage. The larger the Financial Leverage, the more debt the enterprise has, the greater the Financial Leverage ratio, and the greater the financial risk of the enterprise. From the current amount of Tencent Music company’s Financial Leverage, the company’s risk increased, but was still within the normal level. In addition, judging from the current development of the company, the company’s operation is in a period of continuous improvement, and the increase in Financial Leverage can be used to create more profits in the future.

From a comprehensive analysis, most indicators show an increasing trend, reflecting an optimistic state. Therefore, Tencent Music’s overall solvency was relatively good.

4.2. Analysis of Enterprise Operational Capability

The operating capacity of an enterprise refers to the ability of an enterprise to make a profit by using assets in the process of operation. At present, the accounts receivable turnover (K9) and assets turnover rate (K12) representing the operating capacity of enterprises were screened out in the Lasso regression. The following will be based on these two representative indicators for the Tencent Music operation capacity analysis.

As shown in Table 7, after the listing in 2018, the accounts receivable turnover ratio has been in a relatively stable state, but there is a downward trend. This shows that in a certain period, the average number of times the company’s accounts receivable are turned into cash decreased, the working capital stagnant in accounts receivable increased, and the turnover rate of corporate accounts receivable decreased, which is not conducive to the turnover of normal funds. Furthermore, solvency has a certain impact, but the overall impact was not large.
As shown in Table 7, in terms of asset turnover rate, the larger the turnover rate, the stronger the sales ability of the enterprise. From 0.44 in 2018 to 0.47 in 2020, it shows that the turnover of all assets from input to output during the enterprise operation period has accelerated, and it is in the stage of capital expansion. The operation efficiency and management quality of the total assets of the enterprise have improved, and the utilization efficiency of assets improved.

Comprehensive analysis shows that the operating capacity of the enterprise remained stable and was enhanced. In the future, internal management should be strengthened, and asset structure should be actively adjusted to improve operating efficiency.

4.3. Enterprise Profitability Analysis

Profitability is a measure of a company’s ability to earn profits. In Lasso regression, the net profit margin on sales (K16), which represents the profitability of enterprises, was screened out. This index can best reflect the ability of an enterprise to obtain sales revenue in a certain period. In terms of the value of net profit margin on sales, the net profit margin on sales was obviously improved and maintained in a good state, indicating that there is no problem with the current profit model. At present, Tencent Music is making adjustments to improve profitability so that the profitability of the enterprise is significantly improved, but the future profitability still needs to be constantly strengthened.

4.4. Analysis of Enterprise Development Capability

The development capacity of an enterprise refers to the potential capacity of an enterprise to continuously accumulate, expand, and develop its production and operation activities. The indexes that represent the development ability of enterprises screened out from Lasso regression include the growth rate of assets (K18) and equity capital growth rate (K19). As shown in Table 8, from 2018 to 2020, the growth rate of assets of Tencent Music increased rapidly, and the capital accumulation capacity and asset scale increased significantly. In 2020, Tencent Music’s growth rate of assets reached 38%. As for the growth rate of equity capital, from 2018 to 2020, it showed a trend of first decreasing and then increasing. The development of enterprises was also relatively optimistic. From these two aspects, it shows that the enterprise is still in the growth stage and maintaining good momentum of development and growth space. However, in the follow-up, development should also make a good plan to avoid blind expansion.

4.5. DuPont Financial Analysis

According to the representative data screened out in the Lasso regression, the need to reduce the cost of analysis is also taken into account. We used the unbundling framework of DuPont’s financial analysis [51] and the internal relationship between indicators representing various capabilities to conduct a comprehensive evaluation of the company’s financial status and economic benefits.

In the DuPont financial analysis method, the financial indicators were divided into three. The first separation was the separation of return on equity of shareholders. The
second spin-off was the return on total assets. The third was the separation of net profit and total assets. The principle and derivation process of the DuPont analysis method are in Figure 3.

![Figure 3. Derivation and composition of DuPont analysis.](image)

After the split, the return on shareholders’ equity was decomposed into three ratios representing three capabilities related to each other. These three ratios are, respectively, the net profit margin on sales representing the profitability of the enterprise, the total asset turnover rate representing the operating capacity of the enterprise, and the Financial Leverage representing the solvency of the enterprise. The return on shareholders’ equity after dismantling is equal to the product of the above three, as shown in Table 9. The disorganization and analysis of different capability indicators on behalf of enterprises can understand the current operating status and development status of enterprises and achieve the ultimate goal of maximizing shareholders’ equity through the business and financial strategies.

![Table 9. DuPont three factors disaggregation table of Tencent Music Company.](image)

The rate of return on shareholders’ equity is used to measure the efficiency of the company’s own capital, and it is the best standard to measure the company’s management performance and value-added ability. The standard for most investors to measure whether to invest in a listed company is whether the earnings per share will always maintain a sustained growth level, so the return on shareholders’ equity will be an important reference indicator.

As can be seen from Figure 4, from 2018 to 2020, the return on shareholders’ equity of Tencent Music increased from 5.07% to 9.88% and then decreased to 8.66%. On the whole, it presents an upward spiral trend, and its operation tends to be stable. It also speaks to Tencent Music’s overall financial position and improved profitability, and the company’s growing popularity with investors. The intrinsic value of enterprises is also constantly improving.

### 4.6. Enterprise Capital Profit Model

The DuPont analysis mentioned in the previous section does not include the influencing factors of enterprise development capability, but in the LASSO regression screening based on cluster analysis, it is concluded that enterprise development capability plays an indispensable role in evaluating the financial status of an enterprise.

From the indicators screened in Table 5, the growth rate of assets and equity capital growth rate can both characterize the development capability of an enterprise. From the observation in Figure 4, we find that among the mean squared prediction errors...
corresponding to the growth rate of assets and equity capital growth rate, the mean squared prediction error of K19 is smaller, indicating that equity capital growth rate is used to characterize the development capability of enterprises more accurately and more representatively. We choose equity capital growth rate as the characterization index of the enterprise development capability.

\[
\text{ECPG} = \text{FL} \times \text{AT} \times \text{NPM} \times \text{ECG}
\]

In the formula, FL stands for financial leverage, AT stands for asset turnover rate, NPM stands for net profit margin on sales, and ECG stands for equity capital growth rate. ECPG represents the output of equity capital profit growth, which is an indicator of enterprise profitability.

Through the analysis of the enterprise capital profit model, the three-year equity capital growth of Tencent Music is shown in Figure 5.

Comparing the trends of the curves in Figures 4 and 5 with Tencent Music’s financial statements, the change trend in Figure 5 was closer to the trend of Tencent Music’s actual profit change rate. Therefore, the use of Equity capital profit growth to measure corporate financial capability is more accurate and effective than the return on equity.

Therefore, the new method we propose is a more comprehensive measure of financial profitability than the DuPont analysis method.
5. Discussion

In view of the current research status, Tencent Music still has a lot of room for improvement and optimization strategies in future development.

In terms of financing, the combination of internal and external financing can be optimized to reduce the financing pressure on both sides [53]. Though financing is conducive to the normal operation of enterprises, further expanding the development of power provides sufficient financial support.

In terms of profitability, we will gradually implement the diversification of profit models and constantly seek new profit growth points [54]. The industry that Tencent Music operates belongs to the entertainment industry, and the competition pressure is relatively high. With the continuous development of communication technology, various new entertainment methods appear. Therefore, Tencent Music should improve the music entertainment industry chain, develop new businesses, and think about diversified profit models.

Tencent Music can also try to consider establishing new cross-field strategic alliances [55]. The development and improvement of the communication industry and the support of 5G technology can help Tencent Music develop a more intelligent music scene so that limited resources can obtain more development possibilities to achieve win-win development.

Based on the successful listing experience of Tencent Music, it also provides a reference for the development of other industries. Taking Tencent Music as an example, for other domestic industry platforms, the business model [56] proposed above can also be used for enterprise value evaluation [57] and financial analysis. This has very positive applicable value and significance.

The representative financial indicators screened by the mathematical model combined with clustering analysis and Lasso regression cover the indicators needed in the DuPont analysis system. However, the DuPont analysis system does not decompose the different activities of creating value in a deeper way. Therefore, the DuPont financial analysis has certain limitations in enterprises with various and complex financial activities. Other researchers can combine the new mathematical model with the new financial analysis system to further decompose the indicators representing different business capabilities of enterprises and pay more attention to the financial activities of enterprises so as to make the results of their analysis more comprehensive and detailed.

With the rapid development of the network, the era of big data is an irreversible trend. However, big data also has its inherent drawbacks. The collected big data is used as the original data for financial analysis. If there is a deviation in a certain link or the information reporting of a certain department is inaccurate, it will have an impact on the overall data analysis results.

In addition, due to data limitations, we currently only collect the exact three-year financial data of the company. However, our method can be applied not only to three years of data, but also to more data. We use Tencent Music’s three-year data to give an example and launch our proposed methods and conclusions. Moreover, since the financial data used is the financial data of the past three years, the time span is small, and the market environment and various social and economic factors have small changes, so the need for discounting is small, and this difference can almost be ignored. Therefore, we did not use discounting in our analysis.

Furthermore, R&D expenses as a percentage of sales are indeed an important expense ratio. However, due to limited data, only the overall R&D expenses of Tencent were listed in the original report data, while the R&D expenses of Tencent Music Group, a subsidiary of Tencent, were not listed separately. Therefore, we cannot obtain the exact amount of Tencent Music’s R&D expenses.

Finally, manipulation of financial statement earnings is primarily accomplished through fictitious earnings. Enterprises generally increase sales by fictitious economic business, falsely increase revenue, and falsely reduce expenses, so that the financial statements of the company show a higher profit situation. In the comparison with the data of previous
years and the analysis of real earnings management, we found that the indicators related to income did not show abnormal fluctuations. Moreover, the data in the financial statements of the enterprise conform to the correlation and logic of the data between the relevant indicators and conform to the regularity in the industry. Therefore, we think Tencent’s annual reports are free from manipulation of accounting numbers.

6. Conclusions

We propose and test our new method in Section 4.6. Through the comparative experiments in Figures 4 and 5, it can be proved that our proposed new method can measure financial profitability more comprehensively than the DuPont analysis method. Our proposed method uses cluster analysis and Lasso regression to screen and validate financial indicators, which form the derivation process of our proposed new model. At the same time, it also proves that the new model we propose takes into account the insufficiency of enterprise development capabilities and can better measure the multi-party development of enterprises.

Based on the above analysis, Tencent’s business is expanding and entering the mature stage, and its initial capital accumulation has reached a relatively mature level.

In terms of the solvency of enterprises, the capital structure of enterprises is also in the process of continuous optimization. Short-term solvency and long-term solvency are also relatively stable in the middle and low risk stage. Although cash flow from operating activities has slightly decreased, cash flow remains adequate and healthy.

In the aspect of enterprise operation capacity, the enterprise’s operation capacity remains stable and shows a trend of continuous enhancement. Especially after becoming a listed company, the business scope of Tencent Music has been further expanded, the music content has become more comprehensive and rich, the popularity of Tencent Music has increased, and the audience has also continued to increase. With the continuous enhancement of online users’ awareness of payment, the payment rate is also increasing year by year, which provides power for the operation of enterprises.

In terms of corporate profitability, with the expansion of business scope and the increasing number of payers, corporate profitability has maintained a good state. Profitability is not a problem, and there is a lot of room for improvement in the future.

In terms of enterprise development ability, Tencent Music shows a good momentum of development and is in the process of continuous development and expansion. Investors are also looking forward to the future development of Tencent Music. Tencent Music is also in the process of continuous innovation at present. With the help of the Online platform of the Internet [21], Tencent Music launches high-quality products that are more popular with people and creates ever-changing leisure and entertainment activities, constantly enhancing the role and significance of music in people’s life.

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