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The Discrimination Classification in the Listed Companies in Accordance with the Market Quality Indexes*

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Abstract: All listed companies in the Shanghai Stock Exchange in 2008 were ranked according to the total market capitalization, the revenue and the net profit. The top 100 listed companies and the countdown listed companies were selected. Then the random 100 listed companies were extracted. The two discrimination classification functions of the listed companies in accordance with the market quality indexes were established by the three types companies as categorical dependent variables and the price impacting index, the liquidity index, the large transaction costs and the excess volatility ratio as the independent variables that were selected among the 11 market quality indexes by the forward stepwise method. The accuracy rate of the discrimination classification functions of the listed companies was 77.74% through verifying by the original back substitution. The classification results were significant.

Key words: The price impacting index; The liquidity index; The large transaction costs; The excess volatility ratio; The discrimination classification function

1. INTRODUCTION

The multiple discriminance analysis is a branch of the multivariate statistical mathematics, which in accordance with the classification and the criterion of the known data to develop the discriminance function (model), so that the false rate of the derived discriminance function classified the observed sample s is minimum and it is a statistic method that know which kind the unknown classification samples belong to. The specific methods include: the distance criterion, the Bayesian (Bayes) criterion, the Fisher (Fisher) discriminance method etc (LI, HUANG, & YIN, 2006).

The Shanghai Stock Exchange issued the China's first market quality report since 2006.[3] The market quality problems caused a great response in China. But the market quality research is only limited to the simple listing and the horizontal comparison until now. How to dig these deeper ties is still a research gap. The mainly classification of the listed companies according to their financial indexes have a great

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limitations. To improve the listed company quality and optimize the environment for the stock market is significant combining the market quality indexes and making the listed companies evaluation grades.

2. MODEL

Sample selection

All listed companies in the Shanghai Stock Exchange in 2008 were ranked by the total market capitalization, the turnover and the net profit. The top 100 listed companies and the post 100 listed companies were received .Then the listed companies from the No. 600000 to No .600118 were selected randomly , and the 27 companies which were included in the top 100 and the down 100 listed companies were excluded together. The 73 listed companies are common companies.

Samples Source

The Market Quality Report in the Shanghai Stock Exchange (2009) (In fact it is the data of the market quality in 2008).

The Panorama Network (http://www.p5w.com). (the comprehensive capability data in 2008).

Sample data processing

The post-100 listed companies, the 73 random listed companies and the top 100 listed companies that were divided into the poor, the middle and the good categories listed companies were dependent variable. The market quality index (the price impact index, the liquidity index ,the large transaction costs, the total sale of 10 stalls, and the relative bid-ask spread, the relative effective spread, the volatility, the excess volatility, the earnings volatility and the pricing efficiency coefficient and the pricing error factor) were independent variables . These variables were used to structure the listed companies discriminance function by the Spss using the forward stepwise approach.

These discrimination ability variables were selected by the forward stepwise approach in order to avoid variables highly correlated, then use these variables make the difference analysis . Using the Wilks' Lambda method and the F value determine the different capacity of the independent variable s. The smaller is Wilks' Lambda , the greater is the variable's difference .The Wilks' Lambda each step will select the independent variable that reduce the Wilks' Lambda value to a minimum . The F standards is that if the F value is greater than 3.84 ,then the variable is selected in model, if the F value is less than 2.71 ,the variable is delete d. The price impact index was entered in the first step, the Wilks 'Lambda was 0.309. The mobility index was entered in the second step, the Wilks' Lambda was 0.220. The large transaction costs were entered in the third step, the Wilks' Lambda was 0.210. The excess volatility was entered in the fourth step, the Wilks' Lambda was 0.203. The Wilks' Lambda value decreased from 0.309 to 0.203. Every step of the F test probability values were zero, indicating the discrimination of these variables was significant.

The eigen value represents how much information is carried . The variety changing is explained by the variance explaining degree (ZHANG, 2004). The two discriminance functions were extracted. The first discriminance function feature value was 3.098that explained the 93.8% changing. The second discriminance function characteristics value was 0.203 which explained the 6.2% changing. Most information was on the first discriminance function. The greater is the discriminance function typical correlation coefficients , the more obvious is the classification results in this axis . The first function canonical correlation coefficient was 0.869 , the second function canonical correlation was 0.411. The first discriminance function was better tha n the second discriminance function. The canonical correlation coefficient is same meaning as the eigenvalue.

The Wilks' Lambd of the first discriminance function is 0.203. The χ^2 is 415.678 . The Wilks' Lambd of the second discriminance function is 0.831. The χ^2 is 48.233.The Wilks' Lambd and the χ^2 test whether the discriminance functions have a significant statistically meaning .The first and second discriminance function test probability was 0, indicating the explanatory power of the first and second function achieve a

significant level. Although the second discriminance function carried the information was less, the second function can not be gived up.

The discriminance coefficients are divided into the non-standardized and the standardized. The standardized discriminance function coefficients determine which variables the largest impact on the function.The greater is the variable absolute value, the greater is the variable impact on the discriminance function. The standardized discriminance function coefficient of the price impact index was 0.661. The mobility index was 0.142. The large transaction costs were 0.672. The excess volatility was 0.258 in the first discriminance function. The price impact index was 0.931. The mobility index was 0.455. The large transaction costs were -0.619. The excess volatility was 0.240.The largest impact on the first discriminance function was the large transaction costs. The largest impact on the second discriminance function was the price impact index .The standardized discriminance functions were:

$y1$ =0.661 the price impact index+0.142 the mobility index+ 0.672 the large transaction costs+0.258 the excess volatility

$y2$ =0.931the price impact index+0.455 the mobility index-0.619the large transaction costs+0.24 the excess volatility

The price impact index measure the impact level of a certain amount of shares to the market price level. The higher is the price impact index, the higher is transaction costs. The $A1$, $A2$, $A3$,...Ak are respectively the selling prices of the stock i of the limited order book in the moment t .The $S1$,$S2$,$S3$,..$S\ k$. are respectively the corresponding number of the $A1$, $A2$, $A3$,...Ak . The $B1$, $B2$, $B3$..., Bk are respectively the buying prices of the stock i of the limited order book in the moment t .The $D1$, $D\ 2$, $D\ 3$, ... $D\ k$ are respectively the corresponding number of the $B1$, $B2$, $B3$, ... $B\ k$. Then the price impact index of purchasing Q value is

$$\frac{\dfrac{Q}{\left[\sum_{j=1}^{k-1} S_j+\left(Q-\sum_{j=2}^{k-1} S_jA_j\right)\Big/A_k\right]}-\dfrac{(A_1+B_1)}{2}}{\dfrac{(A_1+B_1)}{2}}$$

among $\sum_{j=1}^{k} S_jA_j > Q \geq \sum_{j=1}^{k-1} S_jA_j$, (If does not exist, using a null value).

Then the price impact index of buying Q value is

$$\frac{\left|\dfrac{Q}{\left[\sum_{j=1}^{k-1} D_j+\left(Q-\sum_{j=1}^{k-1} D_jB_j\right)\Big/B_k\right]-\frac{(A_1+A_2)}{2}}\right|}{\frac{(A_1+B_1)}{2}}$$

among $\sum_{j=1}^{k} D_jB_j > Q \geq \sum_{j=1}^{k-1} D_jB_j$, (If does not exist, using a null value). The price impact index on buying and selling the stock i in the moment t is the average of the buying price impact index and the selling price impact index.

The quick ratio refers to the ratio of the liquid assets and the current liabilities .It measure the ability to repay current liabilities among the liquidity assets in corporation.

Quick ratio = liquid assets/current liabilities

among the liquid assets = the current assets –the inventory ,or the liquid assets = the current assets – the inventories – the prepaid – the prepaid expenses .

The large transactions coasts are not less tha n 500000 shares each transaction. It is confirmed to transact by the transaction system. After they agree on the prices and the numbers, the buyers and sellers input the trading system before 14:55 in the trading days by a large block transaction through adopting the same seat. The transaction price is identified by the between the highest price and the lowest price of the buyers and sellers on that day. The transaction price is the closing the price if having no the transaction. The price and the turnover of the large trading volume each stock are included the statistics of the total price and the turnover everyday .but they are not included in real-time quotes and the index calculation. The stock name, the trading volume, the transaction price, the dealers seat name and the name of the buyer and sell will be disclosed announcement to the market. The introduction of the block trading is one of China's stock market pioneering work. It is benefit for enhancing market stability and liquidity, to low the institutional investors transaction costs, and enhance the trading system adaptability.

The excess volatility measure the noise trading, the trading mechanism and is the approximate with the volatility index. The excess volatility is the difference of the day volatility and intra day volatility. The greater is the excess volatility, the greater is the casual volatility. The H_{it} is the highest price of the stock i on t day. The L_{it} is the lowest price of the stock i on t day. The P_{it} is the closing price of the stock i on t day . The P_{it-1}. is the closing price of the stock i on $t-1$ day .The excess volatility of the stock i on t day is :

$$\frac{(H_{it}-L_{it})}{P_{it-1}}-\frac{(P_{it}-P_{it-1})}{P_{it-1}}$$

The non-standardized coefficient does not reflect the difference ability of the distinguish variable, which is used to calculate the difference scores. That is the observed values of the distinguish variables were used in two discriminance functions and were calculated two difference scores and determine its position in the two-dimensional space. The non-standardized coefficient of the price impact index was 0.045.The mobility index was 0.The large transaction costs were 0.012.The excess volatility was -0.022. The constant was-5.619 in the first function . The price impact index was 0.063. The mobility index was0.001.The large transaction costs were -0.011.The excess volatility was -0.020.The constant was -1.763 in the second function .Therefore, the non-standardized discriminance functions of the discriminance function were:

y_1=0.045 the price impact index+0 the mobility index+0.012 the large transaction costs+0.022the excess volatility -5.619

y_2 =0.063the price impact index+0.001the mobility index-0.011the large transaction costs+0.02 the excess volatility -1.763

We judge the difference forces of determining different variables, In addition to check the standardized discriminance coefficients absolute value, but also check its structure factor. The structure is known as a load factor, which represents the correlation coefficient between the standardized discriminance function and a variable. The larger is the coefficient absolute value , the higher is the their correlation.

The structure coefficient of the price impact index in the first discriminance function was 0.743, the structure factor in the second discriminance function was 0.508. The structure coefficient of the mobility index in the first discriminance function was -0.374, the structure coefficient in the second discriminance function was 0.571. The structure coefficient of the large transction costs in the first discriminance were 0.840, the structure coefficient in the second discriminance function was -0.527. The structure coefficient of the excess volatility in the first discriminance function coefficient was -0.009, the structure coefficient in the second discriminance function was -0.244.The first discriminance function prima rily related to the large transaction costs, the price impact index, and the excess volatility. The second distinguishing major related to the mobility index and the excess volatility.

The center value of the poor company in the first discriminance function was 2.128.The center value of the poor company in the second discriminance function was 0.262. The center value of the midd le company in the first discriminance function was-0.065.The center value of the midd le company in the second discriminance function was -0.734 . The center value of the good company in the first discriminance

function was -1.937, The center value of the good company in the second discriminance function was 0.285. When we know the group center, as long as the non-standardized coefficient scores of the unknown cases discriminance function were calculated so that we can know which center the unknown cases was nearest ,we can judge which group the unknown cases will belong to.

The back to the original training sample is substituted into the discriminance function, calculated the wrong ratio through it to examine whether the false is serious. But this method tends to overestimate the discrimination effect. But this method tends to overestimate the discrimination effect. The cross-proof method has be a very developed important distinguish verification technology in recent years ,which has a deeper progress on the dichotomy .When the discriminance function are found to remove one case , using the discriminance function determine the one case. The method avoids effectively the stronger influence point interference (LIN, 2007).

In the original back method, the 79 among the 94 poor listed companies were right, the percentage was 84.0%.The 15 listed companies were convicted wrongly the middle listed companies, the percentage was 16%. The 45 among the 72midd le listed companies were right, the percentage was 62.5%, and the 13 listed companies were convicted wrongly the poor listed companies, the percentage was18.1%, the 14 listed companies were convicted wrongly the good listed companies, the percentage was 19.4%. . The 82 among the 99 good listed companies are right, the percentage was 82.8%, the 2 listed companies were convicted wrongly the midd le listed companies, the percentage were 2%, the 15 listed companies were convicted wrongly the good listed companies, the percentage was 15.2%.

In the cross-verified method, the 78 among the 94 poor listed companies were right, the percentage was 83.0%.The 16 listed companies were convicted wrongly the middle listed companies, the percentage was 17%. The 45 among the 72 middle listed companies were right, the percentage was 62.5%, and the 13 listed companies were convicted wrongly the poor listed companies, the percentage was 18.1%, the 14 listed companies were convicted wrongly the good listed companies, the percentage was 19.4%. The 82 among the 99 good listed companies were right, the percentage was 82.8%, the 2 listed companies were convicted wrongly the poor listed companies, the percentage was 2.0%, the 15 listed companies were convicted wrongly the middle listed companies, the percentage was 15.2%.

The 15 +13 +2 +15 +14 = 59 samples classification were error and the correct rate was (265-59) / 265 = 77.74% with the original back method The 16 +13 +2 +15 +14 =60 sample s classification were error, the correct rate was (265-60) / 265 = 77.36% with the cross verified classification matrix . No matter the correct rate was 77.36%, or was 77.74%, the two discriminance functions that determine the classification was higher.

The Fisher discriminance analysis method is a typical linear discriminance method. Its basic idea is to transform the coordinate systems to the original data and separate the overall as soon as possible by the variance analysis method (LIU, WANG, & YANG, 2006).

The Fisher discriminance function coefficient of the price impact index in the poor company was 0.540. The mobility index was 0.012.The larger transaction costs were 0.077. The excess volatility was 0.819. The constant was -57.881. The Fisher discriminance function coefficient of the price impact index in the middle company was 0.379. The mobility index was 0.01.Thee larger transaction costs were 0.062. The excess volatility was 0.75.The constant was -41.771. The Fisher discriminance function coefficient of the price impact index in the good company was 0.379. The mobility index was 0.01.The larger transaction costs were 0.065. The excess volatility was 0.75.The constant was -41.771. Therefore the Fisher discriminance functions were:

y_1=0.540the price impact index+0.012 the mobility index+ 0.077the large transaction costs+0.819the excess volatility -57.881

y_2 =0.379the price impact index+0.01the mobility index+0.062the large transaction costs+0.75 the excess volatility -41.771

y_3 =0.357the price impact index+0.011the mobility index+0.028the large transaction costs+0.729 the excess volatility -34.562

The unknown case was substituted for the Fisher discriminance functions. Which group value was the biggest, then the unknown should belong to which group.

3. CONCLUSIONS

According to the traditional classification by the total market capitalization, the operating income and the net profit of the listed companies and the classification according to the market quality index is not very different, but the latter is a linear function and the listed companies quantitative evaluation is more scientific. The investors can also understand the market situation, the benefits and the risks of the listed companies by two functions classification. The regulatory authorities and the market regulators can use it in time to find the problem, improve the regulatory quality and efficiency. Urging the listed companies to improve the market quality, reduce the transaction costs, increase the liquidity and reduce the excess volatility has an effective guideline.

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