

The Application of Financial Engineering in Market Operation and Investment Management

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Abstract: With the rapid development of financial market in the economic field, more and more financial problems need to be solved in combination with the actual situation of the company. If an enterprise wants to occupy a place in the fierce competition, it must constantly innovate the management strategies of market investment, operation and financing. In this paper, we build a mathematical model based on ridge regression, and use Python to normalize the required data. In combination with Shanghai Liangxin Electric Co., Ltd., the financial forecast is based on 2017 and the forecast period is 3 years. Then, the author uses the financial engineering analysis technology, taking Shanghai Liangxin Electric Co., Ltd. as an example, to make financial forecast on the company's operation, investment and financing activities in the next three years. The data shows that the fund management of enterprises in the next three years is not so good. The company needs to strengthen its cash flow ability, which provides an analysis basis for internal managers to improve their management and external investors to evaluate their value.

1. Research background and significance

1.1 Background

Financial engineering first appeared in the 1950s, is a relatively early concept of the financial industry, and widely used in the theoretical research of financial engineering [1]. However, many theories of financial engineering technology have been developed and applied continuously. At the same time, they also have different views. When introducing the idea of financial engineering into the financial field, we should fully consider the risks of the company's investment transactions. The person in charge of the company should manage and control the risk, and financial engineering is an effective tool to realize structural management. The broad sense of financial engineering is a relatively effective financial engineering tool [2]. From the technical level, the narrow definition of financial engineering focuses on the risk management technology of investment, which is also the core of market investment and management.

In the process of development, financial engineering industry plays an increasingly important role in market investment management. The financial industry has gradually changed from the traditional operation mode to the new mode, and gradually achieved development integration. The competition among enterprises has become the competition among operation modes. Financial engineering is becoming an important work to promote the integration of traditional financial sector and market investment management.

1.2 Significance

The current financial market system is undergoing changes, and a single traditional financial model can no longer adapt to the new changes [3]. The era of personalized and comprehensive financial engineering industry has come. In this context, market investment, operation and financing management based on financial engineering provide a good development plan for enterprises. The application of financial engineering in the management system of market investment, operation and

financing has effectively promoted the marketization of interest rate. This paper uses the method of combining theoretical analysis with practical cases, combined with the financial situation of electrical companies, to explore the financial analysis of Companies in the era of financial engineering development.

2. Company term prediction based on ridge regression model

In order to determine the prediction period of the company, a biased estimation regression method, ridge regression, is used for collinear data analysis. In essence, it is an improved least square estimation method. By giving up the unbiasedness of the least square method, a more practical and reliable regression method is obtained at the cost of losing part of the information and reducing the accuracy. The fitting of ill conditioned data is better than the least square method. It is the most frequently used regularization method in regression analysis of the problem of inappropriateness.

The least square method commonly used in regression analysis is an unbiased estimation. For a well posed problem X , it is usually a $X\theta = y$ with full rank. The least square method is used to define the loss function as the square of the residual and the minimum loss function as $\|X\theta - y\|^2$.

The above optimization problems can be solved by gradient descent method or directly by the following formula:

$$\theta = (X^T X)^{-1} X^T y \quad (1)$$

When X is not the full rank of a column, or when the linear correlation between some columns is large, the determinant of $X^T X$ is close to 0, that is, $X^T X$ is close to singularity, and the above problem becomes an ill posed problem. At this time, the error will be large when calculating $(X^T X)^{-1}$, and the traditional least square method is lack of stability and reliability.

In order to solve the above problems, we need to transform the ill posed problem into the well posed problem: we add a regularization term to the above loss function, which becomes $\|X\theta - y\|^2 + \|\Gamma\theta\|^2$. Where $\Gamma = \alpha I$ is defined, then:

$$\theta(\alpha) = (X^T X + \alpha I)^{-1} X^T y \quad (2)$$

In the above formula, I is the unit matrix. With the increase of α , the absolute values of $\theta(\alpha)$ elements tend to be smaller and smaller, and their deviation from the correct value DDD is also larger and larger. When α tends to infinity, $\theta(\alpha)$ tends to 0. Among them, the track of $\theta(\alpha)$ changing with the change of B is called ridge trace. In the actual calculation, many α values can be selected to make a ridge trace. To determine the α value, look at which value the graph becomes stable.

Ridge regression features: 1. Ridge regression is a supplement to the least square regression, it loses the unbiasedness, in exchange for high numerical stability, so as to obtain high calculation accuracy; 2. The significance and accuracy of the regression coefficient of the usual ridge regression equation are often significantly higher than that of the ordinary regression, which has great practical value in the study of the existence of collinearity problems and the morbid data bias.

The ridge regression model is adopted, and Python is used to normalize the required data. Combined with Shanghai Nader Electric Co., Ltd., the financial forecast is based on 2017, and the forecast period is 3 years.

3. Analysis of market operation and investment management based on Financial Engineering

Shanghai Nader Electric Co., Ltd. is a company specializing in the manufacture of high and low voltage electrical appliances, one of the leading companies in the medium and high-end market of the domestic low-voltage electrical appliances industry, focusing on the research, development, production and sales of products in the medium and high-end market. Based on the ridge regression

model, the author selects the company's financial statements for financial analysis with the base period of 2017 and the forecast period of 3 years.

Table 1. Statement of changes in main financial indicators of cash flow statement

Project	Annual Amount (yuan)			% change on month	
	2015year	2016year	2017year	2016year	2017year
Cash inflow from operating activities	1196726455.93	1408205696.45	1275549843.57	17.67%	-9.42%
Cash outflow from operating activities	1029045277.25	1185753011.55	1104247906.22	15.23%	-6.87%
Net cash flow from operating activities	167681178.68	222452684.90	171301937.35	32.66%	-22.99%
Cash inflow from investment activities	658670101.94	663233618.26	1713478096.13	0.69%	158.35%
Cash outflow from investment activities	803588163.16	1338949901.43	1890554477.11	66.62%	41.20%
Net cash flow from investment activities	-144918061.22	-675716283.17	-177076380.98	366.27%	-73.79%
Cash inflow from financing activities	5275361.00	494909604.25	39672880.00	9281.53%	-91.98%
Cash outflow from financing activities	30315838.01	64746523.75	104150295.25	113.57%	60.86%
Net cash flow from financing activities	-25040477.01	430163080.50	-64477415.25	-1817.87%	-114.99%

(1) Analysis on the change trend of cash flow in business activities

From the perspective of net cash flow generated by operating activities, the net cash flow generated by Nader's operating activities in 2015-2017 shows an inverted "V" character of first rising and then declining. The net cash flow generated by operating activities in 2016 increased by 54771506.22 yuan compared with 2015, a 32.66% increase on a month on month basis, while the net cash flow generated by operating activities in 2017 decreased by 511507% compared with 2016 47.55 yuan, down to - 22.99% month on month. In 2016, the subtotal of cash inflows and outflows from operating activities increased to a certain extent, which is the main reason for the rise of net cash flows from operating activities in the year on month; in 2017, the cash inflows and outflows from operating activities decreased, and the change in the ratio of cash inflows to outflows from operating activities was - 9.42%, the decline was greater than that of cash outflows from operating activities. Among them, the cash received from the sale of goods and the provision of labor services decreased significantly, the cash paid for the purchase of goods and the receipt of labor services also decreased significantly, the cash paid to and for the employees and the taxes and fees paid rose significantly on a month on month basis, which led to a significant reduction in the net cash flow generated from operating activities in 2017.

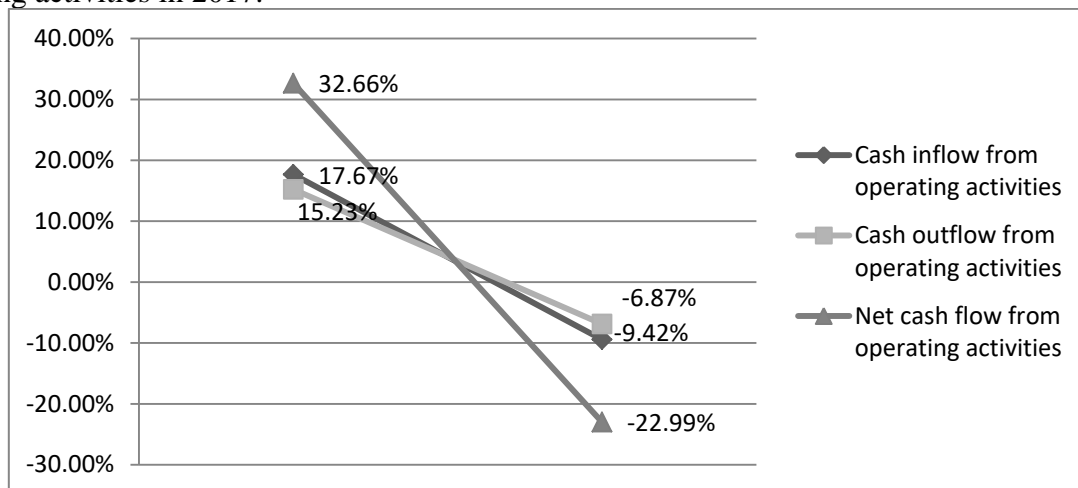


Figure 1. Change of cash flow from operating activities of Shanghai Liangxin

(2) Analysis on the change trend of cash flow in investment activities

In terms of the net cash flow from investment activities, the net cash flow from investment activities in 2016 increased by 366.27% on a month on month basis compared with that in 2015, mainly because the increase of cash outflow from investment activities was greater than that of cash inflow from investment activities, and the amount of outflow was far greater than that of cash inflow. In this year, fixed assets, intangible assets and other long-term assets were disposed. The net cash flow from investment activities increased from -144918061.22 to -675716283.17 due to the largest

increase in the net cash received from assets, but its growth base was small, and the change in the cash paid for investment and other cash paid related to investment activities increased on a relatively large basis. In 2017, the net cash flow generated from investment activities decreased to -73.79% on a month on month basis compared with 2016, with a significant decrease, mainly due to the significant increase in the change in the subtotal of cash inflow from investment activities to 158.35% on a month on month basis, while the increase in cash outflow from investment activities decreased compared with the increase in a month on month basis in 2016. In 2017, the cash received from investment income and other cash related to investment activities increased significantly, while the cash paid for investment changed to 0, so the net cash flow generated from investment activities decreased significantly.

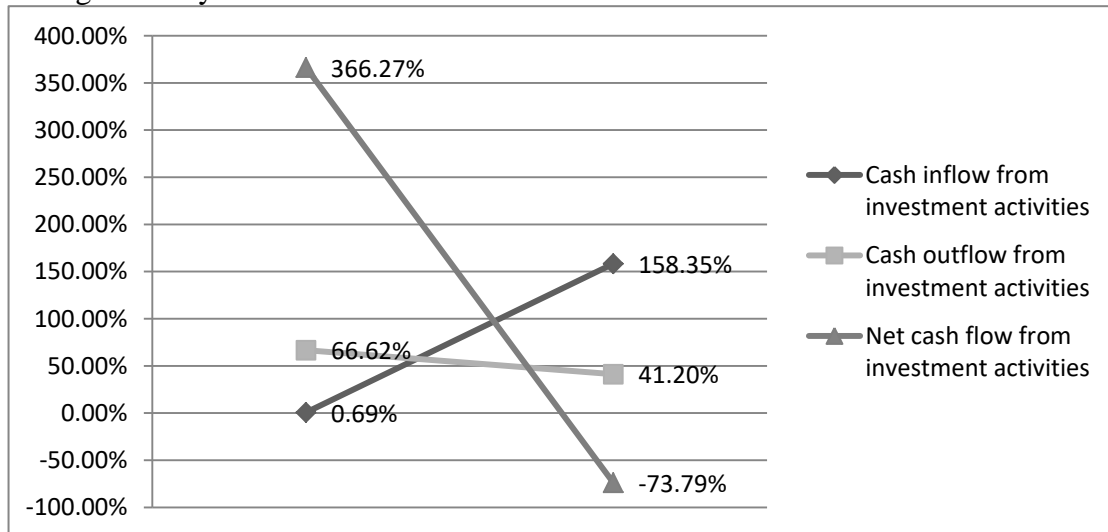


Figure 2. Change of cash flow from investing activities of Shanghai Liangxin

(3) Analysis on the change trend of cash flow in financing activities

From the perspective of the net cash flow from financing activities, the net cash flow from financing activities in 2015 was -25040477.01 in 2016, the amount of which changed to 43013080.50, with a month on month change of -1817.87%, a large margin, mainly due to the significant increase in cash received from investment absorption, resulting in the amount of cash inflow from financing activities far greater than the amount of cash outflow from financing activities. In 2017, the net cash flow from Nader's financing activities changed to -64477415.25, with a month on month change of -114.99%, mainly due to the sharp decline in the cash received by the enterprise in absorbing investment and the sharp rise in the cash paid for distribution of dividends, profits or interest payments, resulting in the cash inflow from financing activities lower than the cash outflow.

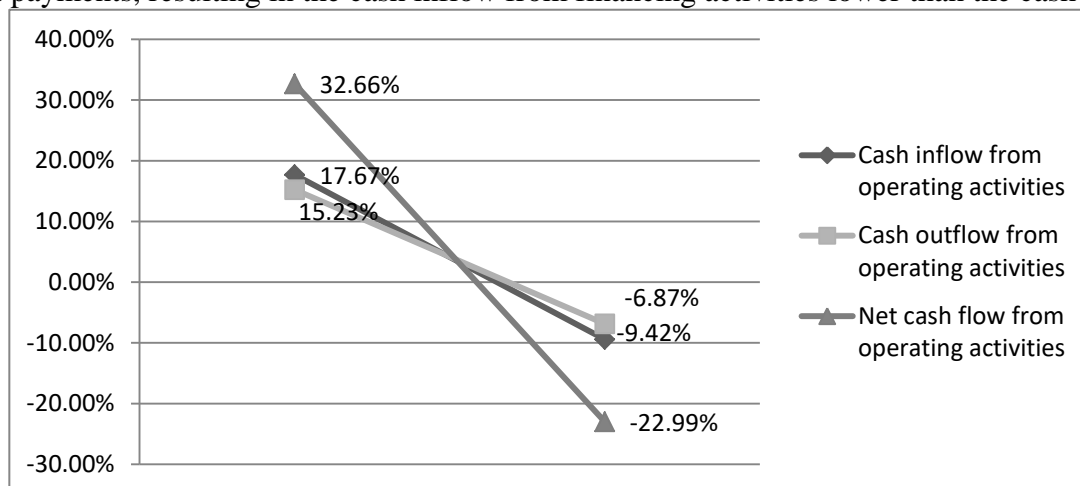


Figure 3. Change of cash flow from operating activities of Shanghai Liangxin

It can be seen from the trend analysis that the change trend of each financial index in different years and the gap between adjacent years can be roughly seen, which provides an analysis basis for internal managers to improve operation management and external investors to conduct value evaluation.

4. Conclusion

This paper uses the financial statements of Nader Electric Co., Ltd. to make financial forecast. Financial analysis with 2017 as the base period and 3 years as the forecast period. From three aspects of business activities, investment activities and financing activities, this paper forecasts the financial indicators.

In terms of business activities, the cash obtained from the sale of goods has declined substantially, and the cash paid for the purchase of goods and the acceptance of services has also declined substantially. The cash paid to employees increased significantly on a month on month basis, which resulted in a significant decrease in the net cash flow from operating activities in 2017. In terms of financing activities, the net cash flow from investment activities decreased significantly in 2017. In terms of financing activities, the cash received by enterprises in absorbing investment in the year decreased significantly, and the cash paid for distribution of dividends, profits or interest payments increased significantly, resulting in lower cash inflow than cash outflow in financing activities.

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