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A Decision Engineering Method to Identify the Competitive Effects of Working Capital: A Neural Network Model*

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Abstract

Enterprise working capital management determines the enterprise market competition efficiency and management efficiency to a great extent, how to configure working capital and make it generate a positive impact on the market competition effect in financial engineering is worth further discussion. This paper from turnover capacity and liquidity two aspects analyze the effects of working capital on engineering product market competition performance in manufacture industry. Research found that enterprise working capital turnover ability has positive effect on product market competition performance while enterprise working capital liquidity has a negatively relationship with market competition performance. Linear regression based on dynamic panel data, examined the impact of working capital on competitive performance. But according to the regression equation to predict the competitive effects of working capital, exists larger error, because the actual impact of working capital on competitive performance may be nonlinear. So we use BP neural network model to predict the competition performance, and the results indicate the overall prediction effect is good.

*Keywords:*Working capital; Turnover ability; Liquidity;The product market competition performance; financial engineering

1. Introduction

In the corporate finance engineering literature, most scholars focus on the study of long-term financing decisions in particular, dividends, capital structure etc. However, in short-term financial management, working capital management is one of the most important affairs and financial managers are always trying to determine a reasonable level of working capital (Lamberson,1995)[1].Working capital is the fund that used to maintain enterprise day to day operations. It refers to the capital invested in all current assets or the difference between current assets and current liabilities that used for production in long-term capital. Many scholars have been dedicated to research working capital management and their research results showed that working capital management determines enterprise market competition benefits and operational efficiency to a great extent. Chakrabory and Bardopadhyay (2007) [2] researched strategic working capital management and its role in the development of corporate strategy, while Singh (2000) found inventory scale directly affected working capital management. For each industry, effective working capital management is an important part of enterprise's survival and development [3].

Working capital management affects the enterprise's profitability, risk and value (Smith, 1980).Efficient working capital management is an important component of enterprise goal of increasing the market value (Deloof, 2003; Afza & Nazir, 2007) [4]. In working capital management, foreign scholars originally mainly studied how to optimize the combination of inventory, accounts receivable and etc. Mihir Dash and Rani Hanuman put forward the goal programming model to study working capital management to achieve the balance between profitability and liquidity[5]. Working capital management mainly includes working capital turnover ability and liquidity, that is, liquid assets turnover ability, inventory turnover ability, accounts receivable

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turnover ability, accounts payable turnover ability, cash turnover ability, liquidity ratio and quick ratio.

The empirical study on engineering manufacture working capital of Deloof found that there were negative correlations between accounts receivable turnover cycle, inventory cycle, cash conversion cycle and enterprise profitability [4]. In addition, scholars Raheman and Nars (2007) also got similar conclusions. Empirical analysis of Yang (1992), Shi (1992), Hsueh (2000) [6] found that enterprises have high liquidity ratio and working capital management level performing relatively better. Mehment SEN (2009) [5] found there was a significant negative correlation between cash flow cycle, net working capital level, accounts receivable cycle and return on total assets in his study. In recent years, some domestic savants also work on the relationship between the performance and working capital. The study of Chinese listed companies in manufacture of Kong Ningning (2009) [7] showed that accounts receivable cycle, inventory cycle and cash conversion cycle are negative related to profitability, while accounts payable cycle is positive related to profitability. This is similar with the study of Shin and Soenen (1998) [8]. Duan Liu, Shou Chen (2011)[9] researched the effect of working capital on product market competition performance and found that working capital turnover ability has a positive effect on product market competition ability, but with the turnover ability raise to a certain level, the positive support role will weaken. And the liquidity of working capital in general has a negatively effect on market competition performance.

Kenneth Nuiul researched the strategic impact of working capital on engineering enterprise, when enterprise rational disposition of its resources, these resources can produce competitive advantage. As yet, most scholars are dedicated to study the relationship between working capital and enterprise profit ability and few scholars research working capital's effect on market competition performance and the industrial differences. The authors find that most present studies on the relation between market performance and working capital are based on the level of the whole industry, while the analysis specific to the different single industry is rare. This paper, aims to analyze the industrial differences of working capital's effect on product market competitive performance. According to the different structure characteristic and competition concentration of manufacture and wholesale and retail industry, to reveal the differences influence of working capital turnover ability and liquidity on market competitive performance.

2. Variables and Methodology

2.1. Variables

Reference to Opler and Titman (1994)[10], Campello(2006)[11], Fresard(2010)[12], we use sales growth ($Salesgrowth_{i,t}$) as an indirect measurement of firm's change in products market share which is computed by function ($Sales_{i,t}$-$Sales_{i,t-1}$)/$Sales_{i,t-1}$, of which the subscript *i* and *t* presented the company and the year respectively. To measure a firm's sales expanding relative to that of its competitors or equivalently proxies for market shares growth, the dependent variable, $\triangle Salesgrowth_{i,t}$, it equals company sales growth minus industry-year mean of the sample company at year *t*.

The independent variables used in this paper are working capital turnover capacity and liquidity. Liquid assets turnover ($Lturnover_{i,t}$), inventory turnover ($Iturnover_{i,t}$) and cash conversion cycle ($CCC_{i,t}$) are mainly used to represent working capital turnover ability. Among them, the liquid assets turnover is the ratio of main business revenue and average current asset; inventory turnover is cost of sales divided by average inventory, it reflects the enterprise inventory management level; and the cash conversion cycle is used for the proxy variable of working capital cycle, equals to the accounts receivable cycle plus inventory cycle and minus accounts payable cycle, of which accounts receivable cycle, inventory cycle and accounts payable cycle equals to 360 days divided by their own turnover respectively. With regards to the liquidity index, liquidity ratio ($Liquidity_{i,t}$) and quick ratio ($Qick_{i,t}$) are used. Liquidity ratio is the ratio of current assets and liabilities; quick ratio is the ratio of quick assets and liabilities, where the current assets refer to the assets that can be converted into cash immediately, equals to liquid assets minus the inventory and long-term deferred expenses. To facilitate analysis strategy effect of working capital, all indexes minus industry-year mean and can get turnover ability and liquidity indexes:$\triangle Lturnover_{i,t}$、$\triangle Iturnover_{i,t}$、$\triangle CCC_{i,t}$、$\triangle Liquidity_{i,t}$ and $\triangle Qick_{i,t.}$

In addition to the above variables affect product market competition performance, we also need to consider other factors that have a significant influence on product market competition performance such as the size ($Size_{i,t}$), sales costs ($SE_{i,t}$) and product market competition performance ($Salesgrowth_{i,t-1}$) at year *t-1* etc., we introduced as control variables. We measured the size as the natural logarithm of total assets; it is the enterprise economic resources and may affect the performance of the enterprise market competition. Sales cost equals to operating expenses divided by sales revenue. As the last year market competitive performance may have a sustained influence on the next year competitive market performance, so we regards the last year product market competitive performance as one of the control variables. The control variables minus the industry-year mean, then gets $\triangle Size_{i,t}$, $\triangle SE_{i,t}$, $\triangle Salesgrowth_{i,t-1}$.

2.2. Methodology

This paper analyzes the different impact of working capital on product market competition performance in manufacture and wholesale and retail trade industry from turnover ability and liquidity two aspects. The basic dynamic panel data empirical models of working capital turnover ability impacted market competition performance were used to test the effect of liquid asset

turnover, inventory turnover and cash conversion cycle and liquidity on sales revenue growth, shown in model *(1)-(5)*.

$$\Delta Salesgrowth_{i,t} = a\Delta Lturnover_{i,t} + \alpha_1 \Delta Size_{i,t} + \beta_1 \Delta SE_{i,t} + \gamma_1 \Delta Salesgrowth_{i,t-1} + w_i + \eta_t + \varepsilon_{i,t} \quad (1)$$

$$\Delta Salesgrowth_{i,t} = b\Delta Iturnover_{i,t} + \alpha_2 \Delta Size_{i,t} + \beta_2 \Delta SE_{i,t} + \gamma_2 \Delta Salesgrowth_{i,t-1} + w_i + \eta_t + \varepsilon_{i,t} \quad (2)$$

$$\Delta Salesgrowth_{i,t} = c\Delta ARturnover_{i,t} + \alpha_3 \Delta Size_{i,t} + \beta_3 \Delta SE_{i,t} + \gamma_3 \Delta Salesgrowth_{i,t-1} + w_i + \eta_t + \varepsilon_{i,t} \quad (3)$$

$$\Delta Salesgrowth_{i,t} = d\Delta APturnover_{i,t} + \alpha_4 \Delta Size_{i,t} + \beta_4 \Delta SE_{i,t} + \gamma_4 \Delta Salesgrowth_{i,t-1} + w_i + \eta_t + \varepsilon_{i,t} \quad (4)$$

$$\Delta Salesgrowth_{i,t} = e\Delta CCC_{i,t} + \alpha_5 \Delta Size_{i,t} + \beta_5 \Delta SE_{i,t} + \gamma_5 \Delta Salesgrowth_{i,t-1} + w_i + \eta_t + \varepsilon_{i,t} \quad (5)$$

Where w_i and η_t control the company individual effect and time effect respectively, $\varepsilon_{i,t}$ is residual items.

The basic dynamic panel data empirical models of working capital liquidity impacts market competition performance were used to test the effect of liquidity ratio and quick ratio on sales revenue growth, shown in model *(6)-(7)*.

$$\Delta Salesgrowth_{i,t} = f\Delta Liqidity_{i,t} + \alpha_6 \Delta Size_{i,t} + \beta_6 \Delta SE_{i,t} + \gamma_6 \Delta Salesgrowth_{i,t-1} + w_i + \eta_t + \varepsilon_{i,t} \quad (6)$$

$$\Delta Salesgrowth_{i,t} = g\Delta Qick_{i,t} + \alpha_7 \Delta Size_{i,t} + \beta_7 \Delta SE_{i,t} + \gamma_7 \Delta Salesgrowth_{i,t-1} + w_i + \eta_t + \varepsilon_{i,t} \quad (7)$$

Where w_i and η_t control the company individual effect and time effect respectively, $\varepsilon_{i,t}$ is residual items.

In addition, to reflect the combined effects on market performance of working capital turnover ability and liquidity ability, we put working capital turnover and liquidity ability indicators into the tested model simultaneously. Because the multicollinearity exists between liquidity ratio and quick ratio, so this paper chooses liquidity ratio by comparison. The combined effects model is shown in model *(8)*.

$$\begin{aligned}\Delta Salesgrowth_{i,t} = {} & a\Delta Lturnover_{i,t} + b\Delta Iturnover_{i,t} + c\Delta ARturnover_{i,t} + d\Delta APturnover_{i,t} + e\Delta CCC_{i,t} \\ & + f\Delta Liqidity_{i,t} + \alpha_1 \Delta Size_{i,t} + \beta_1 \Delta SE + \gamma_1 \Delta Salesgrowth_{i,t-1} + w_i + \eta_t + \varepsilon_{i,t}\end{aligned} \quad (8)$$

Where w_i and η_t control the company individual effect and time effect respectively, $\varepsilon_{i,t}$ is residual items.

In order to solve the dynamic problem resulted by independent variable contains the lag of the dependent variable and endogenous problem between independent variables, this paper using GMM estimation methods and related estimation in model *(1)-(8)*.

3. Data and descriptive statistics

The empirical study is based on a sample of manufacture industry A-share companies listed in Shanghai and Shenzhen stock, from 1996-2009.The sample data collected from the CSMAR database, and used STATA 11 for dynamic panel regression analysis. To ensure accuracy of the data sample and feasibility of the study, the sample data were handled as follows: eliminate the enterprise whose audit report was shown an inexpressible opinions, negative opinions or didn't disclose the audit opinion; eliminate the enterprise that have abnormal data. The descriptive statistics analysis of manufacture, wholesale and retail trade industry which without industry-year-mean adjustment was shown in table 1. Due to the data used in the dynamic panel data GMM estimates were after industry-year mean adjustment, so eliminated the companies with five null data year.

Table 1 Descriptive statistics results

variables	N	Mean	Std.	Min	Max
Salesgrowth	9977	17.32609	43.52685	-99.9	739.43
ARturnover	9951	16.02825	49.10773	0	936.29
APturnover	8177	12.07152	27.94649	0	988.4719
Iturnover	9996	4.299085	12.10469	0	910.03
Lturnover	9996	1.38298	1.375394	0	35.94
CCC	7838	147.3868	137.9962	0.008933	993.1722
Liquidity	9996	1.379325	1.346022	0	37.93
Qick	9996	0.991163	1.148271	0	32.35
Size	7625	20.90687	1.102414	14.18678	26.02169
Δ Size	7692	0.352562	2.439649	-19.797	22.83078
SE	7587	0.063203	0.11095	0	7.001514

Notes: The standard deviation is in brackets.

Descriptive statistics analysis in Table 1 shows that the average sales revenue growth rate of manufacture industry from 1996~2009 is more than 10%. The whole industry sales income grows stability, has enough capital, and also has the option of expanding the scale of production, improving production technology and product sales, developing new products. In working capital management, working capital turnover ability reflects the efficiency of enterprise economic resource utilization and value creation. Manufacture industry liquid assets turnover on average is 1.38%. Inventory and accounts receivable belongs to no gains liquid assets, most cases they cannot benefit to the enterprise. The inventory turnover ability was 4.30%, and the accounts receivable turnover was 16.03%.Then considering cash conversion cycle, manufacture cash conversion cycle was 167.1 days. In terms of liquidity of working capital, liquidity can reflect the risk of working capital management and configuration. The higher liquidity; the more low-income and low-risk liquid assets enterprises have to protect its repay. Table 1 shows liquidity of manufacture is between 0.5 and 2.0, relatively appropriate, can help enterprises to plunder the market share.

4. Empirical results analysis and BP neural network prediction

4.1. GMM regression results and analysis

In working capital management, turnover ability and liquidity not only affect the enterprise short-term financial decisions but also affect enterprise value creation efficiency and sustained normal operation. This part used dynamic panel GMM regression analysis and analyzed the effect of working capital's liquidity and turnover ability on market competition performance.

In order to test and avoid the dynamic problem generated by independent variable containing dependent variable lag items and endogenous problems between independent variables, this paper used dynamic panel data of two phase system GMM estimation, and the results showed that instrumental variables' excessive recognition constraint is not significant (Sargan test). Model (1) to (7) estimate results show in table 2. GMM estimated result showed manufacture liquid assets turnover in 1% significant level is positively related to market competition performance. Inventory turnover in significant levels of 1% is positively related to market competition performance, that is, high inventory turnover is helpful for improving enterprise product market competition performance. Accounts receivable turnover reflects the enterprise recovery receivable ability and speed. Accounts receivable turnover is high, the cycle that enterprise recovery receivable is shorter, the liquidity of assets is more quickly. The regression results of model (3) showed that, in the significance level of 10%, the manufacture industry accounts receivable turnover in general has a strong positive relationship with market competition performance. Enough liquidity on one hand can be used for its debts, on the other hand for promoting sales revenue growth. Cash conversion cycle reflects the situation of enterprise working capital management. Shorter cash conversion cycle means enterprise can use more cash and operation efficiency is high. The existing literature shows that shorten cash conversion cycle will be beneficial to increase enterprise profitability, liquidity and market value (Shin Soenen, 1998; Gentry, 1990; Richards Laughlin, 1980, Deloof, 2003). In significant level of 1%, manufacture cash conversion cycle has negative effect on market competition performance.

In working capital management, liquidity reflects the risk level of enterprise capital allocation. Commonly, liquidity ratio and quick ratio mainly used as fluidity index. Liquidity ratio is the ability that enterprise can be realization for debt in a short time, and quick ratio measures liquidity assets that can be realized to repay current liabilities immediately. In general, high liquidity ratio and quick ratio can guarantee the liquid assets used for repaying short-term debt, also can effectively reduce working capital liquidity risk. But this reduces the cash flow to a certain extent and doesn't conducive to seize market share. Model (6) and model (7) show that liquidity ratio and quick ratio in 1% significant level are negatively related to market competition performance.

Table 2 GMM regression results

variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
$ARturnover_{i,t}$	0.01* (1.36)						
$APturnover_{i,t}$		0.01* (0.04)					
$Iturnover_{i,t}$			5.28*** (4.69)				
$Lturnover_{i,t}$				57.29*** (10.16)			
$CCC_{i,t}$					-0.02*** (-8.50)		
$Liquidity_{i,t}$						-33.04*** (-5.76)	
$Qick_{i,t}$							-42.62*** (-5.71)
$Size_{i,t}$	-1.10 (-0.65)	-0.99 (-0.59)	-1.45 (-0.89)	-0.67 (-0.40)	-1.30 (-0.77)	-2.57 (-1.53)	-2.45 (-1.45)
$SE_{i,t}$	51.80*** (3.84)	51.88*** (3.87)	51.75*** (3.45)	51.89*** (3.77)	55.85*** (3.71)	52.80*** (3.32)	52.27*** (3.49)
$Salesgrowth_{i,t-1}$	0.02*** (57.40)	0.02*** (57.26)	0.02*** (52.77)	0.02*** (41.66)	0.02*** (55.58)	0.03*** (13.02)	0.03*** (11.02)
常数项	-6.9*** (-5.19)	-6.91*** (-5.19)	-5.09*** (-3.57)	-8.21*** (-4.24)	-6.80*** (-5.02)	-9.20*** (-4.91)	-10.40*** (-5.10)

Notes:The dependent variable is product market competition $\triangle Salesgrowth_{i,t}$, using the dynamic panel data of two phase system GMM estimate, and the lag a period difference item of the independent variable as instrument variables. T-values is in brackets. ***at 1% significant, **at 5% significant, *at 10% significant.

The control variables used in this paper, company size has a negative effect on competition performance but is not significant, consistent with research results of Campello (2006) [11]. And sales expenses have positive relationship with competition performance in 1% significant level.

The GMM regression results of model (8) are showed in table 3. Liquid assets turnover in 10% significant level is positively related to market competition performance. Inventory turnover in significant levels of 1% is positively related to market competition performance. Accounts receivable turnover reflects the enterprise recovery receivable ability and speed. In model (8), accounts receivable turnover in general has a strong positive relationship with market competition performance in the significance level of 10%.Cash conversion cycle reflects the situation of enterprise working capital management. In significant level of 1%, manufacture cash conversion cycle has negative effect on market competition performance. Model (8) shows that liquidity ratio in 1% significant level is negatively related to market competition performance.

Table 3 GMM regression results of Model (8)

$ARturnover_{i,t}$	$APturnover_{i,t}$	$Iturnover_{i,t}$	$Lturnover_{i,t}$	$CCC_{i,t}$	$Liquidity_{i,t}$	$Size_{i,t}$	$SE_{i,t}$	$Cons\_$	$Salegrowth_{i,t-1}$
0.01*	0.04*	2.51***	37.79***	-0.1***	-5.0**	0.37	22.04	-7.9***	0.31***
(0.84)	(0.30)	(3.02)	(6.71)	(-2.36)	(-2.18)	(0.52)	(1.44)	(1.36)	(34. 51)

Notes:The dependent variable is product market competition △Salesgrowthi,t, using the dynamic panel data of two phase system GMM estimate, and the lag a period difference item of the independent variable as instrument variables. T-values is in brackets. ***at 1% significant, **at 5% significant, *at 10% significant.

4.2. The prediction of competitive performance based on BP neural network

Linear regression based on dynamic panel data, examined the impact of working capital on competitive performance. But according to the regression equation to predict the competitive effects of working capital, exists larger error, because the actual impact of working capital on competitive performance may be nonlinear. Then we consider working capital variables as input neurons, output neurons as a competitive performance, to build the corresponding BP neural network model, so as to provide investment decision-making reference for investors.

This paper will see the independent variable data as input variables in the panel regression model of competitive performance. The input variable P_1 is 9-dimensional vector, and the target vector is output vector T_1, is competitive performance:

P_1=[$Lturnover_{i,t}$, $Iturnover_{i,t}$, $ARturnover_{i,t}$, $APturnover_{i,t}$, $CCC_{i,t}$, $Liquidity_{i,t}$, $Size_{i,t}$, $SE_{i,t}$, $Salesgrowth_{i,t-1}$]。

T_1= [$Salesgrowth_{i,t}$]

This paper used single hidden layer BP network to predict. Due to input sample was input vector of 10-dimensional, therefore, input layer has 9 neurons. The middle layer of neurons network can take 18 nerve cells, according to Kolmogorov theorem. The output is 1-dimensional vector and the output of neuron is only one. Neural network model was shown in Figure 1.

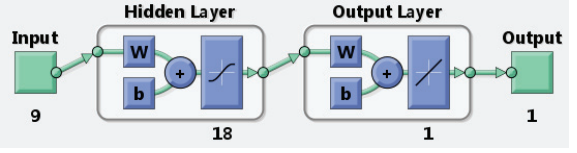

Figure 1 Neural Network Model

As the input vector and output vector are based on the results of the corresponding model of dynamic panel regression, the sample of neural networks comes from the corresponding regression samples. To ensure the results of the prediction, we removed the sample in which there is a vacancy of input vector and output vector. On this basis, take 70% of the sample as the training sample, 15% as the validation sample, and the remaining 15% as the test sample. The training samples directly involved in training of the network, network will continue to make adoption and adjustment according to the error of the training sample. The validation sample is for testing the versatility of the network, stop the training when the network versatility is no longer optimized. Test samples are used to test the effect of network forecast after the network training. Using the neural network toolbox of MATLAB for training, the results of the return of the training include the mean squared error and the correlation coefficient of output value and target value. And the smaller the mean squared error, the better. 0 means there is no error between output value and target value. Correlation coefficient of 0 indicates no correlation between output value and target value. And the coefficient closer to 1 indicates the relationship between the output value and target value is closer. Besides, training error map can visually see changes of all kinds of the error in the sample during the training process. The regression map of the three kinds of samples and the overall sample can visually see the effect of training samples. The error and error map of the output value and target value of the test sample can visually predict the performance of visual effects.

The total sample of BP neural network prediction is 6996, of which 4898 training samples, 1049 verification samples, and 1049 test samples.

4.2.1. BP Neural network prediction of overall sales growth

In this part we use BP Neural network to predict the overall sales growth. The error variation of the three types of sample in the forecast process is shown in Figure 2. The competition performance reaches the best validation performance at epoch 8.The

mean squared error of the training samples is 24.48, the mean squared error of the validation sample is 15.15,and the mean squared error of the test sample is 30.36. The regressions of the three kinds of samples and the overall sample are shown in Figure 3. As can see in the following Figure 3, the training samples, the validation sample and the test sample are still near the line Y = T, which indicates that the overall prediction effect is good.

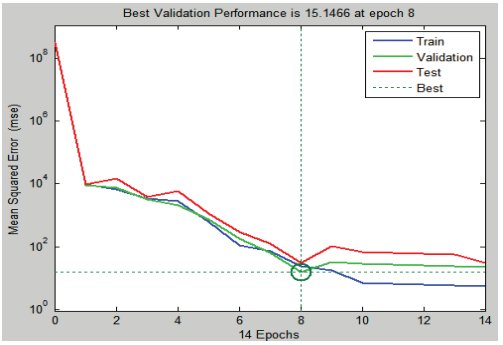

Figure 2 Neural network training process and error of overall sales growth

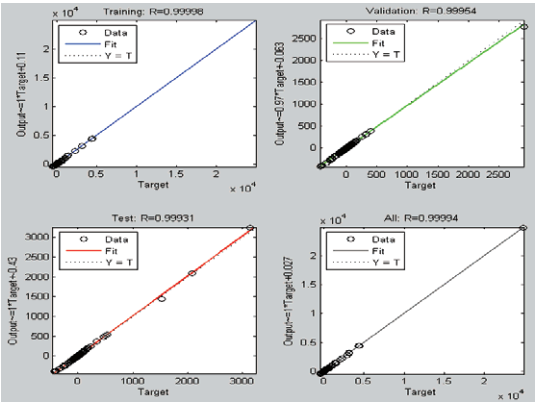

Figure 3 Three types' samples' regression figure of overall sales growth

4.2.1. BP Neural network prediction based on panel regression results

In this part we use BP Neural network to predict the effect of working capital on competitive performance based on the panel regression results. The error variation of the three types of sample in the forecast process is shown in Figure 4. The mean squared error of the training samples is 1111.01, the mean squared error of the validation sample is 2772.82, and of the test sample is 2498.84. The regressions of the three kinds of samples and the overall sample are shown in Figure 3. As can see in the Fig5, most of the sample is still near the Y = T, which indicates the overall prediction effect is good.

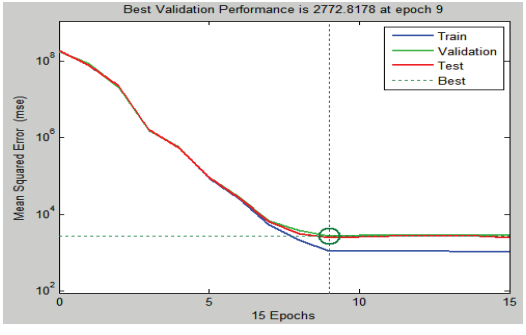

Figure 4 Neural network training process and error

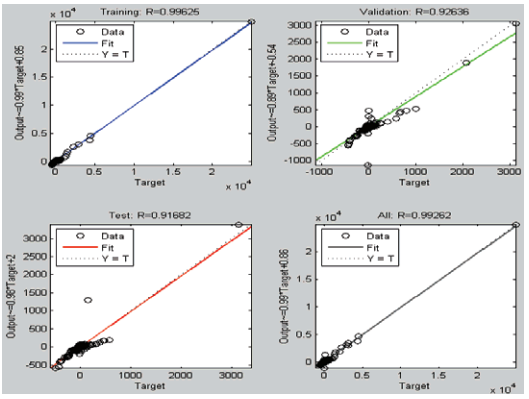

Figure 5 Three types' samples' regression figure of overall sales growth

In order to further clarify the error between the test sample and the BP neural network prediction, we draw the error figure of the test sample, as showed in Figure 6. We can see, as the sample in which the sales growth is too high or too low, the effect prediction of the neural network was not good in that part of the sample. However, the prediction is quite good for the vast majority of the sample in the normal range. Then, to further determine the prediction results of BP neural network on working capital's market competition effect, we compared the actual value of test samples and the predicted values of BP neural network output value, as showed in figure 7. The figure indicates that the prediction is quite good for the vast majority of the sample in the normal range. The analysis results show that we can get good prediction results of the impact of working capital on competitive performance with a neural network.

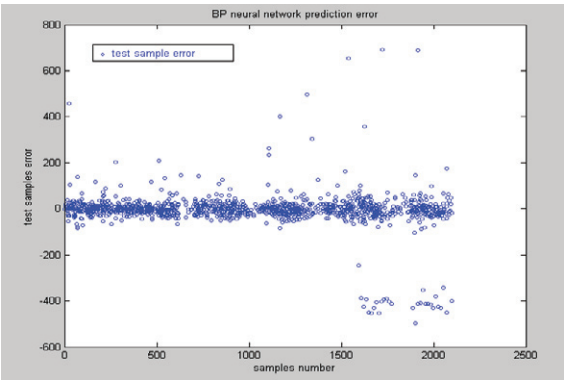

Figure 6 The error figure of the test sample

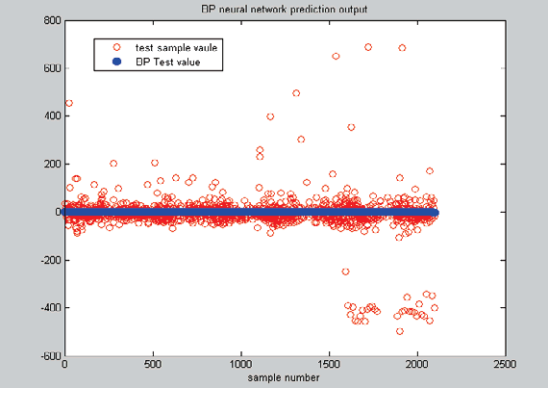

Figure 7 Three types' samples' regression figure of overall sales growth

5. Conclusion

The research on the relationship between product engineering market competitive performance and working capital in manufacture industries has a very important practical significance. This paper discusses the effect of working capital on product market competition performance from turnover ability and liquidity two aspects. Through the dynamic panel data system GMM estimates, and BP neural network prediction can get the following conclusion:

*(1)*Enterprise engineering working capital turnover ability has positive effect on product market competition performance while enterprise working capital liquidity has a negatively relationship with market competition performance. Liquid assets turnover and inventory turnover in 1% significant level are positively related to market competition performance. Accounts receivable turnover reflects the enterprise recovery receivable ability and speed. Accounts receivable turnover is high, the cycle that enterprise recovery receivable is shorter, the liquidity of assets is more quickly. In the significance level of 10%, the manufacture industry accounts receivable turnover in general has a strong positive relationship with market competition performance. Enough liquidity on one hand can be used for its debts, on the other hand for promoting sales revenue growth. Cash conversion cycle reflects the situation of enterprise working capital management. Shorter cash conversion cycle means enterprise can use more cash and operation efficiency is high. In significant level of 1%, cash conversion cycle has negative effect on market competition performance. Besides, working capital's liquidity is negatively related to market competition performance.

*(2)*Linear regression based on dynamic panel data, examined the impact of working capital on competitive performance. But according to the regression equation to predict the competitive effects of working capital, exists larger error, because the actual impact of working capital on competitive performance may be nonlinear. So we use BP neural network model to predict the competition performance, and the results indicate the overall prediction effect is good.

This paper further enriches the study on the interaction between working capital and market competition through using the engineering dynamic panel data system GMM estimates, and BP neural network prediction. But our study only researches the linear correction between the enterprise market performance and working capital, the existence of non-linear relationship between them is not explored, particularly, no theoretical analysis for industrial differences of the effect of working capital on market performance, we look forward to research on these questions.

6. Copyright

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