RESEARCH ON THE RELATIONSHIP OF BANK INDUSTRY'S STOCK PRICE AND TRADING VOLUME WITH PANEL DATA MODEL

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Abstract: Panel data becomes the main data vector with the development of the information technology. The panel model has been applied to many fields such as economics, management and science. In the panel fixed effects regression model, explanatory variable is a constant but the interception changes according to the individuals. Relationship between trading volume and price of stock is not only a way to understand the structure of financial market, but also an effective way to study the arbitrage opportunities and effectiveness of market. In this paper, we take the stock of banking industry as an example, using the fixed effects regression model to analyse the relationship between quantity and price of the stock. It is concluded that the volume fluctuation of stock has significant influence on the price of the stock. As each additional unit of volume of banking stocks is increased, stock prices will increase by 0.003377 units. It shows that the stock market trading volume is the internal driving force of stock price. Trading volume directly reflects the relation of supply and demand in stock market, and to some extent, it determines the trend of the price changes. At last it is found the panel fixed effects model is an effective tool to analyze the relation between trading volume and price of stock.

1 INTRODUCTION

As social economics is becoming increasingly complex, panel data turns to be more popular. There is a limitation to solve the financial and economic problems by using simple application of section data and time series data. Panel data is the combination of cross-section data and time series data. As a statistical model, it is widely used in financial and economics fields. Panel data provides researchers with a large number of data points. It increases the degree of freedom and at the same time it reduces the collinearity about the explanatory variables. It can overcome the defects of the cross-section model and time series model. It can characterize the heterogeneity of cross-sectional data and make its economics significance better. It is beneficial to study the dynamic problem and construct and test behaviour model which is much more complex.

Recently, stock prices and volume trading in financial market attract people's attention, because the relationship between volume and price is not only a way to understand the structure of financial markets, but also an effective way to study the arbitrage opportunities and the important means of market. People also think that stock trading volume is the internal driving force, because it directly reflects the situation of the stock market's supply and demand. To some degree, it decides the direction of price changing. In Modern financial theory, as any factor on the impact of the stock market can be reflected in market behaviour. So stock trading volume and stock prices become basic variables to describe the benefits and risks.

2 LITERATURE REVIEW

There are many studies about the relation between of stock price and trading volume by scholars, some representative researches are as follows:

At first, the Granger causality test of the stock price and trading volume are discussed. Yiling Chen, Fengming Song[1] (2002), Chenwei Wang, Chongfeng Wu[2] (2002), Jiatao Bian, Suo Jiang[3](2008) and so on selected the data after the

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split share structure reform. They used cointegration, ECM, Granger causality test and impulse response function to make a comprehensive in-depth study of the relationship between the stock prices and trading volume. They conclude that stock trading volume changes bring more influences on the changes of stock prices, while the changes of stock price bring less influence on stock trading volume changes.

Secondly, GARCH model are used to study the relation between stock price and trading volume. According to the theory of MDH, Lamoureux and Lastrapes (1990) took the trading volume as an exogenous variable into the GARCH model wave equation to test the relationship between trading volume and price volatility. Yanhui Wang, Kaitao Wang[4]（2005）characterized the volatility of stock returns and verified the impact of trading volume on volatility persistence with GARCH model. Based on mixture distribution model, Bin Yang[5](2005) used the extended GARCH model to explain the volatility persistence impact of the trading volume on the stock price. Shuangcheng Li, Hongxia Wang[6] made an empirical study on the relationship between the Chinese stock market volume and price and non-symmetrical component GARCH-M model.

Thirdly, other methods are used to analyse the relation between stock price and trading volume. Zhengming Qian, Penghui Guo[7], Feng He, Zongcheng Zhang[8] and Fuyu Feng[9] used quantile regression to analyse the relation between stock price and trading volume. With the theory of plasticity and elasticity in the field of physics, Aimei Zhai, Xuefeng Wang[10] study the inflect of plasticity and elasticity those happened in stock price changes and the stock price volatility that is driven by stock volume by means of the simulation.

From the review of the literature about relation between stock price and trading volume, we can see that although there are a lot study of the relationship between trading volume and price of the stock, those are mainly based on time series analysis, most of which are the causation-based models and GARCH models. There are many space for the analysis of the relation between trading volume and price of the stock with panel data models.

3 PANEL FIXED EFFECTIVE MODEL

Time-series data or section data is one-dimensional data. Panel data is the two-dimensional cross-section data obtained in time and space, which is named as time-series and cross-sectional data.

Panel data is defined by variable y about n objects observed t periods obtained a two-dimensional structure of the date,

$$y_{it}\ ,\quad i=1,2,\cdots,m\ ,\quad t=1,2,\cdots,n$$

Because panel data includes changes in cross-sectional data, panel data analysis needs to consider the differences between each individual. We suppose that individual differences between the regression models are mainly reflected in the constant term, it forms a simple prototype model of panel data analysis

$$y_{it}=\sum_{k=1}^{n}\beta_{ki}x_{kit}+u_{it} \tag{1}$$

Here, $i=1,2,\cdots,m$ shows there are m individuals; $t=1,2,\cdots,n$, means there are n time points; $k=1,2,\cdots s$, indicates there are s explanatory variables; x_{sit} means the value of explanatory variable s we observe individual i at time t . β_{si} is a parameter to be estimated, and u_{it} is a random error.

In Linear regression of panel data, different interfaces and different time series cause different intercepts. But the slope coefficients are the same, we name this model as fixed effective model. It is as follows:

$$y_{it}=\alpha_i+\sum_{k=1}^{s}\beta_{ki}x_{kit}+u_{it}\ ,\ i=1,2,\cdots,m\ ,\ t=1,2,\cdots,n\ ,\ k=1,2,\cdots s \tag{2}$$

The estimator of parameters α_i is the residual of the individual observed value. It is $\alpha_i=\overline{y}_i-\overline{x}_i\hat{\beta}$. According to the least squares, $\hat{\boldsymbol{\beta}}$ is an estimator of $\boldsymbol{\beta}$. Based on parameter estimator of the fixed effects model, the residual sum(RSS) of the fixed effective models have different terms of constants.

$$RSS=\sum_{i=1}^{m}\sum_{t=1}^{n}(y_{it}-\hat{\alpha}_i-x_{it}\hat{\boldsymbol{\beta}})^2 \tag{3}$$

As the same, the residual sum of the fixed effective models have the same terms of constants.

$$RSS^*=\sum_{i=1}^{m}\sum_{t=1}^{n}(y_{it}-\hat{\alpha}^*-x_{it}\hat{\boldsymbol{\beta}}^*)^2 \tag{4}$$

If the error term of the fixed effective model u_{it} is a normal distribution $N(0,\sigma_u^2)$, using different panel data model RSS and RSS^* , F statistic can be constructed.

$$\frac{(RSS^{*}-RSS)/(m-1)}{RSS/[mn-m-(k-1)]} \sim F(m-1, mn-m-k+1) \quad (5)$$

The premise of Hausman test is that the model contains random effect. It relates to the explanatory variables. Therefore, the null hypothesis H_0: in the assumption of random effects and explanatory, variables are not related, internal estimator (for the virtual variable model) and the estimator that obtained from GLS are consistent, but internal estimator is not effective. Alternative hypothesis H_1: in the assumption of random, effects and explanatory variables are related, and GLS is no longer consistent, except for the internal estimator.

Thus in the original assumption, the gap of absolute value of $\hat{\beta}_w$ and $\hat{\beta}_{GLS}$ should not be large, so it should be reduced by increasing the sample size, which gradually approaches to 0.

Hausman analyzed the statistics of test with this statistical feature

$$W=\left(\hat{\beta}_w-\hat{\beta}_{GLS}\right)'\Sigma_{\beta}^{-1}\left(\hat{\beta}_w-\hat{\beta}_{GLS}\right) \quad (6)$$

Here Σ_{β} and Σ are different. The discrepancy between the matrix covariance of two estimators (Hausman's basic conclusion is that the discrepancy between valid estimator and non-effective estimator, $\left(\hat{\beta}_w-\hat{\beta}_{GLS}\right)$) equals to 0, so

$$\Sigma_{\beta}=Var\left(\hat{\beta}_w-\hat{\beta}_{GLS}\right)=Var\hat{\beta}_w-Var\hat{\beta}_{GLS} \quad (7)$$

Hausman test is widely used to test the rationality of the selected panel data model.

4 APPLICATION OF THE PANEL FIXED EFFECTIVE MODEL IN STOCK ANALYSIS

Taking banking stock as an example, we use fixed effective model to analyse the relation with trading volume and stock price. The banking stocks data is from the GW stock software. We select the opening price, closing price and trading volume data from June 30, 2010 to Dec 31, 2010 as research objects. As Anxin Trust closed market and the Agricultural Bank of China and China Everbright Bank listed later, the research data does not contain these three stocks. This data includes shares of other 16 banking stocks. This article uses the Eviews software to analyse. Closing stock price is expressed by p, and trading volume is expressed by q. In order to exclude the impact of dimension to the model, at the beginning of the study, the data are standardized. Then the results of data analysis are as follows:

Table 1: The fixed effects of stock trading volume on the stock price.

Var	Coef.	t-Stat	P
C	12.00	316.97	0.000
q	0.0034	5.93	0.000

From the results, we can see that in the bank forum the marginal effects of the stock trading volume on the stock price are the same, it is 0.003377, which means each additional unit of volume increasing promotes stock prices up by 0.003377 units. However, the prices of banking stock are affected by the fundamental value, which is significantly differently, just as following Table 2.

Table 2: The fundamental value of bank shares.

Bank shares	Value
Shenzhen Development Bank A	18.75
Bank of Beijing	13.28
Bank of Nanjing	6.45
SPD Bank	1.57
China Merchants Bank	1.45
Bank of Communications	0.54
Bank of Ningbo	0.51
Huaxia Bank	-0.42
Industrial Bank	-0.96
Shan Guotou A	-1.31
AJ Stock	-2.54
ICBC	-6.34
China Minsheng Bank	-6.98
BOC	-7.34
CCB	-7.95
China CITIC Bank	-8.71

The stock with the highest fundamental value is Shenzhen Development Bank, which is almost three times of the Bank of Nanjing, followed by the Bank of Beijing, whose fundamental value is up to 13.3. But some state-owned commercial banks such as ICBC, CCB and BOC shares, whose fundamental values are negative. There are more than half of the bank's stocks' fundamental values are negative, most of which are state-controlled banks. This shows that overall of the state-controlled banks is worse than foreign-funded banks and the local banks those have geographical advantages and operating characteristics. Therefore, the state-controlled banks should find out the reasons and take measures, explore their advantages, accelerate development to improve the operating conditions. From the results of the data we can obtain the model. The model of Shenzhen Development Bank A is

$$p=18.7540+0.003377q \quad (8)$$

The model has passed the t test and F test, and its goodness of fit is to 0.9795, which indicates that the model is effective. We can get the other bank stocks' trading volume and price models for the same reason.

Modify Hausman test procedures with Eviews software. The program results are as follows.

Table 3: Hausman test for fixed versus random effects.

Chi-sqr(1)	524.66
p-value	0.000

Table 3 shows that, Hausman test reject the null hypothesis, so the panel fixed effective model is reasonable.

Observing the residuals of the regression model, it is found they are white noise residuals. Take the model residuals of ICBC, CCB, BOC and CITIC Bank as examples.

From the Observation we can find that the residual series fluctuations in the value of 0, and it is white noise sequence, which proves the validity of the model.

Table 4: The fixed effects of the stock price on the stock trading volume.

Var	Coe	t-Stat	P
C	-6.30	-0.63	0.53
P	4.85	5.93	0

The volume of stock does have impact on stock prices. Then, what impact would stock price have on the volume of stock transactions? Data analysis results are as Table 4.

According to the data results in Table 4, each additional unit of volume increasing promotes stock prices up by 4.85 units. The model has passed the t test and F test and its goodness of fit is to 0.4321, which shows that the extent explanation by stock prices on the amount of stock transactions is 43.21%. The fitness of the model is not so good. It shows that stock price can not explain the change of stock volume effectively.

5 CONCLUSIONS

The above results show that in China's banking industry, the fundamental values of different kinds of bank shares are different. The fundamental value level of the overall of state-controlled banks is lower than that of foreign-funded banks and local banks. As each additional unit of volume of banking stocks increases, stock prices will increase by 0.003377 units, it has great impact on stock prices. It can be concluded that the stock market trading volume is the internal driving force of stock price. Trading volume directly reflects the relation of supply and demand in stock market, and to some extent, it determines the trend of the price changes. At the same time, it can be found that the panel fixed effects model is an effective tool to analyze the relation between trading volume and price of stock.

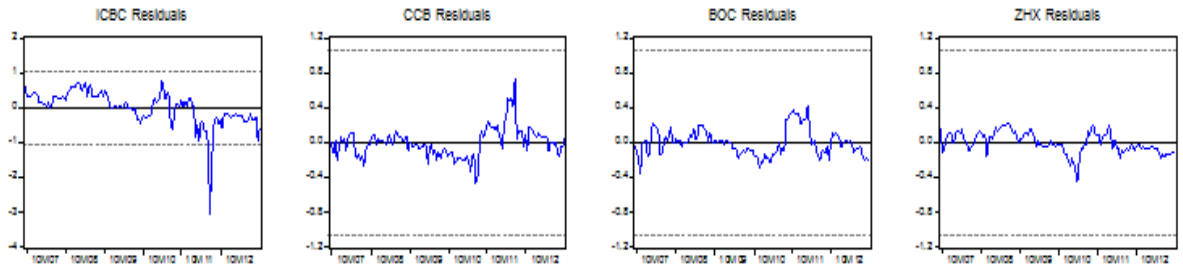

Figure 1: ICBC, CCB (CCB), BOC, CITIC Bank model residuals.

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