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What explains firm valuation? Evidence from the Chinese manufacturing sector

Sha Qiang[a], Yun Joo An[b], Moon Sub Choi[c]
[a]College of Business Administration, Ewha Womans University, Seoul, South Korea
[b]School of Economics, Yonsei University, Seoul, South Korea
[c]Ewha Womans University, Seoul, South Korea

중국 제조업 상장기업의 가치평가 설명요인에 관한 연구

Sha Qiang
이화여자대학교 일반대학원 경영학과 석사

안연주
연세대학교 본대학원 경제학과 석사과정

최문섭
이화여자대학교 경영학부 부교수

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Abstract

The price-to-earnings ratio (PER) is an important indicator to measure the stock price and profitability of a firm; it is also the most used valuation indicator among investors. When using the PER to compare the investment values of different stocks, these stocks must come from the same sector. This study mainly focuses on the China's listed manufacturing firms. By learning from previous research results and analyzing the current situation, we studied the correlation between the manufacturing sector's PER and its influencing factors from both macro and micro perspectives, the combination of which eventually sheds light on such correlation. Analyzing GDP growth rate data, Manufacturing Purchasing Managers' Index, and other macroeconomic variables from 2008 to 2018, we conclude that these variables jointly have a certain impact on the average PER of the manufacturing sector. We then form panel data based on relevant (2014–2018) data gathered from 317 of China's A-listed manufacturing firms to study the impact of micro-variables on PER. By using Stata and other software to analyze the panel data, we reach the conclusion that the Debt to Asset Ratio, Return on Equity, EPS growth rate, Operating Profit Ratio, Dividend Payout Ratio, and firm size have a significant impact on PER. The Current Ratio, Treasury Stock ratio and Ownership Concentration have no distinct effect on PER. Based on our empirical findings, we design a theoretical model that affects the PER.

Keywords: Chinese Listed Firms; Manufacturing Sector; Price Earnings Ratio
JEL Classifications: G32, L6, C33

[a] First Author, E-mail: qs121@ewhain.net
[b] Co-Author, E-mail: yjan@yonsei.ac.kr
[c] Corresponding Author, E-mail: paul.choi@ewha.ac.kr

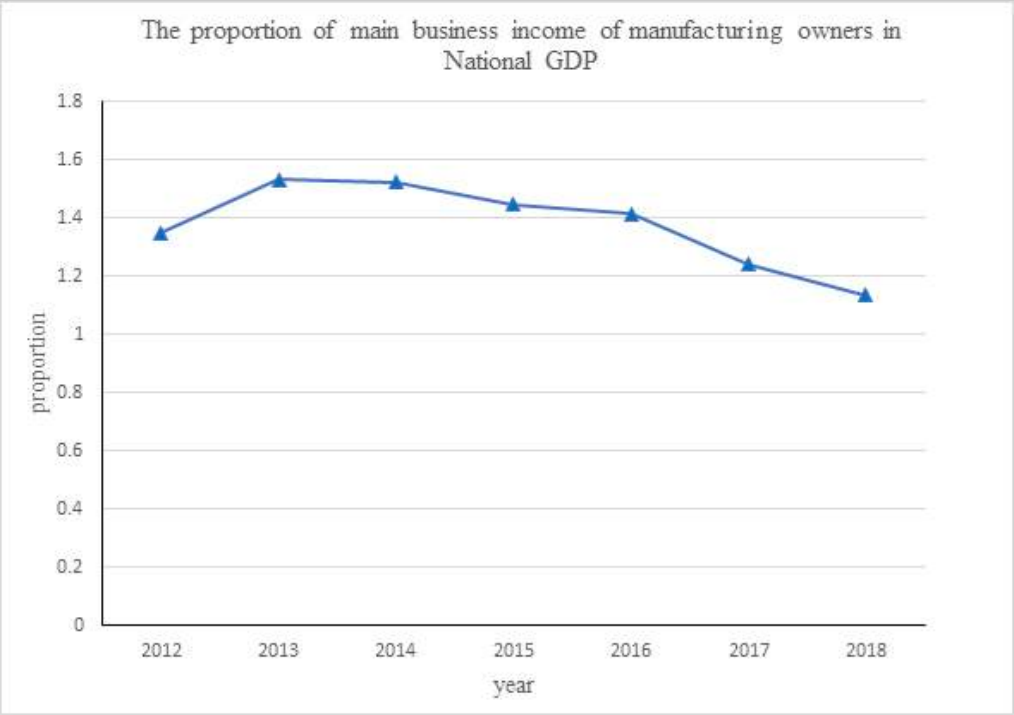
Ⅰ. Introduction

The Price-to-Earnings Ratio (PER) is the ratio of the common stock price to the after-tax profit per share. It is an important indicator used to measure the stock price of a listed firm in relation to its own profitability. The PER is not only a mirror of anticipations held by the stock market to the future earnings of listed firms but also links the correct market reaction to the operating performances of listed firms. It is an important indicator for judging the value of the securities market, weighing market risks, and forecasting investment returns. For investors, the PER can help investors assess a firm's value to choose an appropriate investment target, as well as revealing the risk of potential investment targets, thereby optimizing the investment strategy. For market regulators, the PER can help detect security-market bubbles, formulate reasonable regulatory measures, conduct market regulation in a timely manner, and stabilize the standard operations of the market. However, there is no universally applicable selection principle for the PER and its determining criteria. For this reason, market participants and scholars have been arguing endlessly, especially over the fact that in China's securities market, firms are listed through approval, and there has been a tight admission standard, whereas in Europe and the US, they need be registered. Such differences lead to a surplus of speculation value to China's listed firms; as a result, the PER cannot truly reflect the actual value of a listed firm in China. Thus, our main research goal is to determine how to correctly evaluate the PER of China's securities market and rationally assess its value.

The core meaning of the PER is the price that investors will and must pay for each dollar they receive. Therefore, this indicator has become one of the simplest and most basic indicators for evaluating the value of listed firms. Of course, when using this indicator, we must pay attention to the comparability between stocks. Yin and Hu (2008) suggested that the stock the PERs of different sectors were very different, mainly because each sector has a different life cycle. If the PER is used to compare the value of firms, moreover, it is necessary for the listed firms to be in the same sector; otherwise, there is no comparability. In addition, listed firms in the same sector will have large differences in the PERs for various reasons, such as differences in development stages and in size. Whether the PER is absolutely good or bad, how to treat it correctly can be further understood from its influencing factors. Therefore, the empirical research on PERs—especially the factors that affect them—is more conducive to the quantitative analysis of the main factors affecting the PER of China's stock market, and provides a reference for quantifying the PER and making rational investment decisions for investors.

As the main pillar of the national economy, an important source of technological innovation, and the material guarantee of a society, the manufacturing sector plays an important role in promoting economic and social development. After 70 years of development and continuous expansion, China's manufacturing sector has become the largest manufacturing sector in the world. Figure 1 shows the proportion of the main business income of China's large-scale manufacturing firms (i.e., firms with annual main business income of CNY 20 million and above) in China's GDP from 2012 to 2018. In accordance with the data of the United Nations' Industrial Development Organization,

Fig. 1. The Proportion of the Main Business Income of China's Large-Scale Manufacturing Firms China's GDP from 2012 to 2018.



the added value of the 22 manufacturing industries in China is among the highest in the world, with the added value of textiles, clothing, leather, and basic metals accounting for more than 30% of the world. The output of hundreds of major manufactured products, such as steel, copper, cement, chemical fertilizers, chemical fibers, power generation, shipbuilding, automobiles, computers, notebook computer, printers, televisions, air conditioning units, and washing machines, ranks the first in the world. It can be said that China has transformed into a manufacturing country with the most complete industrial system and industrial supporting facilities in the world, as well as the most important processing and manufacturing base. According to the report,[1] as of June 30th, 2018, there were 3,527 A-share listed companies in China, including 2,224 listed companies in manufacturing, accounting for 63.06%. The total market value of A shares is CNY 55.02 trillion, of which the total market value of listed companies in manufacturing is CNY 24.08 trillion, accounting for 43.78%.

Based on the above research background, this paper studies the PER based on Chinese A-share manufacturing-listed firms. The established econometric model is a supplement and improvement of the PER valuation method and has certain theoretical value. In practical application, it can provide a certain value-judgment-basis for institutions

1) Report data from the Shanghai Securities News. http://www.cnstock.com/

and individual investors. Based on the empirical analysis, it is explained to investors which financial information of listed firms should be focused on when investing and how to use financial information to make a reasonable estimate of PER, such that they can then make a rational investment.

Zang (2004) proposed that the overall the PER of China's securities market was relatively high, and the internal structure of stock market the PER was very different. This shows that the heterogeneity of China's stock market is strong, and the PERs of stocks of different industries, different performance levels, different scales and different styles will have large differences. Therefore, we should analyze the PER from different perspectives so as to better understand its structure and judge its level. Since the PER is not an isolated indicator, it is affected by many factors. We use data from macroeconomics- and manufacturing-listed firms to divide the PER into the manufacturing sector's average PER and manufacturing individual firm stock PER, studying the impact of macro factors on the manufacturing sector's average PER and micro factors on manufacturing individual firm stock PER. The empirical analysis of both macro and micro aspects shows the correlation between the manufacturing sector's PER and its influencing factors.

Bai, Liu, Lu, Song, and Zhang (2004) research the relationship between stock issue to international investors and market valuation in China. They find that government regulation on foreign investment, both country and county level, lead to low market valuation. Rather, not regulating shareholding and prosperously issuing stocks to foreign investors increase market valuation of China. Zhao (2010) use likelihood ratio statistic, VAR, and GARCH model to conclude that foreign exchange and Chinese equity market have bilateral volatility spillovers. The researcher uses real effective exchange rate as a measurement of foreign exchange, in which the rate fluctuation showed active foreign investment in and out of China. Firm valuation and company innovations have significant effects on volatility of real effective exchange rate. The researcher conducts multiple robustness tests to confirm the effectiveness in the other direction, where foreign investment change affects future volatility of equity market.

The firm valuation and international trade maintain its relationship when we look at joint corporate governance and multinational firms. Chen, Hu, and Joseph (1991) investigate 88 U.S. firms built and operating in China. After controlling all relevant variables, they argue that joint venture announcements empirically increased portfolio excess return. In their evidence, U.S. increases firm value as their companies expanded branches to China, becoming Multi-National firms. Cheung, Jiang, Limpaphayom, and Tong (2008) analyze Chinese firms listed abroad. They construct their own model, Corporate Governance Index, after then to conclude that oversea-listed Chinese firms pay more attention to financial disclosure and transparent corporate governance than non-oversea-listed Chinese firms. However, they acknowledge that the fine disclosure and transparency have not yet been fully reflected in market valuation of Chinese companies. The previous studies find that foreign direct investment, where Chinese firms invest on foreign markets and international firms expand in China, have significant impact on China's market and firm valuations. Our paper stands on the side of the previous literature. We emphasize the association of

foreign investment and international trade with firm and market valuation in China.

Kim, Dong, and Kim (2016) claim that firm size has positive effects on frequency and financial value of trade. They add that firm product does not significantly affect trade type. Lee and Kim (2016) examine the effects of entrepreneurial behavior and entrepreneurial environment on economic growth and trade, using firm-level data. They find that trade facilitates the relationship between entrepreneurial behavior and economic growth, in which trade fastens process of a firm grasping opportunities. Li, Chung, and Sohn (2016) propose a noteworthy determinant of firm valuation. Amplifying trade magnifies the role of e-Commerce in Small and Medium-sized Enterprises. China's increasing trade and lessening controls have positive effects on e-Commerce implemented by Small-and Medium-sized Enterprises. Choi (2003) examines early evidence on benefits and hardships of implementation of E-Commerce in economies with voluminous trade, imports and exports.

The main content of this study is divided into five sections: The first section is the introduction, which explains the research background, research objects and purposes, and research ideas. The second section presents the relevant theoretical basis, which explains the related concepts of the PER, its influencing factors, and its traditional theoretical model. Then, the previous domestic and foreign research is considered and discussed. The third section is the correlation analysis between the average PER of the manufacturing industry and macro factors. This includes our research hypothesis, explanation of research variables and data, research methods, empirical analysis, and conclusions. The fourth section is the correlation analysis between the PER and micro factors of manufacturing-listed firms. This includes our research hypothesis, selection of research samples, interpretation of research variables, research methods, selection and construction of research models, and analysis of empirical results. The fifth and final section draws conclusions based on the findings of our research.

Ⅱ. Price-to-Earnings Ratio, Theories, and Empirical Literature

1. Price-to-Earnings Ratio

The PER is the ratio of stock price to earnings per share. The PER reflects the contrast between two values, namely the external market value and the inherent income. The market value reflects the risk of the stock, and the return reflects the return of the stock. Therefore, the PER can also be simply understood as the investment return period of a stock—that is, the number of years to recover the stock price. The higher the PER is, the higher the cost of obtaining the relevant rights will be, and the longer the term of the stock price is recovered. Conversely, the lower the PER is, the lower the relevant investment and the shorter the payback period is. In addition, the PER can also reflect the market's optimism about a certain firm. If the PER is high, it indicates that the market expects the firm's prospects to be high. Most investors in the market have a good attitude towards the firm. Conversely, a lower PER represents a worse market expectation for the firm in the short term.

In terms of classification, the PER can be divided into the historical PER and expected PER. The historical PER is also known as the

static PER. The historical PER is involved in the analysis of general investors or various types of investment. The calculation formula is the market price of the stock divided by the after-tax profit per share for a specific period of time. However, due to the limitations of its calculation method, the historical PER has an obvious defect. Because listed companies cannot accurately provide after-tax profits per share, they can only be calculated using the data of the previous or semi-annual financial reports; however, the data of each stock price available on any day after the reporting period. From the time dimension, the two are not synchronized, and there are certain differences. In order to avoid this shortcoming of the historical PER, the expected PER emerges. The expected PER is calculated by dividing the market price of the stock by the expected earnings per share, while the forecast for earnings per share is based primarily on the projections from the income statement. Although the defects of the historical PER can be effectively corrected, there is a certain problem in the expected PER, namely the accuracy of the expected earnings per share. Since the forecast of the after-tax profit for the next year is usually affected by various factors such as the macroeconomic environment and industry policies, the reliability of such predictions is also controversial.

In this study, the PER is divided into the market average PER and individual firm stock PER. The average PER of the stock market comprehensively reflects various factors. There are two factors that directly determine the average PER, namely the price per share and the earnings per share of the listed firm's individual stocks. When further analyzing the reasons for the impact on the average PER, it is found that there are mainly macro factors such as the basic national conditions of a country, economic development status, interest rate levels, and inflation rate. The calculation of the average PER of the securities market and the analysis of its influencing factors is conductive to making a more comprehensive, reasonable and objective judgment on the overall investment value of the market. An individual firm stock PER represents the firm's growth, and it is believed that a stock market earnings ratio heralds the future growth of the firm's accounting earnings. Analyzing the factors affecting the individual firm stock PER can help investors to better understand their investments so that they can make the right decisions. Therefore, as the average PER and individual stock PER are important reference indicators for investors to evaluate the value of stock investment, they have universal applicability, strong comprehensiveness, and strong contrast.

2. Theories

With regard to corporate valuation theory, a complete theoretical system has been formed. Williams' (1938) idea of corporate value and cash flow laid a solid foundation for Modigliani and Miller's (1958, 1963) theorems and Sharpe's (1964) Capital Asset Pricing Model (CAPM). As the research made progress, various valuation models were proposed, including Gordon's fixed-dividend growth stock valuation model and Fischer Black and Myron Scholes' option pricing model, including the most famous Discounted Cashflow Model. These models have constituted the current, relatively mainstream and practical theoretical basis in enterprise valuation theory. This study only elaborates and expands the following two most classical theoretical models.

1) R.M. Theory

The R.M. theory was proposed by Rubinstein (1976) which is based on the theory of stock pricing in corporate finance theory, based on which to expand research. The theory of stock pricing is that the stock price should be equal to the sum of the income and cash flow of the stock in each future period, which is discounted according to the expected rate of return of investors as the discount rate. In the research process of R.M. theory, if the cash inflow of each stock is the same, and the stock has no expiration date, this cash inflow can be regarded as a perpetual annuity. Among them, the cash income of each period refers to the dividends paid by the enterprise. With regards to the above theory, the cash flow generated by the stock can be the cash dividend paid by the stock, and the transfer income of the stock among different investors is only the flow of cash flow between different investors. Therefore, there is no cash inflow for the entire investment market, and the discount rate is the expected rate of return required by investors. Therefore, according to the derivation, the price of the stock is the cash dividend of each period of the stock divided by the expected rate of return of the investor. The formula can be expressed as

$$P = \frac{D}{R},$$

where P represents the market price of the stock, D represents the cash dividend of the firm, and R represents the necessary rate of return of the investor.

Assuming that the after-tax profits of each period of the firm are constant and are used for dividend distribution, the formula can be further derived as $P = \frac{E}{R}$. E represents the after-tax profit of each period of the enterprise. After the equation transformation,

$$\frac{P}{E} = \frac{1}{R}.$$

So, the PER is equivalent to the reciprocal of the investor's expected rate of return (the required rate of return). For example, if an investor's reasonable expected return on a stock is 5%, then its PER should be 20. It can be concluded that the PER reflects the expected return on investment of investors to some extent. Therefore, when the investor's expected rate of return on the stock is low, the PER is higher; conversely, when the investor expects a higher rate of return, the PER is lower.

2) Gordon Model and Expansion

Gordon's (1959) model also reveals the factors that influence the PER. The Gordon model is a widely used stock valuation model that reveals the relationship between stock prices, expected base dividends, discount rates, and fixed dividend growth rates. On the basis of satisfying the assumptions, the model proposes that the firm brings cash income to shareholders through a series of business activities, and this part of the cash income will be distributed to shareholders in the form of dividend distribution, which can be regarded as a perpetual inflow of future dividends. In the process of investing, investors can earn income when they buy stocks: part of the capital gains obtained from stock price changes at the end of the stock holding period. The other part is the dividends obtained during stock holdings due to stock

dividends. The value of a stock lies in its holder's control over the future cash flow of the firm, and the future cash flow of the firm is usually distributed to investors in the form of dividends. Therefore, under certain assumptions, the future price of the stock is equal to the firm's future dividend divided by the relevant discount rate.

The general model usually assumes that the business is sustainable—that is, that the operating time n tends to be positive infinity, as follows

$$V = \sum_{t=1}^{\infty} \frac{D_t}{(1+R)^t},$$

where V represents the intrinsic value of the stock, represents the cash dividend for t years, and R represents the discount rate or the required rate of return required by investors.

In the operation of the enterprise, in order to avoid the special situation of a sharp growth and decline in performance, the firm often has a smooth profit situation, which makes the annual financial situation maintain a relatively stable growth situation and presents a stable operation mode. The model further assumes that corporate dividends increase at a fixed rate(g) of growth, such that the model becomes the following:

$$P_0 = \sum_{t=1}^{\infty} \frac{D_0(1+g)^t}{(1+R)^t}.$$

When $R > g$, the formula can be simplified as

$$P_0 = \frac{D_0(1+g)}{(R-g)} = \frac{D_1}{(R-g)}.$$

Dividing both sides of the equation by firm profit (E_1)

$$\frac{P_0}{E_1} = \frac{D_1}{E_1(R-g)},$$

where $\frac{D_1}{E_1}$ represents the dividend payout ratio.

The factors that affect the PER are the dividend payout ratio, the investor's required return (R), and the dividend growth rate (g). From the formula, the relationship between the PER and the numerical relationship between various factors can also be obtained. Among them, the PER is positively correlated with the dividend payout ratio and the dividend yield, and negatively correlated with the investor's required return rate (R). This is completely consistent with the basic concept of the cash flow discount model. At the same time, we found that even if a firm has a high growth rate, it does not necessarily have a high PER, because the PER also depends on the investor's necessary rate of return, and the rate of return is also related to the market environment, the firm's operating conditions, and risk conditions.

Above, we found that the Gordon model is very useful for the study of the factors affecting the PER. It allows investors to determine the intrinsic value of a firm that is not affected by current stock market conditions. Second, the Gordon model measures future dividends, focusing on the actual cash flows that investors expect to be available, and helping companies in different sectors to compare. Although no investment model can forever remain applicable to all stocks, the Gordon model is still proven to be a reliable method for selecting stocks that tend to perform better in the long run. It should thus be one of the effective tools that

investors use to select some of the stocks in their portfolio.

3. Empirical Literature

1) U.S. Studies

As the first country to study the influencing factors of the PER, the United States was also the first to study it from the perspective of the firm. Alford (1992) suggests that PERs are not only affected by risk levels and revenue growth rates but must also be combined with industry characteristics. Penman (1992) analyzes the PER from the perspective of financial data and finds that the PER will not only be affected by the current ROE but also by the future ROE. After doing further in-depth research, they pointed out that the PER is negatively correlated with the current ROE and positively correlated with the future ROE. Loughlin (1996) proposed a positive correlation between P/E and EPS growth, and P/E and dividend payout ratio were positively correlated. White (2000) found that PERs were positively correlated with dividend payout ratios, earnings per share, S&P 500 index yields, and real GDP growth rates. Prem and Rosett (2006) proposed that only the expected inflation rate and real GDP growth rate have a significant explanatory effect on the PER, and investor sentiment does not significantly affect the PER. Ying et al. (2007) found that the PER reflects the investor's emotional problems. Testing some extreme data combinations, it was found that the firm-level factors and the macro-economic factors jointly determine the PER. Among them, the growth rate predicted by investors, the dividend payout ratio, and the firm size are positively correlated with the PER. However, the financial risk and bond yields are negatively correlated with the PERs. Of course, foreign scholars have done some interesting research, such as Goodell (2012), who studied the relationship between the PER of the US stock market and the US election cycle. By analyzing the PER data of the US market during the six election cycles, it was found that as the election results became clearer, the market PER also gradually declined.

2) China Studies

In comparison with foreign studies on PER and its influencing factors, Chinese scholars generally offer more descriptive statistical analyses of PER; however, there have not been many empirical analyses using a large amount of data. This may be because China's securities market began to regulate operations in 1991. In October 1992, the China Securities Regulatory Commission was established to conduct special supervision and management of the securities market. Because there were too little sample data and stocks are not yet standardized, the time of sample data was limited. The following summarizes some studies on the factors affecting the PER of Chinese scholars.

Judging from the macro-driving factors of the PER, Xu et al. (2003) proposed that the PER, ratio of outstanding shares, and price index showed a positive correlation. He (2008) found that the inverse of the interest rate is positively correlated with the PER, while the correlation between the PER and GDP is extremely low. Qiu and Zhang (2010) also found that there is no strong correlation between the PER and GDP growth. Jin (2013) found that the average the PER was positively correlated with the stock price index and the RMB exchange rate, while the deposit interest rate and PER showed a

reverse change. Guo (2014) analyzed the real estate, banking and construction industries with low PERs. He found that the reason for the low valuation was not caused by business performance but was subjected to a series of macro policies. Then, having conducted a theoretical derivation and empirical analysis, Song et al. (2016) showed that the interest rate level is the most important factor affecting the PER.

From the perspective of micro-driving factors, Li et al. (1998) proposed a negative correlation between corporate debt ratio and stock PER. Zeng et al. (2002) found that the PER of China's stock market is generally positively correlated with the firm's future growth potential. Yan (2003) proposed that the factors affecting the PER include firm performance, industry factors, equity, and equity structure. Bai et al. (2002) found that earnings per share growth rate, dividend payout ratio, and industry average PER have a major impact on stock PER, while the correlation between the β coefficient and PER is not significant. This is consistent with Chen's (2003) empirical study of the factors affecting the PER of China's stock market. Lu and Wei (2005) found that the PER of listed firms was significantly positively correlated with the beta coefficient, and was significantly negatively correlated with the ratio of outstanding shares. Sun (2006) proposed that the PER and a proportion of outstanding shares, the firm's net profit growth rate showed a negative correlation, meaning that there is no significant relationship between corporate income growth rate and the PER. Chen (2011) found that dividend payout ratio, earnings per share growth rate, and net profit per share growth rate are inversely related to the PER. Li (2011) found that the relationship between the ROE and PER is not significant, while net assets per share and net profit are negatively correlated with the PER, and market value is positively correlated with the PER. Cai (2010) proposed that the beta coefficient, risk-free rate of return, market portfolio expected return, financial leverage, and income tax rate are inversely related to the PER. However, the dividend payout ratio and PER show an uncertain relationship. Moreover, Song et al. (2016) concluded that in terms of corporate finance, the key factors that can affect the PER are dividend payout ratio, beta coefficient and firm size.

As mentioned above, we can conclude that the main factors that affect the PER are the inflation rate, GDP growth rate, interest rate, dividend payment rate, and some related financial indicators of the firm. When domestic scholars study the PER, the previous research is to analyze the listed companies in the whole stock market, and the specific industry research is less. Therefore, based on the previous research, we mainly study the impact of macro factors on the average PER of the manufacturing sector and micro factors on the individual firm PER of the manufacturing sector, as we want to obtain the correlation between the PER and its influencing factors. Through the results of our empirical analysis, we expect to gain a reasonable PER valuation model.

Ⅲ. Variables, Data, and Empirics

1. Variables

This section focuses on the impact of macro factors on the average PER (APE) of the manufacturing sector. The securities market is the leading indicator of the macro economy, and the trend of the macro economy also determines the long-term trend

of the securities market. Therefore, the average PER of the manufacturing sector is bound to be affected by many macroeconomic environments. The firm's economic benefits will vary with changes in macroeconomic factors such as the macroeconomic operating cycle, macroeconomic policies, and price levels. Changes in the firm's economic efficiency will affect the firm's market value, which will affect the market value of the entire securities market, which in turn will affect the average PER. In addition, when the national macroeconomic policy changes affect the cost of holding funds, which will affect the flow of funds in the market, the average PER will also be affected. When macroeconomic conditions are better or the state introduces policies to increase the income of residents, it will stimulate the domestic demand to a certain extent, thereby increasing market capital and the economic returns of enterprises, while simultaneously promoting investment demand in the securities market, thereby affecting the average PER.

Based on the characteristics of the manufacturing sector, we selected four influencing variables to study the impact of macroeconomic aspects on the average PER of the manufacturing sector. The specific variables are explained and the research hypotheses are as follows.

The first is GDP growth rate. Total value of all end products and services of an economy in a certain period of time is called Gross Domestic Product (GDP). GDP is an important indicator to measure a country's national strength and wealth. The GDP growth rate dynamically reflects the country's productivity and future development trends. When a country's economy is in a period of rapid development, the most obvious performance is the rapid growth of GDP. At this time, the market expectation of the firm is relatively high, and investors are more confident in the market. Then, the stock prices that represent the firm's value and development prospects tend to be higher, and the PER will increase. Correspondingly, when GDP growth slows down or declines, people will be more pessimistic about the development prospects and investment sentiment of listed firms, and they will reduce their stocks, so that the stock price of listed firms will fall. The PER will also drop accordingly. Therefore, we expect that the impact of the GDP growth rate on the average PER will be positive.

Money supply refers to the sum of cash and deposits in circulation at a certain point in time. The realistic level of money supply is the target of a country's monetary policy adjustment. Forecasting the growth and change of money supply is the basis for a country to formulate its monetary policy. Money supply generally affects the firm's PER in two ways. On the one hand, from the perspective of supply and demand, in the case of a certain number of stocks, the increase in the money supply will increase the price of the stock. On the other hand, increasing the money supply during the economic recession will lower the interest rate, stimulating private investment and thereby stimulating consumption while increasing production and employment. Conversely, when the inflation rate is too high, the money supply can be tightened to raise interest rates, curb investment and consumption, and reduce or slow production and employment. Under the loose monetary policy, the money supply increases, the national income growth rate is higher, and the profit growth rate of each sector will increase, resulting in a higher PER. Conversely, under tight monetary policy, the

money supply will decrease and the PER will fall. Therefore, we expect that the impact of the money supply growth rate on the average the PER will be positive.

The Purchasing Managers' Index (PMI) is among the internationally accepted macroeconomic monitoring indicator systems; it plays an important role in monitoring and forecasting national economic activities. PMI covers the areas of production and distribution, manufacturing and non-manufacturing, and is divided into manufacturing PMI and service PMI. Some countries have established construction PMI. The manufacturing PMI (MPMI) measures the manufacturing sector's index of eight conditions in terms of production, new orders, commodity prices, inventory, employees, order delivery, new export orders and imports. PMI is a very important sub-indicator of the economic leading indicator and has a high degree of timeliness. The PMI Index and its business reports have become important indicators of economic activity in the world and a barometer of changes in the world economy. Each indicator of the MPMI reflects the reality of business activities, and the composite index reflects the overall growth or decline of the manufacturing sector. An MPMI index of above 50% reflects the overall expansion of the manufacturing sector, whereas an MPMI index of below 50% usually reflects a decline in the manufacturing sector. Therefore, we expect that the impact of manufacturing PMI on the average PER will be positive.

The securitization rate (SR) refers to the ratio of the total market value of various securities in a country to the GDP of the country. It is an important indicator to measure the degree of development of a country's securities market. The higher the SR of a country, the more important the securities market is in the economic system of the country. In developed countries, due to the high market mechanism, the long history of the securities market and the full development, the SR is higher than that of developing countries as a whole. China's securities market started late, and so its development still lags behind. Its SR is not only at a low level when compared to most developed countries, but also lower than the average level of developing countries. Because the SR is related to the stock market value, the stock market value is related to the stock price, and the stock price affects the average PER. In general, the higher the SR is, the more mature the securities market is and the higher the average PER is. Therefore, we expect that the SR will have a positive impact on the average PER.

Combined with the relevant theoretical model of the PER, it can be shown that many Micro-Financial indicators directly or indirectly affect the change of the PER. From the previous research, it is found that the capital structure and profitability of enterprises have a great impact on the PER. Therefore, nine variables are proposed, and they may affect the PER of individual firms from the aspects of corporate capital structure and profitability. The first three variables are related to corporate capital structure and the latter six to corporate profitability.

The Debt to asset ratio (DAR) is the ratio of the total liabilities of a firm to the total assets, which reflects the capital structure of an enterprise. It indicates how much of the firm's total assets are raised through debt. This indicator is a comprehensive indicator for evaluating the firm's debt level. It is also an indicator of the firm's ability to use creditor funds to conduct business activities, and reflects the security level of creditors'

loans. In general, the higher DAR is, the greater the equity multiplier and earnings per share are. Earnings per share is one of the indicators that directly affects the PER. In the case of constant corporate profits, the higher the earnings per share is, the lower the PER is. Conversely, the lower DAR is, the smaller the earnings per share is, and the greater the PER is. Accordingly, we expect that the DAR will be negatively correlated with the PER.

The current ratio (CR) is the ratio of the total current assets of a firm to the total current liabilities. It is used to measure the ability of a firm's current assets to become cash for the repayment of liabilities before the short-term debt expires. Generally speaking, the higher the CR is, the stronger the liquidity of corporate assets and the stronger the short-term solvency will be. Although a higher CR increases the liquidity of corporate assets, a large ratio indicates that the current assets are more occupied, which will affect the operating capital turnover efficiency and profitability. A reasonable minimum flow ratio is generally considered to be 2. A ratio greater than this indicates that the firm's liquidity is very good, meaning that it can work well and its short-term solvency is strong; it will this not worry about the problems caused by its debt. Therefore, in this case, investors will be more optimistic about the firm's development, and the PER will rise. We expect that the CR will be positively correlated with the PER.

The proportion of treasury stock (TS) refers to the ratio of treasury stocks to the total number of stocks. Treasury stock refers to the issued shares that are purchased by the firm without cancellation and held by the firm. The treasury stock is beneficial to the firm's managers to effectively achieve a balance between debt and equity and reduce financing costs. When the debt financing cost is lower than the equity financing cost, the debt is reduced by reducing the proportion of the share capital in the entire asset by repurchasing the shares, which can increase the return on net assets. When the stock exchange market is affected by non-economic factors, in order to avoid the firm's significant impact on the firm's credit and stock rights due to factors other than its finances or debts, the firm can stabilize the stock price by appropriately buying back its own stock. Therefore, treasury stocks also have a certain impact on the PER. We expect that the treasury stock ratio will be positively correlated with the PER.

The Return on Equity (ROE) is the percentage of the firm's after-tax profit divided by its net assets. This indicator reflects the level of return on shareholders' equity and is used to measure the efficiency of the firm's use of its own capital. The higher the ROE is, the higher the return on investment is. The use of this indicator can determine the strength of a firm's profitability. When a firm’s ROE is relatively high, it indicates that the firm’s shareholders have a higher net profit when they invest, which means that their profitability is relatively strong, thus attracting investors to increase the firm's investment. The corresponding stock price will consequently rise, along with the PER. On the contrary, when a firm's return on net assets is lower, it indicates that the firm's profitability is relatively weak, the shareholder's investment brings less income, and the firm is not favored by investors; its stock price will accordingly be suppressed, and the PER will decline. We expect that the ROE will be positively correlated with the PER.

Earnings per share (EPS) refers to the ratio of after-tax profits to the total number of shares. EPS is often used to reflect the firm's

operating results in order to measure the profitability of common stocks and investment risks—which is one of the important financial indicators for investors to evaluate corporate profitability, predict the growth potential of enterprises, and then make relevant economic decisions. When the other conditions are certain, the higher the EPS is, the lower the PER is. On the contrary, the lower the EPS is, the higher the PER is. Therefore, there is a negative correlation between the PER and EPS. The growth rate of EPS refers to the degree of increase in EPS, reflecting the degree of increase in the profit that each firm's equity can share. Generally, the faster the EPS grows, the higher the EPS is, and the lower the PER is. We expect that the EPS growth rate will be negatively correlated with the PER.

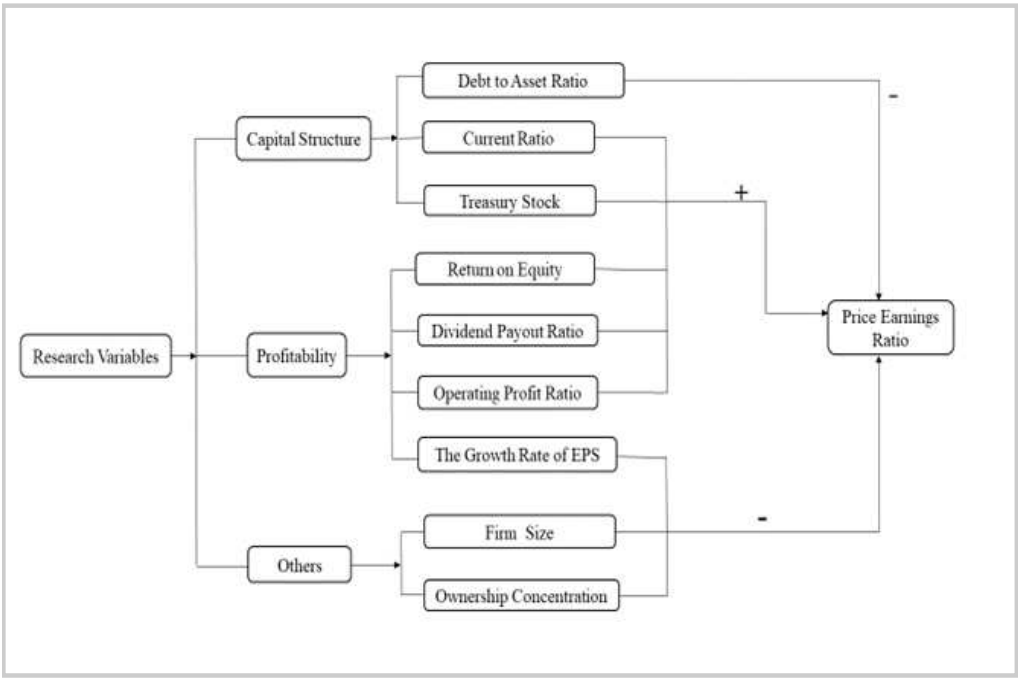
The dividend payout ratio is the percentage of dividends distributed to shareholders as a percentage of the firm's earnings. This indicator reflects how much common stockholders share from the total net income per share. For individual common stock investors, this indicator reflects the current benefits more directly than the net income per share. In accordance with the derivation formula of the Gordon model, the PER is a function of the dividend payout ratio, the necessary rate of return, and the dividend growth rate. The dividend payout ratio is positively correlated with the PER. When the dividend payout rate of a listed firm is higher, the higher an investor's expected return is, the higher the price of the investor's stock in the capital market is, and the higher the firm's the PER is. When the dividend payout rate of a listed firm is lower, the lower the expected remuneration that investors can obtain is, the lower the price of the firm's stock in the capital market becomes, and the lower the PER of the firm is. We expect that the dividend payout ratio will be positively correlated with the PER.

Operating profit ratio refers to the percentage of operating profit from operating income as a percentage of invested capital. It can comprehensively reflect the business efficiency of a firm or an industry. Operating profit ratios vary widely across industries and firms in the same sector, and not all firms are profitable every year. The higher the operating profit ratio is, the more the operating profit provided by the firm's commodity sales is, and the stronger the firm's operating profitability is. By contrast, the lower the operating profit ratio is, the weaker the profitability of the firm is. The stronger the firm's profitability is, the faster investors think the firm grows, the more confident the firm is, and the willingness to exchange higher stock prices for relatively certain yields and PER will rise. We expect that the operating profit ratio will be positively correlated with the PER.

The firm size refers to the size of the firm. There are many indicators for measuring the size of the firm, such as the number of employees and sales. We use the assets of a firm to measure its size. Generally speaking, the more assets a firm has, the larger its size and development potential are. In comparison with smaller firms, investors are more optimistic about the development prospects of large firms. However, the larger the firm is, the higher the corresponding management cost is and the less manageable it is, which leads to its lower operational efficiency of the firm.; as a result, its development prospects decline, causing its stock price and PER to decrease. We expect that the firm size and PER will be negatively correlated.

Ownership concentration refers to the concentration of equity that is expressed by

Fig. 2. The Proportion of the Main Business Income of China's Large-Scale Manufacturing Firms China's GDP from 2012 to 2018.



'+' represents positive correlation between the variables and the P/E ratio.
'–' represents negative correlation between the variables and the P/E ratio.

all shareholders due to the difference in shareholding ratio. It is the main indicator to measure the firm's equity distribution. The shareholding ratio of the top ten shareholders is an important indicator for examining the concentration of a corporate equity. The greater the ratio is, the greater the likelihood is for the firm to be controlled by minority shareholders, indicating an increase in ownership concentration. When the equity is too concentrated, the major shareholder of the enterprise can rely on its voting rights at the shareholders' meeting to control the enterprise, with their own interests as the starting point, which has an adverse impact on the business activities of the firm. Therefore, the higher the concentration of equity is, the more easily the firm is controlled by a small number of people, which poses a threat to the business performance of the firm and thus reduces the PER. We expect that the ownership concentration will be negatively correlated with the PER. The expected signs of the effects of the identified micro factors on the PER are summarized in Figure 2.

2. Data

We selected the Chinese A-share manufacturing sector-listed firms as the research object, and the average PER (APE) also refers to the average PER of the A-share manufacturing sector. We relied on China's

Table 2. The Calculation Method of the Study Variables, the Source and the Abbreviations Used in the Later Empirical Analysis.

Research variable	Abbreviation	Calculation method	source
Debt to asset ratio	DAR	total liabilities / total assets * 100%.	RESSET database
Current ratio	CR	current assets / current liabilities * 100%	RESSET database
Treasury stock ratio	TS	Treasury stocks / Total stocks * 100%	GTA Research Service Center
Return on Equity	ROE	net profit / ending shareholders' equity * 100%	RESSET database
Earning Per Share Growth Rate	GEPS	(Earnings per share / earnings per share for the same period last year -1) * 100%.	RESSET database
Dividend Payout Ratio	DPR	Cumulative total dividends/net profit attributable to the parent company*100%	RESSET database
Operating Profit Ratio	OPR	Operating profit / operating income * 100%	RESSET database
Firm Size	FS	The total assets of the company 's logarithm	GTA Research Service Center
Ownership Concentration	OC	The sum of the shareholding ratio of the top 10 shareholders.	RESSET database
P/E ratio	PE	Stock price for the same period / (net profit for the same period / paid-in capital at the end of the same period)	GTA Research Service Center

macroeconomic data from 2008-2018 for our empirical analysis. Both the GDP growth rate (TGDP) and money supply growth rate (MS) data are derived from the National Bureau of Statistics of China.[2] The manufacturing PMI (using the annual average manufacturing PMI) data was gathered from the China Federation of Logistics and Purchasing.[3] The securitization rate and manufacturing sector's average PER (to avoid the impact of extreme data on the results, excluding stocks with a negative the PER of 200 or higher) are derived from the RESSET database.[4]

A panel data is a mixture of time series and cross-section data, which is the data obtained by continuously monitoring multiple episodes of a group of individuals. It is often referred to as tracking information. The panel data is data observed by n individuals over two or more periods T. If the data set contains observations of variables X and Y, the data can be expressed as (X_{it}, Y_{it}).

$$i = 1,2,...,n,\ \ t = 1,2,...,T,$$

where i represents observed individual, t represents the observed time.

Using the panel data to establish an econometric model can identify and measure the influencing factors that cannot be found by simple time series models and simple cross-section data models, and can thus improve the accuracy of the research. Therefore, in order to more accurately study the long-term impact of micro factors on the PER, we selected the manufacturing firms listed on China's A-share market as of December 31st, 2012, as the research object.

2) http://www.stats.gov.cn
3) http://www.chinawuliu.com.cn
4) http://www.resset.cn.

If the firm's listed time is short, the PER is unstable. To avoid this impact, we select the relevant data of the sample firm for five years, from 2014 to 2018, to construct panel data to study the impact of micro factors on the PER.

To ensure the comparability of the data, we screened the sample companies. First, their PER was positive, which is meaningful. If the PER is too high, the price of the stock has a bubble, the value is overvalued, and each sector also has a reasonable the PER range, combined with the previous average PER of the manufacturing sector. The study excludes listed firms with a negative PER and a PER greater than 80. Excluding the changes in the industry during the sample period, the inability to obtain accurate data and the availability of listed firms with incomplete data, eliminating firms with delisting risks during the sample period, and finally screening 317 listed firms as the main research object, including select the sample firm's five-year relevant data to form balanced panel data for empirical analysis. The data comes from the GTA Research Service Center[5] and the RESSET database. The specific research variable data sources and calculation methods are shown in Table 2.

3. Empirics

1) Macro Effects on the PER

(1) Descriptive Statistics

Descriptive statistics is a very intuitive way to present the relationship between dependent and independent variables in a graphical and statistical manner. Having selected 11-years' worth of data for research, we conducted an empirical analysis of the factors affecting the manufacturing sector's average PER. Firstly, using Excel software, we drew the change trajectory of the variable and the average PER of the manufacturing sector, then presented the correlation between the variable and the average the PER of the manufacturing sector. The result is shown in Figure 3.

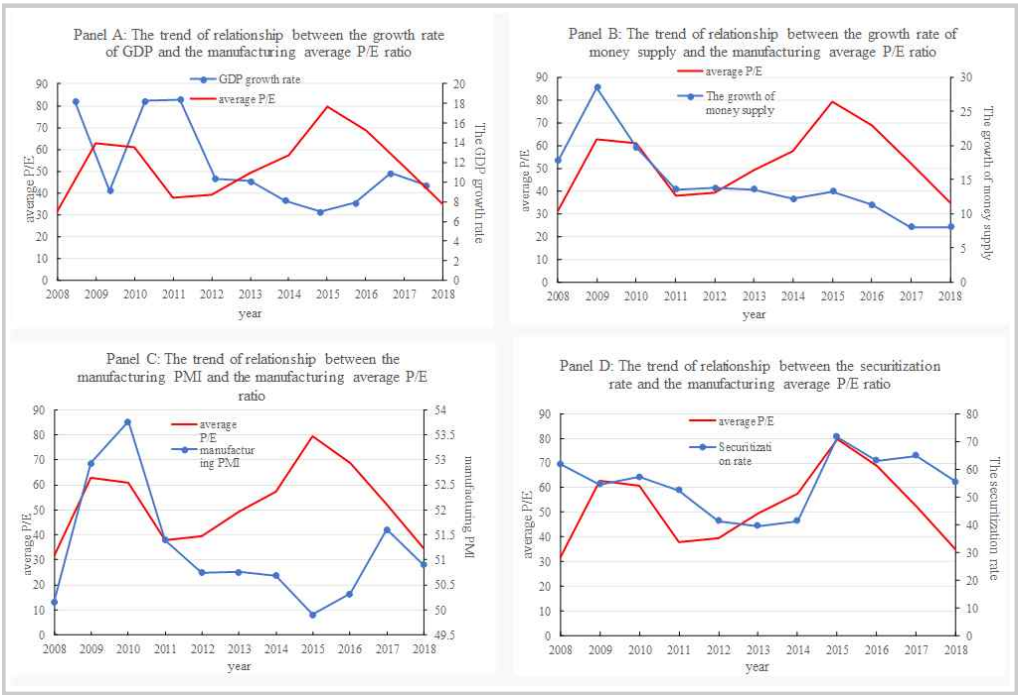
The result (Panel A, Figure 3) shows that the direction of change in the average the PER and GDP growth rate is uncertain. There is no sufficient reason to prove that hypothesis 1 is established and further verification is needed. The result (Figure B, Figure 3) shows that the change in the direction of the manufacturing sector's average PER and money supply growth rate has become uncertain after 2012, so there is no sufficient reason to prove that hypothesis 2 is established, meaning that further verification is required. The result (Figure C, Figure 3) shows that the manufacturing the PER and the direction of manufacturing PMI change are sometimes positive and sometimes reversed, so it is necessary to further verify whether hypothesis 3 is true. The result (Figure D, Figure 3) shows that the change in the direction of the manufacturing sector's average P/E and SR is positive for most of the period, but further verification of hypothesis 4 is nonetheless needed.

Descriptive statistical analysis only gives us some visual representations of the surface and does not clearly indicate the correlation between these variables and the average the PER of the manufacturing sector. Therefore, a further correlation analysis between these influencing factors and the manufacturing sector's average PER is needed to determine the impact relationship between them.

A correlation analysis is a method used to prove the correlation between a set of variables. The Granger causality test and

5) http://www.gtafe.com/

Fig. 3. The Trend of Relationship between Independent Variables and the Manufacturing Average P/E Ratio



Panel A shows the trend of relationship between the GDP growth rate and manufacturing average P / E ratio. Panel B shows the trend of relationship between the growth rate of money supply and manufacturing average P / E ratio. Panel C shows the trend of relationship between the manufacturing Purchasing Managers' Index and manufacturing average P / E ratio. Panel D shows the trend of relationship between the securitization rate and manufacturing average P / E ratio.

cointegration test are used to further analyze the correlation between the average PER of the manufacturing sector and its influencing factors. Since the research data selects a time series of 11 consecutive years, and there is a certain trend of these variables over a period of time, the change in the PER may be affected by some factors, and there may be some correlation between them. Through Granger's (1969) causality test, it is obvious that this correlation between the average PER of the manufacturing sector and each of the influencing factors is called causality, and the relationship is one-to-one. To understand this causal relationship, if the change of one variable A is caused by the change of another variable B, then the variable B is the cause of the change of the variable A; that is, B is the Granger cause of A. This is to say that there is a correlation between the two variables. The cointegration test is to test the cointegration relationship between the average PER of the manufacturing sector and all the influencing factors. This relationship is one-to-many, and is a comprehensive effect of the influencing factors on the average the PER of the manufacturing sector.

Table 1. Human Capital Accumulation and Economic Growth of Exports

Panel A: Unit root test					
Variable	Test Statistic	Critical Value			MacKinnon approximate p-value for Z(t)
		1%	5%	10%	
APE	-2.265	-3.750	-3.000	-2.630	0.1836
First-differenced	-2.568	-3.750	-3.000	-2.630	0.0999*
TGDP	-2.480	-3.750	-3.000	-2.630	0.1203
First-differenced	-4.622	-3.750	-3.000	-2.630	0.0001***
MS	-1.190	-3.750	-3.000	-2.630	0.6778
First-differenced	-6.100	-3.750	-3.000	-2.630	0.0000***
MPMI	-2.076	-3.750	-3.000	-2.630	0.2543
First-differenced	-3.250	-3.750	-3.000	-2.630	0.0173**
SR	-1.922	-3.750	-3.000	-2.630	0.3219
First-differenced	-3.084	-3.750	-3.000	-2.630	0.0278**

Panel B: Granger causality test(All is the first-differenced variables)			
Null hypothesis	F-statistic	P-value	Conclusion
TGDP does not Granger-cause APE	2.99	0.1343	accept
APE does not Granger-cause TGDP	3.84	0.0978*	reject
MS does not Granger-cause APE	0.17	0.6940	accept
APE does not Granger-cause MS	0.64	0.4531	accept
MPMI does not Granger-cause APE	1.77	0.2316	accept
APE does not Granger-cause MPMI	0.64	0.4537	accept
SR does not Granger-cause APE	0.79	0.4085	accept
APE does not Granger-cause SR	1.11	0.3336	accept

Panel C: Cointegration test(Null hypothesis: residual exists unit root)	
	Test statistic
Augmented Dickey-Fuller test statistic	-3.105***
1% Critical Value	-2.660
5% Critical Value	-1.950
10%Critical Value	-1.600

Panel A shows the unit root test of variables. Panel B shows the Granger causality test. Panel C shows the ADF test statistics for cointegration using the residuals of APE, TGDP, MS, MPMI and SR regression. ***, **, and * represent rejection of the null hypothesis significance at the 1%, 5%, and 10% levels, respectively.

(2) Granger Causality Test

The Granger causality test is a common method for testing the causal relationship between two variables. If there is no causal relationship between the variables, the empirical result is futile. There may be similar trends between the two variables, and they will show better saliency and fitness in

the regression; however, it may be the case that they do not constitute a causal relationship at all. Therefore, this significance and fit would be useless. It should be noted that in the Granger causality test, the time series as the test object must be stable. Therefore, the unit root test (Dickey and Fuller, 1981) must be performed on the sequence of the test first. This so-called "augmented Dickey-Fuller" (ADF) test determines whether there is a unit root in the test sequence. Because there is a unit root that is a non-stationary time series, this will result in a pseudo-regression in the regression analysis. For the time series with unit roots, it generally shows obvious memory and persistence of fluctuations. The unit root test is also the basis for the existence test of a cointegration relationship. If it is not a stationary sequence, it is smoothened by one or more differences, and then the Granger test is performed on the two stationary sequences. First, the Granger causality test uses the Stata software to perform ADF test on each variable. The results are shown in the following table.

The results (Panel A, Table 1) show that the original variables have unit roots and are unsteady, but after the first-order difference, the variables reject the null hypothesis, meaning that there is no unit root, which is stable. Next, the Granger causality test is performed on the first-differenced stable variables and the first-differenced average PERs.

The results (Panel B, Table 1) show that, at a significant level of 10%, rejecting the null hypothesis of APE does not Granger-cause TGDP, meaning that at a significant level of 10%, the average PER of manufacturing is considered to be the Granger cause of GDP growth. Therefore, it can be considered that there is a correlation between the GDP growth rate and the average PER of the manufacturing sector. However, this is not a mutual influence relationship; rather, only the average PER of the manufacturing sector affects the GDP growth rate. For other variables, we cannot reject the null hypothesis, which can prove that the money supply growth rate and average PER, manufacturing PMI and average PER, and SR and average PER, are independent relationships. It is unaffected and there is no correlation between the two.

(3) Cointegration Test

Engle and Granger (1987) proposed the cointegration theory, producing the Engle-Granger test method. In macro-econometric analysis, the Engle-Granger cointegration method has become one of the most important tools for analyzing the quantitative relationship between non-stationary economic variables. In the above test, we found that all variables are non-stationary, and that we need to perform a cointegration test on these non-stationary variables. Cointegration has a common tendency toward randomness. The purpose of the cointegration test is to determine whether a linear combination of a set of non-stationary sequences has a stable equilibrium relationship. In the ADF test, since the manufacturing sector's average PER, GDP growth rate, money supply growth rate, manufacturing PMI, and SR are all single-order, the cointegration test can be performed.

When performing a cointegration test, it is first necessary to construct a simple linear regression equation for the dependent and independent variables, as follows

$$APE = \beta_0 + \beta_1 \cdot TGDP + \beta_2 \cdot MS + \beta_3 \cdot MPMI + \beta_4 \cdot SR + \epsilon,$$

where β_0 is the intercept, $\{\beta_2, \beta_3, \beta_4\}$ are the coefficients of the relevant variables, ϵ is the error term.

Firstly, the regression equation is estimated by the OLS method to obtain a residual sequence. Secondly, the residual root sequence is tested by the unit root. If the residual sequence is stable, the average the PER and its influencing factors are cointegrated; otherwise, they are not integrated.

The results (Panel C, Table 1) show a significant level of 1%, such that the null hypothesis can be rejected; that is, the residual has no unit root and is stable. There is a cointegration relationship between the average PER of the manufacturing sector and GDP growth rate, money supply growth rate, manufacturing PMI, and SR, which means that these variables have a certain degree of correlation with the average PER of the manufacturing sector.

(4) Empirical Implications

Through the above empirical test, we arrive at the following implications: First, the factors affecting the average PER of the manufacturing sector are non-stationary, but their first-order difference is stable; therefore, they can be verified by the cointegration test. Through the EG cointegration test, it is found that there is a cointegration relationship between the average PER of the manufacturing sector and its influencing factors, which means that a linear regression model can be established to analyze it.

Second, through the Granger causality test, it was found that there is a correlation between the GDP growth rate and the average PER of the manufacturing sector, though there is no mutual influence. Rather, only the average PER affects the GDP growth rate. Although some factors in the descriptive statistical analysis and average PER of the manufacturing sector show certain rules, they are not the causes of the change in the average the PER. It is explained that there are other reasons for the relationship between GDP growth rate, money supply growth rate, manufacturing PMI and SR, and the manufacturing sector's average PER.

Third, none of the hypotheses passed the empirical test. This was because the macro market is still mainly regulated by the state, and the PER is a product of the capital market. Therefore, some macro indicators cannot fully match the PER. A national policy or speech by a leader will have an impact on the PER.

Fourth, it was found that although the GDP growth rate, money supply growth rate, manufacturing PMI, and SR are not the reasons for the change in the manufacturing sector's average PER. However, through the cointegration test, it is found that these influencing factors are still linearly related to the average the PER of the manufacturing industry. Therefore, it is not easy to determine whether one of the single factors has a positive or negative impact on the average PER. Instead, the overall macro-features should be used to judge their combined impact on the PER.

2) Micro Effects on the PER

(1) Descriptive Statistics

The descriptive statistical analysis can identify the general characteristics of the sample from a holistic perspective. It can be seen from the above that 317 sample companies produced balance panel data during the five-year sample period, and descriptive statistical analysis of the data was performed using Stata software. The results

Table 3. The Result of the Descriptive Statistical Analysis

Variables	Overall				Between			Within		
	Mean	Std. Dev.	Min	Max	Std. Dev.	Min	Max	Std. Dev.	Min	Max
PE	30.588	15.906	2.866	79.981	10.704	4.157	61.241	11.778	-3.258	79.773
DAR	36.449	17.236	2.163	94.332	16.247	5.491	73.551	5.813	10.91	96.083
CR	2.716	3.010	0.169	54.507	2.570	0.257	26.563	1.573	-22.090	30.660
TS	15.703	18.532	0	90.183	14.930	0	63.984	11.004	-32.435	87.849
ROE	11.921	6.294	0.075	52.136	5.236	3.486	31.378	3.502	-12.228	34.654
GEPS	24.001	132.139	-97.818	4550.49	58.722	-18.824	927.970	118.412	-1001.787	3646.521
DPR	38.570	32.016	0	364.735	21.605	0	118.975	23.653	-69.671	318.381
OPR	14.068	16.352	-452.854	160.193	10.839	-64.132	67.380	12.256	-374.654	141.458
FS	22.569	1.005	20.243	27.386	0.972	20.426	27.102	0.261	21.494	23.502
OC	0.577	0.139	0.207	0.928	0.134	0.261	0.911	0.039	0.166	0.746

are shown in Table 3. Hu (2016) offered a descriptive statistical analysis of panel data to show the changes in the dataset variables as a whole and among between-and within-groups. The whole refers to the entire data set, the between-groups refer to the change of the average value of each individual in different time-periods, and the within-groups refer to the change of the deviation of each individual from the respective average values.

As shown in Table 3, we found that during the sample period, the average stock the PER of listed firms in China's A-share manufacturing sector was 30.588, with a maximum of 79.981 and a minimum of 2.866. It can be seen from the between groups value that the sample firm's PER is different at different times; the maximum value of the average change is 61.241, and the minimum value is 4.157. It can be seen from the within-groups value that the deviation between each individual the PER and the respective average minimum is -3.258, the maximum is 79.773. The sample firm's PER thus shows a big difference. From the standard deviation, the overall degree of dispersion of each influencing factor is also different, in which the EPS growth rate is the largest, and the degree of dispersion of the ownership concentration is the smallest. This shows that the EPS growth rate of listed firms in the manufacturing sector has changed greatly during the period of 2014-2018. However, the firm's share concentration has not changed much, which proves that the manufacturing firm's share capital structure during the study period has not changed greatly.

(2) Correlation Analysis

In the data analysis, because there are multiple independent variables, and because there may be interdependence and mutual restraint relationships among the variables, there are two main types of these relationships. One is a function relationship; that is, the value of a variable can be uniquely determined according to a certain function relationship in the case where other variables are determined. The other is the correlation; that is, although there is a relationship between variables, the value given by each or one group of variables cannot obtain the unique value of the other variable. The correlation analysis is meant to analyze this. Correlation analysis is the basis of regression analysis. If there is no

Table 4. The Result of Correlation Analysis between Variables

variables	PE	DAR	CR	TS	ROE	GEPS	DPR	OPR	FS	OC
PE	1									
DAR	-0.1787***	1								
CR	0.1742***	-0.5525***	1							
TS	0.1259***	-0.1528***	0.1623***	1						
ROE	-0.3966***	0.0317	-0.0241	-0.0125	1					
GEPS	-0.1022***	0.0946***	-0.0629**	0.0248	0.1243***	1				
DPR	0.0383	-0.1119***	0.0131	0.0243	-0.0066	-0.0690***	1			
OPR	-0.1280***	-0.3912***	0.2465***	0.0715***	0.2608***	0.0061	0.0432*	1		
FS	-0.3953***	0.5699***	-0.3051***	-0.2081***	0.1952***	0.0637**	-0.0043	-0.0370	1	
OC	-0.0463*	-0.0453*	0.0642**	0.2139***	0.2075***	-0.0413	0.1500***	0.1199***	0.0749***	1

***, **, and * represent statistical signifificance at the 1%, 5%, and 10% levels, respectively.

significant correlation between dependent and independent variables, then the regression equation is meaningless. We use the Pearson Correlation Coefficient to describe the correlation between each indicator and the manufacturing stock PER. The results are shown in Table 4.

As seen in Table 4, we found that the current ratio and treasury stock ratio are positively correlated with the manufacturing stock PER, at a 1% significance level, and the correlation coefficients are 0.1742, 0.1259, respectively, which is consistent with our research hypothesis. This shows that these two variables have a significant positive correlation with the manufacturing firm stock PER.

The debt to asset ratio, Earning Per Share growth rate, and firm size are negatively correlated with the manufacturing stock PER at a significant level of 1%, consistent with our research hypothesis. Having a 10% significance level and a correlation coefficient of -0.0463, the ownership concentration passed the test, indicating that the higher the ownership concentration is, the lower the PER is, which is consistent with our research hypothesis.

The return on equity and operating profit ratio are negatively correlated with manufacturing stock PER, with a significance level of 1% and correlation coefficients of -0.3966 and -0.1280, respectively. This result is contrary to our research hypothesis. The dividend payout ratio did not pass the test, indicating that it has no correlation with the manufacturing firm stock PER.

(3) Regression Analysis

The correlation analysis mainly discusses the degree, direction, and form of correlation between variables. The regression analysis aims to construct a regression model to further explore the structure of the correlation between variables, particularly the structure of causality. When using the econometric model established by a multiple regression analysis, if some unobservable, important explanatory variables are missing from the model, the random error term of the regression model often has autocorrelation. The least squares OLS estimator of the regression parameter is then no longer an unbiased estimate or a valid estimate. The panel data used in this study can not only use the cross-section data and time series data to establish the econometric model, but can also better identify and measure the influencing factors that the simple time series model and simple cross-section data model

Table 5. Unit-root and cointegration test results

Panel A: Harris-Tzavalis unit-root test				
Null hypothesis: Panels contain unit roots Alternative hypothesis: Panels are stationary				
Variable	Test Statistic	z	p-value	Conclusion
PE	-0.2033	-4.2616	0.0000***	reject
DAR	-0.1862	-3.7107	0.0001***	reject
CR	-0.3482	-8.9449	0.0000***	reject
TS	-0.1865	-3.7201	0.0001***	reject
ROE	-0.2772	-6.6490	0.0000***	reject
GEPS	-0.3736	-9.7658	0.0000***	reject
DPR	-0.4036	-10.7336	0.0000***	reject
OPR	0.0682	-15.7749	0.0000***	reject
FS	-0.1908	-3.8585	0.0001***	reject
OC	-0.1497	-2.5284	0.0057***	reject

Panel B: Kao test for cointegration		
Null hypothesis: No cointegration Alternative hypothesis: All panels are cointegrated		
	Statistic	p-value
Modified Dickey-Fuller t	4.1784	0.0000***
Dickey-Fuller t	-8.4676	0.0000***
Augmented Dickey-Fuller t	-15.3534	0.0000***
Unadjusted t	0.6281	0.2650
Unadjusted Dickey-Fuller t	-11.3146	0.0000***

***, **, and * represent statistical signifificance at the 1%, 5%, and 10% levels, respectively.

cannot find. And test more complex regression models. We thus created the following panel:

$$y_{it} = \alpha + x_{it}\beta + \delta_i + \gamma_t + \epsilon_{it}$$
$$i = 1,2,\cdots,N, \quad t = 1,2,\cdots,T,$$

where $y = \alpha + x\beta + \delta_i + \gamma_t + \varepsilon$ represents the observed value of individual i at time t, α represents the constant term of the model, δ_i represents a fixed or random cross-section effect, γ_t represents a fixed or random time effect, x_{it} represents the k-order explanatory variable observation vector, β represents the explanatory variable's coefficient vector, and ϵ_{it} represents the independently and identically distributed error.

The panel data includes both the time and

section dimension data. Although the panel data reduces the non-stationarity of the data, the correlation of variables is reduced, but each variable still has a trend and intercept problem, may still be non-stationary data, and has a unit root. A direct regression analysis of such data can result in pseudo-regression. In order to avoid false regression and ensure the validity of the estimation results, it is necessary to perform the stationarity test on each panel data. The most common method for verifying data stability is the unit root test.

There are many methods for the unit root test of the panel data, but the application of each method is different. According to the characteristics of the data in this study, we adopted Harris and Tzavalis's (1999; HT) test. This method is suitable for a panel data unit root test with a large number of sections and a short time-period. The HT test assumes that the number of time-periods is fixed and requires that the panels be strongly balanced. The test has as the null hypothesis that all the panels contain a unit root. If the null hypothesis is rejected, it means that there is no unit root and the data is stable. Baltagi (2008) mentions that T being fixed is the typical case in micro-panel studies. Here, there may be a panel dataset of firms, and it may be more natural to think that if the sample size of one's dataset could be increased, it would be done by collecting data on more firms, despite that the number of time-periods available for each firm is fixed. Using the HT test to perform a unit root test on the variables, we arrived at the following results.

The results (Panel A, Table 5) show that the variables all reject the null hypothesis, as the unit root is significantly at the level of 1%, which proves that there is no unit root in the original sequence; in other words, each variable is stable.

After the unit root test finds that the variables are stable, it is necessary to test the cointegration relationship between the relevant variables. The cointegration test can show that there is a long-term, stable equilibrium relationship between variables, and the regression residual of the equation is stable. On this basis, the original equation can be directly regressed, and the regression result at this time is more accurate. The method of the cointegration test of panel data mainly includes the Pedroni (1999, 2004) and the Kao (1999) test. The Kao test uses the extended DF and ADF tests to propose a test panel cointegration method. This method assumes that there is no cointegration relationship, and uses the residuals of static panel regression to construct statistics. The Pedroni test is based on the residual panel-based cointegration test method given by the null hypothesis that there is no cointegration relationship in the dynamic multivariate panel regression. At shorter times, the Kao test is more potent than the Pedroni test. The sample period of this study was only five years, which is rather short. We used the Kao test for cointegration analysis.

The results (Panel B, Table 5) show that the adjusted DF and ADF statistics reject the null hypothesis at the 1% significance level, which proves that there is a cointegration relationship between the variables. A linear regression model can be established to study the effects of each variable on the manufacturing stock PER.

In summary, we construct a regression model of the following form

$$\begin{aligned} PE = {} & \beta_1 DAR + \beta_2 CR + \beta_3 TS + \beta_4 ROE \\ & + \beta_5 PS + \beta_6 DPR + \beta_7 OPR + \beta_8 FS \\ & + \beta_9 OC + \alpha_i + \gamma_t + \epsilon, \end{aligned}$$

Table 6. Regression Results

Panel A: Fixed-effects (within) regression			
Variables	coeffificient estimates	Standard error	t-statistic
DAR	0.0756	0.0566	1.33
CR	0.1341	0.2099	0.64
TS	0.032	0.0278	1.15
ROE	-1.1817	0.0855	-13.82***
GEPS	-0.0055	0.0025	-2.25**
DPR	0.0244	0.0121	2.01**
OPR	-0.1186	0.0273	-4.34***
FS	-16.1576	1.1292	-14.31***
OC	7.8725	8.0406	0.98
Constant	402.0291	25.7643	15.60***
F(9,1259) = 57.49		Prob > F=0.0000	
R-squared=0.2913			
F test that all u_i=0: F(316, 1259) = 3.39			
Prob > F = 0.0000			

Panel B: Random-effects GLS regression			
Variables	coeffificient estimates	Standard error	z-statistic
DAR	0.0679	0.0362	1.88*
CR	0.4144	0.1578	2.63***
TS	0.0374	0.0218	1.71*
ROE	-0.8889	0.066	-13.46***
GEPS	-0.0058	0.0024	-2.40**
DPR	0.0196	0.011	1.78*
OPR	-0.1053	0.024	-4.39***
FS	-6.5459	0.5644	-11.60***
OC	6.4784	3.4872	1.86*
Constant	181.8569	12.0265	15.12***
Wald chi2(9)=537.77		Prob > chi2=0.0000	
R-squared=0.2640			

where the subscript i_t represents the observations of the variables of individual i at time t, $\beta_1, \beta_2, \ldots, \beta_9$ represent the individual effect ϵ_{it} represents the error.

Table 6. Lagrangian and Hausmann Test Results

Panel C: Breusch and Pagan Lagrangian multiplier test for random effects

pe[code,t] = Xb + u[code] + e[code,t]

Estimated results:

	Var	sd = sqrt(Var)
pe	253.0139	15.90641
e	123.6929	11.12173
u	45.65212	6.756635

Test: Var(u) = 0

chibar2(01) = 197.09

Prob > chibar2 = 0.0000

Panel D: Cluster-Robust Hausman Test(based on 200 bootstrap repetitions)

b1: obtained from fixed-effects model.

b2: obtained from random-effects model.

Null hypothesis: difference in coefficients not systematic

Test results:

chi2(9) = (b1-b2)' * [V_bootstrapped(b1-b2)]^(-1) * (b1-b2)

Prob>chi2=0.0000

***, **, and * represent statistical signifificance at the 1%, 5%, and 10% levels, respectively.

The panel data model usually has three forms. One is the Pooled Regression Model. If, from the cross-section, there is no significant difference between different individuals in terms of time, then there is no significant difference between different sections, and the panel data can be directly mixed together to estimate the parameters by OLS. One is the Fixed Effects Regression Model. If the intercepts of the models are different for different sections or different time series, the regression parameters can be estimated by adding dummy variables to the model. One is the Random Effects Regression Model. If the intercept term in the fixed effect model includes the average effect of the cross-section random error and the time random error, and the two random error terms obey the normal distribution, the fixed effect model thus becomes the random effect model.

Before selecting the applicable model, a joint significance test of individual and random effects should be performed to determine whether the panel data model needs to be utilized. The results are shown in Table 6.

The results (Panel A, Table 6) shows that the F statistic for testing the individual effect (u_i) is 3.39, rejecting the null hypothesis that there is no individual effect at the 1% significance level, given the indication that there is an individual effect, and the fixed effect needs to be considered in the model.

Table 7. Robustness Test

Panel A: Regression with Driscoll-Kraay standard errors			
Method: Fixed-effects regression			Number of obs=1585
R-squared=0.2913			Number of groups=317
F(9, 316) =2072.22			Prob > F = 0.0000
Variables	coeffificient estimates	Standard error	t-statistic
DAR	0.0756	0.0256	2.95***
CR	0.1341	0.1698	0.79
TS	0.0321	0.0384	0.84
ROE	-1.1817	0.1027	-11.51***
GEPS	-0.0055	0.0019	-2.88***
DPR	0.0244	0.0113	2.16**
OPR	-0.1186	0.0237	-5.01***
FS	-16.1576	6.3787	-2.53**
OC	7.8725	7.9566	0.99
Constant	402.0291	139.4535	2.88***

Panel B:Matching table of expected hypotheses and empirical results for each variable			
Variables	Research hypothesis	Empirical analysis	Comparative
DAR	-	+	Different
CR	+	+	Same
TS	+	+	Same
ROE	+	-	Different
GEPS	-	-	Same
DPR	+	+	Same
OPR	+	-	Different
FS	-	-	Same
OC	-	+	Different

***, **, and * represent statistical signifificance at the 1%, 5%, and 10% levels, respectively.
'+' represents positive correlation between the variables and the P/E ratio.
'−' represents negative correlation between the variables and the P/E ratio.

This also proves that the pooled OLS model does not apply here. It is necessary to perform a random effect regression before testing whether the random effect in the model is significant. The results (Panel B, Table 6) show the random effect regression, and the results (Panel C, Table 6) show the test of whether the random effect is significant. It can be seen that the null hypothesis is rejected at the 1% significance level. This proves that there is a significant random effect. The overall results indicate the need to consider individual and random effects, indicating the need for a panel data model.

Next, we had to choose a fixed effect model or a random effects model. When testing a random effects model or a fixed effects model, the traditional Hausman test cannot be used in the presence of heteroskedasticity or serial correlation within panels because, in this case, the RE-GLS estimator is not fully efficient. Cameron and Trivedi (2009) proposed that the Hausman test, based on Bootstrapping, can overcome both the heteroscedasticity and sequence related problems to some extent. Therefore, we used the Hausman test based on the Bootstrap method. The results are shown in Table 6.

The results (Panel D, Table 6) show that the null hypothesis is rejected at the 1% significance level, so the fixed effect model should be selected for regression analysis. Panel data Due to its own characteristics, the error of the regression model may include heteroscedasticity, serial correlation (autocorrelatio n), and cross-sectional dependence. These errors will lead to a decrease in the accuracy of the general fixed-effect regression model. When there are heteroscedasticity, autocorrelation, and cross-sectional dependence errors, the regression method of the modified error proposed by Driscoll and Kraay (1998) can be used. This method can correct these errors, thereby making the regression results more accurate. These standard errors are robust to general forms of cross-sectional and temporal dependence when the time dimension becomes large. Because this nonparametric technique of estimating standard errors places no restrictions on the limiting behavior of the number of panels, the size of the cross-sectional dimension in finite samples does not constitute a constraint on feasibility, even if the number of panels is much larger than the time. The results of our regression analysis using this method are shown in Table 7.

The results (Panel A, Table 7) show that the F statistic value of the model is 2072.22, passing the test at a significant level of 1%, indicating that the overall regression model is good. These nine variables generally affect the change of the PER. According to the regression results, we can find that the Debt to Asset Ratio, Return on Equity, EPS growth rate, and the Operating Profit Ratio all passed the test at a significant level of 1%. Then, with a 5% significance level, the Dividend Payout Ratio and firm size passed the test, indicating that these variables can significantly affect the PER. However, the Current Ratio, Treasury Stock Ratio and Ownership Concentration did not pass the significance test. The results show that the constant term passes the test at the 1% significance level. Substituting the significant variables into the previous regression model, we can obtain the following linear regression model that affects the PER.

$$PE = 0.0756DAR - 1.1817ROE - 0.0055GPS + 0.0244DPR - 0.1186OPR - 16.1576FS + 402.0291.$$

From the above formula, we can assume that the other variables remain unchanged; for every 1% increase in the Debt to Asset Ratio, the firm's the PER will increase by 0.0756. Based on this assumption, for every 1% increase in Return on Equity, the firm's the PER will decrease by 1.1817, and the firm's the PER will decrease by 0.0055 for every 1 % increase in the EPS growth rate. Assuming that the other variables remain the same, for every 1% increase in the Dividend Payout Ratio, the firm's the PER will increase by 0.0244, and the firm's the PER will be reduced by 0.1186 for every 1% increase in Operating Profit Ratio. Lastly, assuming that the other variables remain unchanged, for

every 1% increase in firm size, the firm's the PER will decrease by 16.1576. We can therefore conclude that the firm size has the greatest impact on the PER of the manufacturing sector, followed by Return on Equity, Operating Profit Ratio, Debt to Asset Ratio and Dividend Payout Ratio. The least impact on the PER is the EPS growth rate.

(4) Empirical Implications

The table (Panel B, Table 7) compares the empirical results and the research hypotheses. Based on our considerations hitherto, we have the following results: First, the Debt to Asset Ratio is positively correlated with the PER at the 1% level of significance. This is contrary to our expectation. This may be because the debt to asset ratio is higher, indicating that the firm through the debt management, the scale of production has been expanded, the vitality of the firm has been enhanced, and the firm has obtained higher profits. This can convey a good signal to the market and make the firm's stocks more favored by investors, causing the PER to increase.

Second, Return on Equity passed the test at a significant level of 1%, which is negatively correlated with the PER. The higher ROE of the firm is, the lower the PER is, which is contrary to our expectation. The reason may be that the higher ROE represents the higher the profit level of the firm, causing the EPS to increase above the stock price. Therefore, the ROE is negatively correlated with the PER.

Third, the Operating Profit Ratio passed the test at a significant level of 1%, which was negatively correlated with the stock PER. The higher the operating profit ratio of the firm is, the lower the PER is, which is contrary to our expectation. The reason may be that the higher the operating profit ratio means that the more operating profit provided by the firm's commodity sales, the stronger the profitability of the firm is, resulting in a higher EPS and lower PER.

Fourth, the EPS growth rate passed the test at the significant level of 1%, which is negatively correlated with the stock PER of the manufacturing sector. That means the higher the EPS growth rate of the firm is, the lower the PER is, which is consistent with our expectation. The Dividend Payout Ratio passed the test at the significant level of 5%, which is positively correlated with the PER; thus, hypothesis 6 was verified. The firm size passed the test at the significant level of 5%, which is negatively correlated with the stock the PER. The larger the firm's size is, the higher the PER is, which is consistent with our expectation.

Fifth, the Current Ratio, Treasury Stock Ratio and Ownership Concentration did not pass the test at a significant level of 5%, indicating that they would not affect the stock PER, which is inconsistent with our expectations. The reason may be that the sample size after screening was not enough to explain the correlation between them.

Ⅳ. Conclusion

We have studied the correlation between the manufacturing sector's PER and its influencing factors from both macro and micro aspects. The macro aspect mainly studies the impact on the average PER of the manufacturing sector. First, a descriptive statistical analysis was carried out to visually show the correlation between the average PER of the manufacturing sector and its influencing factors. Secondly, the Granger causality test was carried out on the average

PER of the manufacturing sector and its influencing factors. The intrinsic change relationship between the average PER of the manufacturing sector and its influencing factors was analyzed in-depth. In the end, we conducted a cointegration test on the average PER of manufacturing sector and its influencing factors, which proves that there is a cointegration relationship between them and can carry out regression analysis. Finally, it was concluded that on the macro level, the average PER of China's manufacturing sector is generally in a more rational range, and the average PER will change with the changes in the macro environment. The four influencing factors involved in the study cannot just determine whether one of the single factors will have a positive or negative impact on the average the PER of the manufacturing sector. Instead, it considered these influencing factors as a whole and combine them to determine their impact on the PER.

On the micro level, we focus on the impact of the manufacturing individual firm's stock PER. Based on previous studies and theoretical models, we propose nine variables that might affect the PER. At the same time, after screening and composing the panel data for research, we first carried out the descriptive statistics on the data, analyzed the changes in the level of the stock PER, and then analyzed the correlation between manufacturing individual firm's stock PER and its influencing factors according to the Pearson correlation coefficient. Immediately, because the panel data has the characteristics of time series data, the unit root test was performed on the research variables to verify the stationarity of the data. After obtaining the stable data, a cointegration analysis was performed to determine if the variables can be performed by the regression analysis. In the regression analysis, the fixed effect model applied in this study was determined by the Bootstrap-based Hausman test. Finally, on the premise of considering the model error term, a regression method that can correct the error is used to establish a multiple linear regression model, and a more in-depth analysis of the correlation between the PER of the manufacturing sector and its influencing factors.

By means of empirical analysis, we found that the impact of the dividend payout ratio is very significant, but in the sample screening, many listed firms have not disclosed this indicator; as a result, we propose to improve the content, format, and information disclosure of listed firms. Procedures to strengthen the means of information disclosure and improve the quality of information disclosure. Symmetrical information is important in stock trading, and only investors can get enough information to make a correct judgment on the stock market. In particular, factors that were shown to have had a significant impact on the PER in this study should be disclosed for investors' analyses. Investors should also use these factors related to the PER to make rational investments. In general, the ROE is an indicator that comprehensively evaluates the benefits of the firm. The higher the ROE is, the better the performance of the firm is. However, it was found in our study that the ROE is negatively correlated with the stock PER. Therefore, investors must pay attention to the ROE when evaluating the firm's PER. This is not as positively correlated with the PER as usual. Based on the conclusions drawn above, when considering the indicator of ROE, it is also necessary to combine the evaluation of the value of the firm. If the investor underestimates the value of the firm, a higher ROE would result at the expense of a lower PER.

Although this study focuses on the PER as a relative measure of firm valuation, it does not rule out other accounting multiples including the price-to-book ratio (PBR). It was not until Fama and French (1992) the PBR received due academic attention. Traditionally, it was perceived as the expected return on equity (Graham et al., 1962; Preinreich, 1938; Edwards and Bell, 1961; Peasnell, 1982). Like the PER, the PBR is deemed a growth signal (Preinreich, 1932; Kay, 1976; Brief and Lawson, 1992) determined by leverage (Graham et al., 1962). Analysts describe the PBR as the "margin of safety, a comparison of price to liquidation value" (Bodie et al., 1989) like Tobin's (1969) q. The PBR can describe the relative degree of stock mispricing (Rosenberg et al., 1985) discerning a "value stock" as opposed to a "glamor stock" (Lakonishok et al., 1994). Chan et al. (1991) and Fama and French (1992) find that, as a proxy for risk or an indicator of distress, the PBR indicates mean stock returns. In another study on the firm valuation of the Chinese manufacturing sector, we can consider the PBR as an alternative measure of relative pricing.

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