

The Impact of China's Market Integration on Total Factor Productivity of Heterogeneous Enterprises

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Abstract

Based on China's micro enterprise data area and inter provincial panel data from 1998 to 2007, this paper uses a two-way fixed effect model to study and analyze the impact of market integration and enterprise total factor productivity. At the same time, it investigates the different performances of enterprises with different institutional properties in the process of market integration. The analysis shows that the inter provincial market integration has a significant positive effect on the total factor productivity of micro enterprises. Further analysis points out that compared with state-owned enterprises, private enterprises, Hong Kong, Macao, Taiwan funded and foreign-funded enterprises are more significantly affected by market integration.

Keywords

Market integration; Total factor productivity; Heterogeneous Enterprises; Two-way fixed effect model.

1. INTRODUCTION

Since the reform and opening up in 1978, China's economy has grown rapidly. On the one hand, through market-oriented reform, we will gradually adjust the planned economy to a socialist market economy with Chinese characteristics, so as to realize the great role of the market in resource allocation. Under the condition of market economy, market factors and commodities flow freely under the action of price mechanism, produce scale effect, deepen division of labor and improve total factor productivity, so as to promote economic growth. On the other hand, opening to the outside world enables domestic enterprises to participate in the global division of labor, brings huge international market to domestic enterprises and shares the dividends of global economies of scale. At the same time, the policy of opening to the outside world will also urge the Chinese government to relax the control of enterprises and realize the marketization of enterprises. While China continues to deepen its opening-up and actively participate in the global division of labor, trade protectionism and antiglobalization forces led by the United States are rising. When the prospect of opening up the international market is not optimistic, the Chinese government put forward the policy of "promoting the formation of a new development pattern with the domestic cycle as the main body and the double cycles at home and abroad promoting each other". The Chinese government actively promotes the domestic cycle, continues to deepen reform, improves the technical level of enterprises, fully tap the potential of China's market demand, and promote the high-quality development of China's economy.

Yin Wenquan et al (2001) [1] believes that market segmentation is a unique product of the dual track economic system, and administrative decentralization is its deep reason. Among them, short-term market segmentation may bring benefits to local governments, but in the long

run, it will make the economy deviate from the growth path. Bai chongen et al (2004) [2] thinks that under the fiscal decentralization system, local governments adopt local protection policies for local state-owned enterprises and enterprises with high interest and tax rates in order to achieve the goal of economic growth. Lu Ming et al (2009) [3] believes that there is a nonlinear relationship between opening to the outside world and market integration. On the whole, opening to the outside world will increase the degree of domestic market segmentation; at the same time, the author also finds that domestic market segmentation has a negative impact on domestic market. The economic growth impact of each province shows an inverted U-shaped relationship. In the early stage, it will promote the economic growth of the province and inhibit the economic growth of a province in the later stage. Sheng bin et al (2011) [4] through analysis, it is concluded that both opening to the outside world and regional market integration have a positive impact on China's inter provincial total factor productivity, and there is a substitution relationship between them. It is pointed out that the positive effect of opening to the outside world is more significant in coastal areas, and the positive effect of market integration in inland areas is more significant.

By combing the existing literature, it can be seen that researchers have basically reached a more consistent conclusion on the impact of market integration on market economic growth and total factor productivity, that is, market integration has a positive impact on economic growth and total factor productivity. However, the existing literature is limited to the macro data level, rarely uses micro enterprise data, and studies the impact of market integration on micro enterprise total factor productivity from the perspective of enterprise heterogeneity. Based on the calculation of domestic market integration index and enterprise total factor productivity, this paper will study the impact of China's domestic market integration on enterprise total factor productivity. This paper attempts to make contributions from the following aspects: (1) previous studies have considered the impact of market integration on economic growth at the macro level, but not at the micro level. As a further study, this paper will use the micro enterprise database to calculate enterprise total factor productivity and study the impact of market integration on enterprise total factor productivity. (2) Previous studies pay little attention to the heterogeneity of micro enterprises, and enterprises with different systems will respond differently in the face of market integration. (3) In order to ensure the reliability of the conclusion, this paper tests the stability of the conclusion from three aspects: explanatory variable replacement, explanatory variable replacement and outlier elimination.

The structure of this paper is as follows: The second part constructs the measurement model and variable setting, and makes a descriptive analysis; The third part is model selection, basic regression, grouping regression and stability test; The fourth part is the conclusion.

2. ECONOMETRIC MODELS AND VARIABLES

This paper mainly studies the impact of market integration on total factor productivity. Therefore, the bidirectional fixed effect measurement model is constructed as follows:

$$ln tfp_{ijt} = \alpha_0 + \alpha_1 integ_{jt} + \alpha_2 Province_{jt} + \alpha_3 X_{ijt} + \delta_i + \delta_t + \varepsilon$$

$ln tfp$ represents the total factor productivity of enterprises. $integ$ represents the level of market integration. $Province$ represents the characteristics of provinces. X represents the characteristics of enterprises. δ represents the characteristics of industries, provinces and years, and ε represents the error term. The subscript means the i -th enterprise, the j -th province and the t -th year. In order to control the impact of unobserved industry characteristics,

provincial characteristics and enterprise characteristics on enterprise production, a fixed effect model is used to reduce the estimation error.

Lntfp index represents the total factor productivity of enterprises. The Lntfp index is constructed based on the method of Olley et al (1996) [5] and with reference to the specific method of estimating TFP by Lu Xiaodong et al. (2012) [6]. Based on the price index method of Parsley et al (1996, 2001) [7] and referring to the "relative price method" of GUI qihan et al (2006) [8], the market integration index (integ) is constructed. The market integration index uses the commodity price index as the measurement standard. If regions are divided, there is a price difference between them. If there is free trade between regions, the price difference is relatively small, because if the price difference is too large, there will be arbitrage opportunities. After arbitrage in economic exchanges, the price difference will disappear. The control variables include: (1) Govscal represents government fiscal expenditure scale. Expressed as the proportion of government fiscal expenditure to GDP, this indicator indicates the degree of government intervention in economic activities. (2) Open represents the trade openness. Expressed as the proportion of total import and export trade to GDP, this indicator indicates the degree of regional trade openness. Trade openness is generally considered to have a dual impact on local enterprises. On the one hand, imported goods and foreign-funded enterprises will bring crowding out effect to the local market, improve the degree of local market competition, and eliminate local inefficient enterprises; On the other hand, competition will drive local enterprises to actively improve total factor productivity to improve competitiveness. At the same time, foreign enterprises will also bring technology spillover effect. (3) Stru represents the industrial structure Expressed by the proportion of tertiary industry employment in the total employment, this index represents the development level of a regional service industry. In the process of China's urbanization, the labor force in the primary industry continues to transfer to the secondary and tertiary industries. The adjustment and upgrading of industrial structure is an important channel to realize the reallocation of resources, and the enterprises with high productivity have been expanded, thus improving the efficiency of service industry Total factor productivity. (4) R&D represents the R&D investment. Expressed as the proportion of internal expenditure of R & D funds in GDP, this indicator represents the level of R&D investment in the region. (5) Revenue represents the enterprise sales scale. This indicator is expressed as the present value of industrial sales revenue of the enterprise. This indicator represents the sales scale of the enterprise. The larger the scale of the enterprise, the more motivated it is to improve total factor productivity. (6) Lnage represents the enterprise age. This indicator is expressed by the logarithm of the time from the opening of the enterprise to a certain year. This indicator represents the duration of the enterprise.

The samples of this paper are all state-owned enterprises and non-state-owned enterprises above Designated Size from 1998 to 2007. The data are from the database of all state-owned and Non-state-owned Industrial Enterprises above designated size. The control variable is the panel data of 33 provinces except Tibet from 1998 to 2007, in which the R & D input index data of the proportion of internal expenditure of research and experimental development funds in GDP comes from the China Science and Technology Statistical Yearbook; Other data are from China Statistical Yearbook.

Table 1 reports the statistical characteristics of the main variables, from which it can be seen that the correlation between most explanatory variables and the explained variables is consistent with the expectation, in which the correlation coefficient between market integration and total factor productivity is 0.14, which is significant at the 1% level. In addition, the absolute value of the correlation coefficient between the explanatory variables is lower than 0.6. Through further investigation of the variance expansion factor (VIF), it is found that the value is in the interval [1.01, 1.74], and the mean value of Vif is 1.26. According to the empirical rule, $Vif \leq 10$ is considered to have no multicollinearity, so there is no multicollinearity problem in this paper.

Table 1. Descriptive analysis

| | Intfp | integ | Govscal | Open | Stru | R&D | Revenue | lage |
|---------|--------------------|--------------------|--------------------|--------------------|--------------------|-------------------|-------------------|------|
| Intfp | 1 | | | | | | | |
| integ | 0.140*** 0.000 | 1 | | | | | | |
| Govscal | -0.00100 0.451 | -0.039*** 0.000 | 1 | | | | | |
| Open | 0.081*** 0.000 | -0.012*** 0.000 | 0.072*** 0.000 | 1 | | | | |
| Stru | 0.114*** 0.000 | 0.160*** 0.000 | -0.322*** 0.000 | 0.531*** 0.000 | 1 | | | |
| RD | 0.080*** 0.000 | -0.061*** 0.000 | 0.357*** 0.000 | 0.524*** 0.000 | 0.287*** 0.000 | 1 | | |
| Revenue | 0.307*** 0.000 | 0.058*** 0.000 | 0.022*** 0.000 | 0.024*** 0.000 | 0.016*** 0.000 | 0.019*** 0.000 | 1 | |
| lnage | -0.061*** 0.000 | -0.035*** 0.000 | 0.029*** 0.000 | -0.017*** 0.000 | -0.062*** 0.000 | 0.009*** 0.000 | 0.097*** 0.000 | 1 |

*** p<0.01, ** p<0.05, * p<0.1

3. REGRESSION RESULTS AND ANALYSIS

3.1. Basic Regression and Analysis

In this paper, the panel ordinary least square method is used to give the preliminary estimation results, The results are reported in columns (1) - (4) of the table. The estimation results of pooled least square are reported in column (1) of the table, and fixed effect (FE), random effect (RE) and two-way fixed effect (Two-way FE) are reported in columns (2), (3) and (4). It is strongly rejected that "there is no individual random effect" through LM Test The original hypothesis shows that random effect (RE) model is more suitable than pols model. Further, through Hausman test, the results show that the original hypothesis is rejected at the 1% significance level, indicating that the fixed effect (FE) model is more suitable than the random effect (RE) model. Finally, through the time joint test, the results show that the original hypothesis of "no time effect" is strongly rejected, and it is considered that the model should include time effect, so the two-way fixed effect is finally selected.

Next, we take the two-way fixed effect model as the basic model of analysis. Market integration has a positive impact on total factor productivity, which is significant at the level of 1%. The government expenditure coefficient is significantly positive, indicating that the positive effect of government expenditure on total important productivity is greater than the negative effect. The trade opening coefficient is positive, which is significant at the significant level of 10%, indicating that the higher the degree of trade opening, the higher the total factor productivity of enterprises, and the positive effect of trade opening is greater than the crowding out effect. The industrial structure coefficient is significantly positive, indicating that with the upgrading of industrial structure, the improvement of resource redistribution efficiency caused by the flow of labor from the primary industry to the secondary and tertiary industries has effectively improved the total factor productivity. Surprisingly, the result of R&D input coefficient is not significant, which may be because this index uses the proportion of internal expenditure of research and experimental development funds in GDP. These funds are mainly provided for the research needs of state-owned enterprises, and the overall sample includes a large number of private enterprises, Hong Kong, Macao, Taiwan funded and foreign-funded enterprises. These enterprises can rarely get the support of these funds, so the overall performance is not significant. The Revenue indicators coefficient is significantly positive,

indicating that the longer the enterprise duration, the stronger its internal coordination ability and anti risk ability, and the more it can improve total factor productivity.

Table 2. Basic regression

| VARIABLES | (1) OLS | (2) FE | (3) RE | (5) Two-way FE |
|---------------------------|-------------------------|-----------------------|-----------------------|---------------------------------|
| integ | 0.0077*** (157.46) | 0.0010*** (22.14) | 0.0040*** (97.73) | 0.0008*** (8.60) |
| Govscal | -0.0452** (-2.17) | 2.6298*** (55.59) | 1.8873*** (67.10) | 1.6754*** (25.11) |
| Open | 0.0148*** (9.50) | 0.0272*** (5.00) | 0.0263*** (11.18) | 0.0206** (2.32) |
| Stru | 0.6547*** (66.45) | 0.7795*** (35.89) | 1.2082*** (93.63) | 0.1236*** (3.78) |
| R&D | 6.1092*** (65.83) | 1.6165*** (4.78) | 5.3218*** (36.70) | 0.5236 (1.10) |
| Revenue | 0.2434*** (437.82) | 0.2833*** (294.54) | 0.2850*** (383.16) | 0.2746*** (140.60) |
| Lnage | -0.0902*** (-118.98) | 0.2373*** (112.19) | 0.0088*** (8.40) | 0.1421*** (39.38) |
| Constant | 2.6851*** (588.62) | 2.0304*** (312.50) | 2.2753*** (462.88) | 2.4311*** (200.89) |
| Observations | 1,804,626 | 1,804,626 | 1,804,626 | 1,804,626 |
| R-squared | 0.128 | 0.138 | | 0.142 |
| Company FE | NO | NO | NO | YES |
| Year FE | NO | NO | NO | YES |
| Number of company time | | 474,822 | 474,822 | 474,822 474821*** [0.000] |
| LM | | | 876409*** [0.000] | |
| Hausman | | | 31429*** [0.000] | |

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

3.2. Grouping Regression and Analysis

Next is heterogeneity analysis. According to the setting of variables, this paper is divided into three categories according to enterprise ownership: state-owned enterprises, Hong Kong, Macao and Taiwan enterprises, foreign-funded enterprises and private enterprises. The results of grouping regression showed that there were significant differences among the three. State owned enterprises are significantly positive at the 10% level, which is not consistent with the overall situation of the country. The regression coefficient of private enterprises, Hong Kong, Macao, Taiwan and foreign-funded enterprises is significantly positive at the 1% level, because as an enterprise responsible for its own profits and losses, in order to expand the production scale and improve its competitiveness, it has continuously adjusted the production structure and improved the technical level, thus improving the production efficiency of the enterprise.

Table 3. Grouping regression

| VARIABLES | (1) State-owned enterprise | (2) Private enterprise | (3) Hong Kong, Macao, Taiwan and foreign-funded enterprises |
|-------------------|----------------------------------|------------------------------|----------------------------------------------------------------------|
| integ | 0.0007* (1.76) | 0.0005*** (4.93) | 0.0017*** (7.88) |
| Govscal | 0.1019 (0.58) | 2.0092*** (24.95) | -0.1666 (-0.93) |
| Open | 0.0689** (2.15) | -0.0074 (-0.65) | 0.1053*** (6.07) |
| Stru | 0.7389*** (4.88) | 0.2089*** (5.08) | -0.1723*** (-2.84) |
| R&D | 4.2779*** (2.59) | 0.8580 (1.42) | 0.9561 (1.01) |
| Revenue | 0.2525*** (42.89) | 0.2934*** (105.30) | 0.2518*** (81.52) |
| Lnage | 0.0041 (0.20) | 0.1517*** (36.74) | 0.1822*** (20.42) |
| Constant | 2.0793*** (30.25) | 2.4513*** (172.25) | 2.5650*** (95.79) |
| Observations | 117,734 | 1,277,830 | 409,062 |
| R-squared | 0.138 | 0.148 | 0.137 |
| Number of company | 27,207 | 354,324 | 93,291 |
| Company FE | YES | YES | YES |
| Year FE | YES | YES | YES |

Robust t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

3.3.Stability Test

(1) The total productivity index calculated by LP method and ACF method. LP method and ACF method are used to calculate the total factor productivity index of enterprises. Taking it as the explanatory variable of stability test, the results are shown in columns (1) and (2) in the table. The regression results of total factor productivity index constructed by LP method and ACF method show that the significance and sign of explanatory variables have not changed, and the regression results are generally stable.

(2) Explanatory variables lag by one period. The two-way fixed effect model adopted in this paper can effectively reduce the endogenous problems caused by the omission of variables that do not vary with individual and time factors, but there may still be endogenous problems caused by reverse causality. In the process of market integration, enterprises improve productivity by adjusting the combination of production factors, improving technical level and management level, and produce more high-quality and lower price products, so as to promote the further development of market integration. The stability test is carried out by using the explanatory variable market integration lag phase I index, and the results are shown in column (3) of the table. The results show that the significance and sign of the explained variables have not changed, and the regression results are generally robust.

(3) Eliminate abnormal samples. In order to eliminate the influence of abnormal sample points, we first calculated the average value of the market integration index of each province

and the provinces with their 10% and 90% quantiles during the sample period, eliminated 6 provinces and cities such as Beijing, Shanghai, Tianjin, Shandong, Hebei and Liaoning, and finally obtained the samples of 27 provinces and cities. Two way fixed effect regression analysis was performed on these new samples, and the results are shown in column (4). The results show that the significance and sign of explanatory variables have not changed, and the abnormal sample points have no substantive impact on the estimation, indicating that the estimation result is robust.

Table 4. Stability test

| VARIABLES | (1) LP | (2) ACF | (3) 1997~2006 | (4) Intfp |
|-------------------|-----------------------|-----------------------|-----------------------|-------------------------|
| integ | 0.0011*** (12.59) | 0.0006*** (6.66) | 0.0017*** (17.38) | 0.0006*** (4.84) |
| Govscal | 1.3284*** (20.18) | 1.8728*** (27.38) | 1.6619*** (24.84) | 1.2329*** (17.47) |
| Open | 0.0418*** (4.75) | 0.0082 (0.90) | 0.0225** (2.53) | 0.1465*** (12.20) |
| stru | 0.3858*** (11.80) | 0.0737** (2.20) | 0.0973*** (2.97) | -0.0546 (-1.35) |
| R&D | 1.1073** (2.34) | 0.5848 (1.20) | 1.1175** (2.33) | -17.0575*** (-23.29) |
| Revenue | 0.3465*** (163.22) | 0.2396*** (123.10) | 0.2742*** (140.50) | 0.2753*** (117.94) |
| lnage | 0.2893*** (81.85) | 0.3281*** (88.47) | 0.1416*** (39.23) | 0.1136*** (27.48) |
| Constant | 4.7033*** (393.06) | 1.5100*** (121.60) | 2.4262*** (207.61) | 2.5694*** (183.17) |
| Observations | 1,804,626 | 1,804,626 | 1,804,626 | 1,304,467 |
| R-squared | 0.206 | 0.182 | 0.142 | 0.147 |
| Number of company | 474,822 | 474,822 | 474,822 | 343,107 |
| Company FE | YES | YES | YES | YES |
| Year FE | YES | YES | YES | YES |

Robust t-statistics in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

4. CONCLUSION

Using the panel data of 33 provinces and cities in China from 1998 to 2007, this paper uses a two-way fixed effect model to study the impact of market integration on total factor productivity. The results show that market integration significantly promotes the improvement of total factor productivity. Then, according to the nature of enterprises, the impact of market integration level on total factor productivity of enterprises with different ownership is different. There is a significant positive correlation between foreign-funded enterprises and private enterprises at the level of 1%, and there is only a significant positive correlation between state-owned enterprises at the level of 10%. This is mainly due to the different degree of marketization of enterprises with different ownership, as well as the different factors such as internal management, technological innovation and incentive mechanism. Facing the continuous improvement of market integration and marketization, foreign-funded enterprises and private enterprises are responsible for their own profits and losses, have a strong operation and management mode, improve the technical level, improve the overall productivity of enterprises,

expand the production scale and realize the scale effect, so as to improve the competitiveness of enterprises under the background of expanding the market. Therefore, with the development of China's new era, while continuing to promote the "domestic big cycle" and "international small cycle", China should continue to adhere to the market-oriented reform of state-owned enterprises. Only by continuously deepening market-oriented reform can the effect of domestic market integration be better brought into play, better promote the development of enterprise total factor productivity, and continue to promote China's high-quality economic growth.

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