Regional Inequality of Firms’ Export Opportunity in China: Geographical Location and Economic Openness

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Abstract: China has a large land area and uneven regional development. There are significant disparities between the three belts (eastern, central, and western China), with the eastern region being the most developed and the western region the least developed. Considering that export is regarded as one of the troikas for China’s economic growth and firms are the basic entities engaged in trade activities, we examine whether there exists inequality of firms’ export opportunity between the three regions. We find that the critical productivity level of firms’ export in developed eastern China is significantly lower than that of western and central regions. Our results indicate that firms in eastern China are more likely to export and there is an obvious inequality of firms’ exporting opportunities.

Keywords: regional disparities; export opportunity; export; productivity; China

1. Introduction

Equal development opportunity for residents and enterprises is an important guarantee for sustainable social development. However, in reality, this is usually difficult to achieve, especially since serious regional gaps make the residents and enterprises in the less developed areas face unequal development opportunities. Over the past 40 years, China has experienced dramatic economic growth. However, China’s economic growth has been accompanied by serious regional disparities. The most significant disparity is between the three belts (eastern, central, and western China) [1]. There are significant disparities in terms of physical environment, economy, culture, and institution between the three regions, with the eastern region being the most developed and the western region the least developed [2,3].

Take exports as an example: the export value of China has increased dozens of times since the 1980s, and the eastern region has accounted for more than 90% [4,5]. Exports are the main engines of economic growth. During the past 40 years, China’s reform and opening-up policy has resulted in the country becoming an extroverted economy with high international openness. Export has played an important role in promoting economic growth and is regarded as one of the troikas for economic growth in China. Furthermore, enterprises as the main body of the economy are the basic entities engaged in trade activities, and their competitiveness and performance are a direct reflection of regional economic development. At the same time, the business environment and development opportunities faced by enterprises are also the direct manifestation of regional disparities. In this context, one question is whether enterprises in different regions of China are facing the same development opportunities. Specifically, since exports have played an important role in China’s economic growth, and enterprises are the basic entities engaged in trade activities, it is particularly

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important for enterprises located in different regions to face the equal export opportunities. Therefore, this paper attempts to examine whether enterprises located in different regions have equal export opportunities and to provide a new perspective to explain the serious regional gap in China.

Various determinants on firm export have been investigated in the literature, including the firm-specific determinants, such as firm productivity, size, capital intensity, and wage and ownership structure [1,6,7]; and government and region-specific influences, such as preferential policies and state subsidies, agglomeration, and industrial structure [8–11]. As far as the firm's export opportunity is concerned, the cutoff productivity level for successful entry into the export market can well represent it. Productivity is an important reflection of firm competitiveness [12], and the heterogeneous firm trade theory argues that enterprises must reach a certain productivity threshold when entering the export market [13]. Only firms with productivity above a certain threshold can self-select into export markets. It can be seen that when the cutoff productivity level for successful entry into the export markets is higher, fewer enterprises enter the export market, and the opportunities for enterprises to export are fewer. Therefore, based on the heterogeneous firm trade theory, this paper compares and analyzes whether there is a significant heterogeneity in the export opportunities represented by cutoff productivity level of firms for successful entry into the export market between different regions. When enterprises in different regions have heterogeneous critical productivity levels for entry into the export market, there will be regional inequalities in firms' export opportunities.

Furthermore, we mainly compare and analyze the similarities and differences of export opportunities of enterprises between the three belts (eastern, central, and western China). Both physical and economic geographies are not homogeneous between these three regions. In terms of physical geography, the biggest difference between different regions is the location; the eastern region is located in the coastal area, and the central and western regions are located inland. Considering that distance to ports is crucial in exporting decisions of firms, since maritime transportation predominates in international trade, firms with lower productivity in the eastern coastal provinces can more easily enter the export market compared to their counterparts in central and west China that bear higher transportation costs. In terms of economic geography, the eastern provinces have higher degrees of openness because the reform and opening-up policy that generated the Chinese “export miracle” began from these areas [14]. In addition, tariff reductions, exporting subsidies, and other preferential policies have been more oriented to eastern than central and western China [15]. Meanwhile, the well-developed labor market in the eastern region contributes to the exporting opportunity, since the skilled labor brought by the rapid urbanization and industrialization have concentrated more in the east [16]. In addition, the increasing number of trade fairs [17] and the advanced service sector in eastern China [18] help attract both international and national businesses.

In summary, this paper attempts to examine whether there is inequality of firms’ export opportunities from a comprehensive analysis of geographic and economic heterogeneities, which have previously drawn less attention. Specifically, we will look at firm heterogeneities in accessibility to seaports and economic openness of firm location. We applied categorical logit models to analyze both individual and joint effects of these two factors on export entry opportunities across different regions in China. Our econometric results demonstrate that there is serious inequality of export opportunities among firms in different regions. Specially, the requirement of high TFP is lower for the firms in eastern China compared to those in western and central China. That is, firms located in eastern China are more likely to export due to the lower cutoff productivity level for entry into the export market. As far as the specific theoretical mechanisms are concerned, transportation costs and the economic openness of the firms’ location work together and co-shape the inequalities of firms’ export opportunities between different regions. Specially, the farther away from the coast, the higher TFP a firm needs to have in order to enter the export markets. In addition, a higher degree of openness to the international trade in general increased the exporting possibility of firms with low productivity. Materials and methods are discussed in Section 2. Research hypotheses are given in Section 3. Empirical results and related discussions are provided in Section 4. Section 5 concludes the paper.
2. Materials and Methods

2.1. The Analysis Methods

The primary research method of the paper is an adaptation of categorical logit or categorical logistic regression model [1,19]. Firm’s exporting behavior is modelled on the basis of a variety of observed, firm-specific characteristics along with a set of categorical variables that reflect our research hypotheses.

\[
P(Ex_{it} = 1) = \Lambda(lnTFR_{it}, lnSize_{it}, lnCappc_{it}, lnWage_{it}, Region_{it}, Time_{it}, Open_{it}, Owner_{it})
\]

(1)

The left side of Equation (1) reflects the export opportunity, Ex is a dummy variable of export, i is the firm index, and t is the year. \(\Lambda\) is a cumulative distribution function of logistic distribution. TFP is the total factor productivity estimated by a semi-parametric method proposed by Levinsohn and Petrin [20], who used intermediate input to control for correlation between input levels and the unobserved firm-specific productivity process (Appendix A provides a detailed procedure used by Levinsohn and Petrin to estimate TFP). In addition, we also use the method proposed by Olley and Pakes [21] to estimate the TFP as a robustness check (see Appendix B). \(TFP_{lp}\) and \(TFP_{op}\) represent the total factor productivity estimated by the LP and OP methods, respectively.

According to previous research, we include several control variables that have an impact on firms’ export decision [6,22–26], including firm size (Size), capital per capita (Cappc), wage per worker (Wage), and a set of categorical variables that affected firms’ opportunity of entering the export market. Size is represented by the logarithm of employees, Cappc is the ratio of capital and labor, and Wage is calculated by the logarithm of the wage per worker and represents labor skill. All continuous variables on the right-hand side are one-year lagged to reduce potential simultaneity problems. In addition, we also control for a full set of two-digit industry dummies (Industry) and year dummies (Year).

Region is categorized into three groups and two dummy variables are used to denote them, the eastern or the central region equals 1 when a firm is located in this corresponding region while the western region as the reference category. Time is the shortest transportation time from the city where a firm is located to its nearest port and represents transportation cost. Open, donating the exporting opportunity, is the ratio of total value of import and export to GDP of the province where the firm is located. We categorize Time and Open into four groups according to 25%, 50%, and 75% quantiles of the full sample, and the first 25% is used as the reference category. The results of these two categorical variables and their distribution in different groups are shown in Table 1.

| Variable | Category | Interval of Value | Interval of Quantile | Western Region | Central Region | Eastern Region |
|----------|----------|-------------------|----------------------|----------------|---------------|---------------|
| Open     | Open1    | (0.032, 0.102)    | (0, 25%)             | 68.42%         | 70.03%        | 2.96%         |
|          | Open2    | (0.102, 0.347)    | (25%, 50%)           | 31.58%         | 29.97%        | 19.75%        |
|          | Open3    | (0.347, 0.756)    | (50%, 75%)           | 0              | 0             | 39.82%        |
|          | Open4    | (0.756, 1.721)    | (75%, 1)             | 0              | 0             | 37.47%        |
| Time     | Time1    | (0, 2.817]        | (0, 25%)             | 0              | 0             | 40.32%        |
|          | Time2    | (2.817, 5.069]    | (25%, 50%)           | 0              | 0.47%         | 35.93%        |
|          | Time3    | (5.069, 10.938]   | (50%, 75%)           | 13.10%         | 41.53%        | 21.42%        |
|          | Time4    | (10.938, 51.322]  | (75%, 1)             | 86.90%         | 58.00%        | 2.33%         |

Owner is a categorical variable of three types of ownership, Others — 0, state-owned enterprises (SOEs) — 1, and foreign-owned enterprises (FOEs, including those owned by Hong Kong, Macao, and Taiwan investors) — 2. WTO is a dummy variable indicating the entry of WTO, which is assigned 1 after the year of 2001 and 0 before 2001. The summarizing statistics of these explanatory variables between exporters and non-exporters in different regions are reported in Table 2.
Table 2. Summarizing statistics of exporters and non-exporters in different regions.

| Variables | Eastern China | Central China | Western China |
|-----------|---------------|---------------|---------------|
|           | Exporters     | Non-Exporters | Exporters     | Non-Exporters | Exporters | Non-Exporters |
| TFP_lп    | 6.97 1.13     | 6.46 1.08     | 7.4 1.32      | 6.76 1.18      | 7.42 1.40 | 6.46 1.27     |
| TFP_op    | 7.74 1.22     | 7.19 1.13     | 7.80 1.36     | 7.15 1.20      | 8.04 1.47 | 7.03 1.31     |
| LnSize    | 5.17 1.08     | 4.5 0.99      | 5.30 1.25     | 4.84 1.09      | 5.75 1.27 | 4.89 1.08     |
| Capc      | 4.98 1.14     | 4.94 1.04     | 4.68 1.15     | 4.62 1.05      | 5.20 1.09 | 4.85 1.07     |
| LnWage    | 2.61 0.64     | 2.34 0.69     | 2.22 0.64     | 1.99 0.76      | 2.43 0.70 | 2.17 0.71     |
| LnTime    | 1.47 0.49     | 1.63 0.52     | 2.57 0.20     | 2.59 0.22      | 3.11 0.35 | 3.08 0.37     |
| Open      | 0.88 0.46     | 0.74 0.47     | 0.09 0.04     | 0.09 0.04      | 0.10 0.04 | 0.10 0.04     |
| FOEs      | 0.37 0.48     | 0.11 0.31     | 0.14 0.35     | 0.04 0.21      | 0.22 0.41 | 0.04 0.20     |
| SOEs      | 0.01 0.12     | 0.08 0.27     | 0.07 0.25     | 0.18 0.38      | 0.10 0.29 | 0.23 0.42     |
| WTO       | 0.93 0.26     | 0.83 0.38     | 0.92 0.28     | 0.76 0.43      | 0.93 0.25 | 0.79 0.41     |

Our research hypotheses are tested through the categorical variables included in Equation (1). Region is the most important categorical variable. Region is categorized into three groups and two dummy variables (Eastern and Central) are used to denote it. In addition, the interactions between all continuous variables and Region are tested to assess regional heterogeneity of these influences. Time represents transportation cost and is used to test H1 (see Section 3). Open is tested to confirm H2 (see Section 3).

2.2. Data Sources

This paper uses firm-level data taken from the Annual Survey of Industrial Firms (ASIFs), which is an annual survey of Chinese manufacturing firms compiled by the State Statistical Bureau of China (SSB, YEAR) [23]. The dataset contains all state-owned enterprises and non-state owned firms with annual turnover over five million RMB. We mainly use the manufacturing firms’ data from 1998 to 2007 for two considerations. First, China was experiencing steady growth during this period, which was before the global financial crisis in 2008 [27]. Second, the data compilation during this period was done more rigorously and the data quality was more reliable [25].

As usually done in papers pertaining to this research topic [28], we eliminate the observations that meet the following conditions: (1) any one of the following variables is missing or containing zero value—gross output, value added, employment, fixed assets, intermediate input, or total sales; and (2) total sales is less than export value or employment is fewer than eight. To avoid the bias that may be caused by firms’ collapse, we only keep the firms that are continuously operated. After the data pre-processing, the final dataset includes 266,640 firms, of which 19,483 firms are exporters. The number of firms located in eastern, central, and western China are 175,859, 55,879, and 34,906 (of which 15,702, 2874, and 907 firms are exporters), respectively.

2.3. Exporters’ Distribution in Different Regions: Descriptive Analysis

Figure 1 plots the number of exporters and their distribution in western, central, and eastern China from 1999 to 2007. It is clear that the number of exporters in eastern China exhibits an upward trend from 1998 to 2007 and is far more than the numbers of firms in central and western China. This finding confirms that the firms in eastern China, compared to the firms in central and western China, are more likely to export. Figure 2 shows the spatial distribution of the exporters in 2003, indicating that most exporters are located in eastern China.
Figure 1. The evolution of the number of exporters in eastern, central, and western China. Source: Authors' tabulations from the Annual Survey of Industrial Firms (ASIFs) compiled by the State Statistical Bureau of China (SSB, YEAR).

Figure 2. The distribution of exporters in different regions in 2003. Source: Authors' tabulations.

Figure 3 displays the change trends of the proportions of exporters and foreign-invested firms in western, central and eastern China from 1999 to 2007. The percentage of exporters at the national level fluctuates between 3% and 9%. In addition, the proportion of foreign-invested firms in general rose from less than 9% in 1999 to approximately 11% in 2007. In terms of regional disparity, compared to less than 3% and 5% in western and central China, the proportion of exporters in eastern China fluctuates between 9% to 11%. The proportion of foreign-invested exporters in eastern China reaches nearly 13% in 2007, while this ratio in the central and western regions is only about 5%.
3. Research Hypotheses

Regional disparities always exist in developing countries [29], and China is no exception. There are huge differences in physical geography, such as geographical location, and economic geography, such as the depth of opening-up between eastern, central, and western China, which result in different foreign market entry costs and the heterogeneous cutoff productivity for export. Our primary research question focused on the roles that physical and economic geographies play in the export opportunities of Chinese firms. In this section, we put forward our main hypotheses according to the following analyses.

3.1. Geographical Location and Heterogeneous Trade Costs

Eastern China is located in the coastal areas close to ports, but central and western China are located inland with complex terrains. Compared with the coastal region, the far-off distance and rugged terrain of inland regions limit the accessibility to seaports and the international market [30]. China’s exports to major trading partners are through marine transportation. According to the China Customs Statistical Yearbook, the proportions of river and sea transport for export were 66.2%, 65.6%, 65.1%, 65.9%, and 67.3% from 2003 to 2007. This indicates that the goods of firms in central and western China must be transported to the port through land transportation first. According to the empirical results of Limão and Venables [31], using the cost data of shipping a standard 40-foot container from Baltimore to different destinations around the world in 1990, an extra 1000 km transportation by sea adds $190 USD, whereas 1000 km by land adds $1380 U. In addition, due to China’s “market segmentation,” “marginal effect,” etc., land transportation cost is 35–95 times higher than sea transportation cost. For example, the land transportation cost from Chengdu to Shanghai (2100 km) is equal to a sea transportation cost of 7.6–19.9 million km, which was much higher than the actual maritime transportation cost from Shanghai to San Francisco (about 10,000 km) [32]. Therefore, firms in central and western China have to pay higher transportation costs compared to...
firms in eastern China. The location disadvantage increases the export costs of firms located in central and western China.

According to the above analyses, we put forward Hypothesis 1 for examination.

**Hypothesis 1 (H1).** Transportation cost always matters in a firm’s choice of entering the export market, under the same conditions, the cutoff productivity for entry into the export market for firms in the eastern region is lower than in the western and central regions due to the latter having to pay higher transportation cost.

### 3.2. Economic Openness and Heterogeneous Export Market Entry Costs

The firms in eastern, central, and western China not only have heterogeneous transportation costs due to different distances to the seaports but also have the heterogeneity in market entry costs due to different degrees of economic openness.

China’s economic reform and opening-up policy had the eastern region obtain the first opportunity to open. For example, four special economic zones (Shenzhen, Zhuhai, and Shantou in Guangdong Province and Xiamen in Fujian Province), which were first allowed to experiment with, on a trial-and-error basis, nonconventional, market-oriented, and outward-looking measures in promoting economic development, and they are all located in eastern China [33]. In particular, in terms of both foreign direct investment and foreign trade dependence, FDI was concentrated in the coastal areas [34], and the export value of the eastern region accounted for more than 90% of the national total from 1980 to 2007 [4].

Furthermore, taking the national-level export processing zones as an example, the majority of them are located in the eastern region. For example, there are 63 export processing zones in China, and 47 of them are located in eastern China. Eastern China is favored by this kind of place-based policy, the firms in eastern China have more advantages in export market entry costs than those in central and western China. As a result, eastern China possesses the highest degree of openness and the closest distance to the international market, which further reduces the foreign market entry cost for the firms in this region. All of these have dramatically enhanced the location advantages of eastern China.

According to the above analyses, we put forward Hypothesis 2 for examination.

**Hypothesis 2 (H2).** Due to the lower transportation costs and higher export opportunities, firms located in the eastern region face lower critical productivity for exporting, and they are more likely to enter the export market.

### 4. Results and Discussion

We estimated nine different specifications of Equation (1) to examine our research hypotheses. The empirical results were shown in Tables 3 and 4. We reported the odds ratios of logit regressions. In addition, to further verify the robustness of our baseline regressions, we used TFP measured by the OP method to repeat the above regressions (see Appendix A).

#### 4.1. Baseline Results

Table 3 showed the logit regressions for the regional heterogeneity of the impact of productivity on export. The first logit model (Logit-1) in Table 3 examined whether efficient firms are more likely to export using the full sample. The results revealed that the odds of exporting became 0.947 times when the TFP increased one unit, which means that productivity had a significant and slightly negative influence on the exporting probability of firms. The empirical results confirm the existence of the productivity paradox of Chinese exporters at the national level, which is consistent with the existing research [35].

In order to confirm the regional heterogeneity, we introduced the categorical variable, Region, in the second logit model (Logit-2). When a firm’s characteristics of size, wage, and capital were controlled, the regional disparity was clear. The odds ratios of categorical variables Central and Eastern were 1.735 and 2.675, respectively, with the western region as the reference category. These
results implied that the possibility for firms to export was the highest in the eastern region and the lowest in western China. In addition, there was an obvious heterogeneity of ownership. In comparison with the other ownerships, the odds for a foreign-owned firm engaging in export are 3.512 times higher, while that of a state-owned enterprise are 0.378 times lower. The results suggest that FOEs were more likely to export, and SOEs largely produce for the domestic market, which is consistent with the existing research [25]. To some extent, this confirms that FOEs mainly use China’s lower labor costs and environmental costs to engage in assembly production and then export products to foreign markets. However, SOEs have more government support policies, making it easier to enter the domestic market to achieve a scale economy. In addition, consistent with the result of Logit-1, the odds ratio of TFP was less than 1 and significant at the 1% level.

The third logit model (Logit-3) in Table 3 considered the continuous variables and the interaction of two categorical variables, Region and Ownership. The results of Logit-3 showed that the FOEs were more likely to export, while SOEs were less likely to export in all regions. In terms of the regional heterogeneity of ownerships, the odds ratios of FOEs in the western, central and eastern regions were 4.091, 2.123 (4.091 × 0.519) and 3.633 (4.091 × 0.888). Comparatively, the odds ratios of SOEs in above three regions were 0.596, 0.424 (0.596 × 0.711) and 0.313 (0.596 × 0.525). These results indicated that the premium of FOEs in exporting possibility was the largest in the western region and the smallest in the central region. State-owned enterprises have a lower possibility of exporting especially in the eastern region.

We introduced the interactions between TFP and the categorical variable Region (western region, central region, and eastern region) in Logit-4 to test the regional heterogeneities of firms’ export opportunity. Our estimation results revealed that the odds ratio of the TFP was 1.069 (significant at the 1% level); and the odds ratio of the interactions between TFP and central and eastern regions were 1.077 (significant at the 5% level) and 0.867 (significant at the 1% level), respectively. The above empirical results suggested that firms in central and western China must be more productive in order to enter the export market. However, in the eastern region, even firms with low productivity were able to export. On the whole, our results indicate that the cutoff productivity for entry into the export market for firms in the eastern region is lower than in western and central China and there exists inequality of firms’ export opportunity.

Furthermore, as shown in Table 3, common economic rules are observed in China. A larger firm size increases the odds of exporting. Capital intensive firms are more likely to enter the export market. Moreover, firms with high-skilled employees represented by average wages usually have higher odds of exporting. These results are in alignment with the findings in the existing research [36].

|                      | Full Sample | Logit-1 | Logit-2 | Logit-3 | Logit-4 |
|----------------------|-------------|---------|---------|---------|---------|
| TFP_lp               | 0.947***    | (0.005) | 0.964*** | (0.005) | 0.965*** | (0.026) |
| lnSize               | 1.828***    | (0.011) | 1.864*** | (0.011) | 1.865*** | (0.045) |
| lnWage               | 1.527***    | (0.014) | 1.441*** | (0.013) | 1.438*** | (0.047) |
| lnCappc              | 1.012***    | (0.006) | 1.010*   | (0.006) | 1.010*** | (0.030) |
| FOEs                 | 3.677***    | (0.044) | 3.512*** | (0.042) | 4.091*** | (0.225) |
| SOEs                 | 0.342***    | (0.010) | 0.378*** | (0.011) | 0.596*** | (0.042) |
| Central              | 1.735***    | (0.059) | 1.977*** | (0.058) | 19.175***| (3.684) |
| Eastern              | 2.675***    | (0.022) | 2.838*** | (0.074) | 11.776***| (1.930) |

Table 3. The regional heterogeneity of the probability of exporting: Logit estimates.
Central * FOEs 0.519*** (0.036) 0.621*** (0.046)
Central * SOEs 0.711*** (0.063) 0.950*** (0.088)
Eastern * FOEs 0.888*** (0.050) 0.984*** (0.061)
Eastern * SOEs 0.525*** (0.043) 0.526*** (0.045)
Central * TFP_lP 1.077** (0.031)
Eastern * TFP_lP 0.867*** (0.022)
Central * lnSize 0.723*** (0.020)
Eastern * lnSize 0.976*** (0.023)
Central * lnWage 1.073*** (0.049)
Eastern * lnWage 1.297*** (0.054)
Central * lnCappc 0.763*** (0.023)
Eastern * lnCappc 0.838*** (0.022)

Industry included included included included included
Year included included included included included
No. obs 798556 798556 798556 798556

Notes: We reported the odds of ratios. * p < 0.1, ** p < 0.05, *** p < 0.01. All explanatory variables are lagged one year. Z-values in parentheses, based on robust standard errors.

| Variable          | Logit-1          | Logit-2          | Logit-3          | Logit-4          | Logit-5          |
|-------------------|------------------|------------------|------------------|------------------|------------------|
| TFP_lP            | 0.988*** (0.006) | 0.891*** (0.008) | 0.992 (0.006)    | 1.247*** (0.020) | 1.263*** (0.047) |
| lnSize            | 1.849*** (0.011) | 2.061*** (0.021) | 1.865*** (0.011) | 1.414*** (0.022) | 1.508*** (0.053) |
| lnWage            | 1.368*** (0.013) | 1.352*** (0.021) | 1.386*** (0.013) | 1.213*** (0.026) | 1.135*** (0.066) |
| lnCappc           | 0.989* (0.006)   | 1.055*** (0.009) | 0.999 (0.006)    | 0.929*** (0.015) | 1.012 (0.041)    |
| FOEs              | 3.431*** (0.041) | 3.117*** (0.129) | 3.610*** (0.043) | 5.045*** (0.095) | 3.975*** (0.138) |
| SOEs              | 0.384*** (0.012) | 0.580*** (0.031) | 0.388*** (0.012) | 0.370*** (0.024) | 0.347*** (0.024) |
| Time 2            | 0.955*** (0.011) | 0.489*** (0.064) |                  |                  |                  |
| Time 3            | 0.546*** (0.008) | 0.775* (0.108)   |                  |                  |                  |
| Time 4            | 0.407*** (0.007) | 0.339*** (0.042) |                  |                  |                  |
| TFP_lP * Time 2   |                  |                  |                  |                  | 1.090*** (0.015) |

Table 4. The regional heterogeneity of the probability of exporting: explanation from the distance to the sea ports and economic openness.
4.2. Mechanism Test

According to the theoretical analysis in Section 3, we further analyze the theoretical mechanism that causes the inequality of firms’ export opportunities between different regions. Table 4 further examined the heterogeneous exporting behavior from accessibility to seaports and economic openness. More specifically, we took into account the influence of transportation time, which represented transportation cost and was defined as the shortest transportation time from the city where a firm was located to its nearest port, and openness, which was the ratio of total value of import and export to GDP of the province where the firm was located.

Logit-1 in Table 4 showed that the odds ratios of Time 2, Time 3, and Time 4 were 0.955, 0.546, and 0.407 and were all significant at the 1% level, which indicated that the long distance away from the port decreased the probability of firms’ export and confirmed the important role of transportation cost in firms’ exporting possibility. Meanwhile, Logit-2 in Table 4 further considered the interactions between Time and TFP. The odds ratios of the interactions between TFP and Time increased along the transport distance, 1.090 at Time 2, 1.194 at Time 3, and 1.353 at Time 4, implying that the farther away from the port a firm was, the higher the cutoff productivity necessary for the firm to export. These results indicate that lower transportation costs increased the possibility of firms’ export, especially less productive firms.

Logit-3 and Logit-4 in Table 4 disclosed the regional heterogeneity from the perspective of heterogeneous openness. We introduced the categorical variables of Open in Logit-3 and their interaction with TFP in Logit-4. Logit-3 showed that the odds ratios of Open 2, Open 3, and Open 4 were 0.945, 2.325 and 1.546 and were all significant at the 1% level, indicating that the exporting probability of firms increased with the climb of openness, but was not simply linear. On the other hand, as shown in Logit-4, the odds ratios of the interactions between TFP and Open 2, Open 3, and Open 4 fluctuated at 0.786, 0.731, and 0.789 and were all significant at the 1% level, implying that the requirement of firms’ productivity was declining significantly from open 1 to other levels of openness. However, the variations of the interactions between TFP and the openness at Open 2, 3,
and 4 were relatively trivial. These results suggest that a higher degree of openness to international trade in general increased the exporting possibility of firms with low productivity. In addition, it is interesting to point out that the openness factor does not show clear spatial disparities in terms of affecting firms’ export opportunity, although it only shows a strong and significant impact for the firms with the lowest openness. The impact of the openness factor does not display a linear trend, while the interactions between openness and TFP fail to differentiate between other three levels of openness. The explanation is the open-door policy is the national strategy in China. The influence of economic reform and opening-up is outweighed by other factors, such as traditional location advantages and concentration of foreign-invested enterprises in eastern China.

We further explained the regional heterogeneity of firms’ behavior from the perspective of openness represented by the entry of the World Trade Organization (WTO). China’s entrance into the WTO in 2001 signaled a new stage of development and globalization [37]. We expected that firms located in the eastern region would benefit more from WTO membership so that the productivity necessary for exporting would become lower relative to the western and central regions. Logit-5 in Table 4 compared the odds ratios of TFP after and before China joined the WTO across different regions. For simplicity, we categorized the regions into two groups with a dummy variable Eastern, where Eastern equals to 1 indicated eastern region and 0 indicated western and central regions. We examined the interaction of WTO*Eastern*TFP, where WTO was a dummy variable indicating the year entering the WTO. The empirical results showed that joining the WTO had the effect of productivity on exporting possibility of firms in the eastern region becoming 0.873. By contrast, this effect in other regions became 0.925 after joining the WTO. These results imply that joining the WTO reduced the productivity necessary for firms to export in all regions. However, the effect was larger in the eastern region. The above results suggest that entry into the WTO helped less productive firms enter the export market and increased the opportunity of a firm’s export, especially the firms located in the eastern region.

These findings are consistent with Hypotheses 1 and 2 and demonstrate that, due to closeness to international markets, lower transport costs, and a higher concentration of foreign capital, the firms in eastern China do not need to be very productive in order to enter the export market. In other words, firms, when located in eastern China, have reduced export market entry costs and a decreased cutoff productivity level for entry into the foreign market. By contrast, only high-productivity firms can enter the export market in central and western China due to higher entry costs to foreign markets. Firms located in western and central China must be productive enough to cover the higher trade costs and foreign market entry costs for entering the export market. In brief, the empirical results demonstrate that there is significant inequality of firms’ export opportunity between different regions in China. In particular, the exporters in developed eastern China are not necessarily productive firms, but the exporters in the less developed western and central China must be highly productive firms.

5. Conclusions

The prerequisite for sustainable social development is that every citizen and enterprise has equal development opportunities. Considering that export is the main engine of the economic growth, this paper examines the heterogeneity of firm’s export opportunities between different regions in China and further investigates the embedded mechanisms that may result in the inequality from the heterogeneities of geographical location and economic openness that are estimated to determine the exporting costs. On this basis, drawing on Chinese manufacturing firms’ (continuously operating non-exporters and continuously operating new exporters) data from 1998 to 2007, our paper has empirically examined the hypotheses of regional inequality of the firm’s export opportunity.

We argue that, due to the disadvantageous geographical location and economic openness of the western and central regions, firms in these regions have to bear higher trade costs. Thus, the cutoff productivity for entry into the export market for firms located in western and central China is much higher than that in the eastern region, and only highly productive firms in central and western China
are able to enter the export market. This phenomenon indicates that there exists serious inequality of firm’s export opportunity, which is not conducive to the sustainable development of society.

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**Appendix A**

Firm i’s production function is written as (i is omitted for simplicity):

\[ Y_t = \beta_0 + \beta_1 l_t + \beta_2 k_t + \beta_3 m_t + w_t + \eta_t = \beta_0 + \phi(k_t, m_t) + \eta_t, \]  

(A1)

\[ \phi(k_t, m_t) = \beta_0 + \beta_2 k_t + \beta_3 m_t + w_t(k_t, m_t), \]  

(A2)

where \( Y_t \) is the logarithm of the added value of firm i, and \( l_t, k_t, \) and \( m_t \) denote logarithms of firm’s total employment, fixed capital, and intermediate input of year \( t \), respectively. \( A_t \) is the productivity of firm i and taken as a function of \( k_t \) and \( m_t \). There are three steps to estimate the production function and all of these stages can be finished by Stata command *levpet*. After the estimation of production function, TFP is able to be calculated by simple algebra.

\[ TFP = Y_t - \beta_1 l_t - \beta_2 k_t - \beta_3 m_t \]  

(A3)

**Appendix B**

To further check the robustness of the above results, we repeated the estimation in Section 4.1 using the TFP estimated by the OP method (TFP_op). The empirical results were shown in Tables A1 and A2.

As shown in Tables A1 and A2, the estimation using TFP estimated by the OP approach did not change the above results. Therefore, the robustness check further confirmed our expectations. That is, less productive firms located in eastern regions with lower transportation costs and higher openness were more likely to export. The regional inequality of the exporting opportunity of firms was functioning in China, as the exporters in eastern China were not necessarily highly productive in comparison with their counterparts in central and western China.

**Table A1.** The regional heterogeneity of the probability of exporting.

|                | Full Sample |
|----------------|-------------|
|                | Logit-1     | Logit-2     | Logit-3     | Logit-4     |
| TFP_op         | 0.984***    | 0.970***    | 0.970***    | 1.057**     |
|                | (0.005)     | (0.005)     | (0.005)     | (0.026)     |
| lnSize         | 1.788***    | 1.862***    | 1.863***    | 2.004***    |
|                | (0.011)     | (0.011)     | (0.011)     | (0.047)     |
| lnWage         | 1.505***    | 1.437***    | 1.435***    | 1.161***    |
|                | (0.013)     | (0.013)     | (0.013)     | (0.047)     |
| lnCappc        | 1.003       | 1.011***    | 1.012***    | 1.209***    |
|                | (0.006)     | (0.006)     | (0.006)     | (0.032)     |
| FOEs           | 3.686***    | 3.513***    | 4.090***    | 3.667***    |
Table A2. The regional heterogeneity of the probability of exporting: explanation from the distance to the seaports and economic openness.

|                     | Logit-1 | Logit-2 | Logit-3 | Logit-4 | Logit-5 |
|---------------------|---------|---------|---------|---------|---------|
| TFP_lp              | 0.991   | 0.907***| 0.999   | 1.216***| 1.248***|
|                     | (0.006) | (0.008) | (0.006) | (0.020) | (0.047) |
| lnSize              | 1.846***| 2.055***| 1.858***| 1.420***| 1.505***|
|                     | (0.011) | (0.022) | (0.012) | (0.022) | (0.054) |
| lnWage              | 1.366***| 1.338***| 1.385***| 1.227***| 1.136** |
|                     | (0.013) | (0.020) | (0.013) | (0.027) | (0.066) |
| lnCappc             | 0.989*  | 1.061***| 0.997   | 0.919***| 0.997   |
|                     | (0.006) | (0.010) | (0.006) | (0.015) | (0.041) |
| FOEs                | 3.431***| 3.123***| 3.052***| 3.978***| 3.978***|
|                     | (0.041) | (0.129) | (0.095) | (0.138) |         |
| SOEs                | 0.385***| 0.573***| 0.374***| 0.350***|         |
|                     | (0.012) | (0.030) | (0.024) |         |         |

Notes: We reported the odds of ratios. * p < 0.1, ** p < 0.05, *** p < 0.01.
|                  | Time 2  | Time 3  | Time 4  |
|------------------|---------|---------|---------|
| Eastern          | 0.955*** | 0.546*** | 0.406*** |
|                  | (0.011)  | (0.008) | (0.007) |
| Time 2 * TFP_lp | 1.067*** | 1.170*** | 1.304*** |
|                  | (0.015)  | (0.019) | (0.025) |
| Open 2           | 0.946*** | 2.332*** | 1.550*** |
|                  | (0.018)  | (0.040) | (0.027) |
| Open 3           | 0.731*   | 0.667*  | 0.484*** |
|                  | (0.127)  | (0.114) | (0.064) |
| Open 4           | 0.827*** | 0.748*** | 0.820*** |
|                  | (0.017)  | (0.014) | (0.016) |
| WTO * Eastern * TFP_lp |                  | 0.843*** | 0.866*** |
|                  | (0.035)  | (0.017) | (0.037) |
| WTO * Otherregions * TFP_lp |                  | 0.924*** | 0.924*** |
|                  | (0.037)  | (0.037) | (0.037) |

| Industry | included | included | included | included | included | included |
|----------|----------|----------|----------|----------|----------|----------|
| Year     | included | included | included | included | included | included |
| No. obs  | 798556   | 798556   | 798556   | 798556   | 798556   | 798556   |

Notes: We reported the odds ratios. * p < 0.1, ** p < 0.05, *** p < 0.01.

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