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Market segmentation and firm survival

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Abstract

Using the annual data of Chinese manufacturing firms over the period of 1998–2007, this paper applies the Cox proportional hazards model and analyzes the impact of inter-provincial market segmentation on the exit hazard of firms in China. This study shows that market segmentation increases the risk of enterprises exiting the market in China. Moving from the 10th percentile of the distribution of market segmentation (score of 0.0995) to the 90th percentile (score of 0.7084) would increase the exit probability of firms by 7.5 percentage points. An analysis of the mechanisms involved shows that market segmentation benefits are often outweighed by lower productivity and less incentive to innovate. Our study also demonstrates that inter-provincial market segmentation facilitates the likelihood that state-owned enterprises (SOEs) will survive, but not for non-SOEs in China. A one unit increase in the degree of regional market segmentation will reduce the probability that SOEs withdraw from the market by 19.5% while increasing the probability that non-SOEs will leave the market by 5.80%.

1 | INTRODUCTION

With the continuous advancement of mass entrepreneurship and innovation activities, the number of newly-established enterprises in China has increased to a daily average of 18,000 in year 2018.[1] However, most Chinese companies also withdraw from the market in a very short period of time. The *Analysis Report on the Survival Time of Domestic firms in China* (2013) issued by State Administration for Industry and Commerce in China pointed out that 13.22 million firms registered in China from 2000 to 2012, but only half of them survived for more than five years. Firms that survived for more than ten years only accounted for 17.7% of the total number of

firms. What factors affect Chinese firm survival rate? The answer to this question has important policy implications and will help to significantly promote industrial development.

Unlike the competitive market in developed countries where firms enter and exit industries due to market competition, market segmentation and local protection policies in China are not only prevalent but have also played an important role (Poncet, 2003, 2005; Young, 2000). Local governments tend to promote economic development by restricting the entry of foreign products into local areas or increasing subsidies to protect local enterprises. Take shield tunneling machines as an example. Shield tunneling machines are large excavators for creating tunnels, railways, and even underground cities. However, the production of their parts often needs to be configured differently according to different soil and geological conditions. For instance, some need to have the ability to crush boulders in order to excavate ground with rocks. With the rapid expansion of urban rail transit, intercity railways, river crossing tunnels, and water conservancy projects, the demand for shield tunneling machines is increasing rapidly. However, most local governments in China support local enterprises in producing shield tunneling machines and avoid purchasing these machines from firms in provinces with a comparative advantage. As a result, the firms with a comparative advantage cannot access the market, and enterprises that are not proficient in the technology to produce shield tunneling machines eventually become the assembly workshops of foreign brands.[2] Historical experience shows that regions that neglect their comparative advantages tend to have low economic performance (Lin, 2012).[3] Similar situations such as in government procurement are commonly found throughout other provinces of China.[4] This kind of local protectionism has formed a discriminatory and exclusive market environment. As a result, the market segmentation formed by "beggar my neighbor" behavior may damage the long-term interests of local firms, and in the end, reduce the likelihood of firm survival.

The purpose of this paper is to explore how market segmentation affects the survival hazard of firms. First, we measure the regional market segmentation in China through the relative price index method. Then using the annual data of a large sample of Chinese manufacturing firms over the period of 1998–2007, we find that market segmentation increases the risk of enterprises exiting the market in China. Moving from the 10th percentile of the distribution of market segmentation (score of 0.0995) to the 90th percentile (score of 0.7084) would increase the exit probability of firms by 7.5 percentage points.

The paper contributes to the literature in several ways. First, we explore how market segmentation affects the survival hazard of firms while controlling for a number of firm-specific characteristics. The literature on the survival of firms has been developed in general based on the following two perspectives. On the one hand, most of the literature on firm survival emphasizes the importance of their characteristics. Agarwal and Audretsch (2001) examine the impact of firm size on market viability, and find that it is positively correlated to their survival time. A large number of subsequent studies examine the factors that affect the survival time of firms such as innovation (Cefis & Marsili, 2006; Howell, 2015; Sharif & Huang, 2012; Ugur et al., 2016), export behavior (Beveren, 2007; Pérez et al., 2004) and capital structure (Chung et al., 2013). For example, Cefis and Marsili (2006) explore the relationship between innovation and the survival probability of manufacturing firms in the Netherlands. They argue that innovation has a positive and significant effect on the probability that a firm will survive, and this effect increases over time and is conditional on firm age and size. Ugur et al. (2016) argue that the relationship between the intensity of research and development (R&D) and firm survival follows an inverted-U shaped pattern by using a panel dataset of 37,930 R&D-active UK firms over the period of 1998–2012. Beveren (2007) finds that foreign companies have shorter market survival times than domestic companies based on data of the survival time of Belgian companies. On the other hand, a large

volume of the literature have explored the influential factors of firm survival time from the perspective of the external environment. For instance, Zheng et al. (2015) investigate how political ties affect firm survival. They show that political connections can buffer firms from threats to their survival, and under narrower conditions, enable sales growth. Zhang et al. (2019) explore the relationship between local corruption and the survival of private firms by using firm-level data and regional registered cases of corruption from 1998 to 2012 in China. They conclude that local corruption facilitates the likelihood that private firms will survive. Melitz and Ottaviano (2008) develop a monopolistically competitive model with firm heterogeneity and analyze how market size and trade affect firm survival. Baumohl et al. (2019) analyze the impact of institutional quality on firm survival with a large dataset of firms during 2006–2015 in 15 European emerging markets. Their results show that institutional quality is a significant preventive factor for firm survival. Although the literature above has discussed the influence of firm characteristics and external environment on the survival time of enterprises, these studies have largely neglected the role of market segmentation in firm survival prospects in China. Our paper addresses this research gap. We control for firm characteristics and external environment in our analysis and focus on the effect of market segmentation, which has not been done by any other study to the best of our knowledge.

Second, this paper investigates the differentiated effects of market segmentation on state-owned enterprises (SOEs) and non-SOEs. In the Chinese context, the government system places officials at the center of the market, and their authority and power might be above market entry regulations (Yao, 2002; Zhang et al., 2019). Therefore, even with severe market segmentation and entry barriers, SOEs still can easily obtain permits and licenses due to their stronger political connections compared to their non-SOE counterparts. We argue that the domestic market segmentation in China plays the role of invisible subsidies for SOEs and is conducive to enhancing their economic viability. We conduct a subgroup analysis by using ownership to investigate the differential impact of market segmentation on firm survival time. Our study demonstrates that inter-provincial market segmentation facilitates the survival probability of SOEs but has a negative effect on non-SOEs in China. One unit increase in the degree of regional market segmentation will decrease the probability that SOEs withdraw from the market by 19.5% while increasing the probability that non-SOEs withdraw from the market by 5.80%. This is consistent with the literature that private firms in a transition economy commonly suffer from more pressure to survive than firms in developed countries (Zhang et al., 2019).

Third, this paper further examines the underlying mechanisms of market segmentation that affect the survival hazard of enterprises. According to the infant industrial protection theory (Selwyn, 2009), the local government puts forward a market segmentation policy to promote local firms to realize economies of scale and firm productivity, to realize detour overtaking. Melitz and Ottaviano (2008) also make an important point: new entrants are hard to survive under large immense market competition. Thus, protection such as higher trade barriers will reduce competition and enable new entrants to increase their survival rate. However, our result shows that market segmentation increases the risk of enterprises exiting the market in China. A mechanism analysis shows that market segmentation benefits are often outweighed by lower productivity and incentive to innovate. On the one hand, market segmentation reduces firm productivity due to obstacles that impede market expansion, rising production costs and low mobility of production factors. On the other hand, market segmentation also reduces firm innovation which plays an essential role as a preventive factor to help firms improve their likelihood of surviving.

The findings of this paper have important policy implications. For a long period of time, local governments in China have protected local enterprises by taxing foreign enterprises or

establishing administrative barriers. Our results show that even though market segmentation can alleviate the pressure of SOEs to survive, it might be fatal to most non-SOEs. The "good intentions" of local governments who attempt to support the development of local enterprises through a market segmentation policy may not be holistic enough. If local governments fail to consider the overall economic development benefits, their "wishful thinking" which focuses on local economic development will inevitably result in failure. It might be a better strategy to eliminate the market segmentation among regions, remove market barriers, and promote market integration for the long-term growth of enterprises.

The remainder of the paper is as follows. Section 2 provides an introduction on the institutional background that has led to market segmentation in China and literature that links market segmentation with firm performance. Section 3 provides an introduction on the measures of market segmentation in general and specifically in China. Section 4 is the research design. Section 5 presents the model and regression results. Section 6 presents a possible mechanisms examination, and section 7 concludes.

2 | INSTITUTIONAL BACKGROUND AND MARKET SEGMENTS

The goal of our paper is to estimate the effect of market segmentation on firm survival and explore the mechanisms involved. We start with an introduction of the institutional background that has led to market segmentation in China. This helps to provide a better understanding of the factors and mechanisms of market segmentation on firm survival.

2.1 | Institutional background

Market segmentation was not a widespread phenomenon during the planned economy period of China. However, since the political reform which involved the decentralization of power and profit transfer in the early 1980s, local market segmentation emerged and became increasingly more pervasive. In 1980, the Chinese Central Government decentralized financial and tax power to most local regions of China and implemented a system where local authorities took full responsibility for their finances. The investment and financing authority and enterprise management authority of local governments also expanded. A pattern was found, where the highly concentrated financial power and financial resources in the planned economy were dismantled and redistributed due to the reform. The local governments established a relatively independent primary budget, which increased the regulatory functions of the local finance department regionally through financial allocation, and adhered to their own interests. At the same time, this system increased the difficulty of setting boundaries that separate the state from enterprises, encouraged local protectionism, and led to serious local market segmentation.

In 1994, the Chinese Central Government reformed the fiscal and taxation system again. However, relevant studies (Yin & Cai, 2001) show that the reform was still transitional and did not eliminate the fiscal and taxation basis of local market segmentation. The fixed income division between the Chinese Central Government and local governments was not completely independent of a subordinate relationship. The central enterprise income tax belongs to the Chinese Central Government, and the local enterprise income tax belongs to the local government. The local government is still motivated to protect the interests of local enterprises. In particular, this

reform did not impact another important factor of the administrative decentralization system. That is, the local government still controls a large number of SOEs. SOEs will receive far more protection from local governments during their progression compared to their non-SOE counterparts. Although the Chinese Central Government and relevant departments have been actively trying to create remedial measures, such as formulating and implementing the "*Anti Unfair Competition Law*" (1993, 2017, 2019), the problem of local market segmentation has not been fundamentally resolved.

2.2 | Market segments and their related literature

There are a large volume of studies that testify to the existence of market segmentation in China and how it has evolved over time (Fu, 2017; Lu & Chen, 2009). Moderate market segmentation may have a certain protective effect on firm survival in the early stages. Based on the infant industry theory (Selwyn, 2009) which states that protecting new industries in developing countries against competition is important until their maturity, the market segmentation policy of the local governments promote local firms to realize economies of scale and firm productivity, and realize detour overtaking. Two good examples include Germany during The Second Reich (1871–1918) when Otto von Bismarck was in power, and South Korea during the dictatorship of Park Chung-Hee (1963–1979). However, aside from Germany and South Korea, most developing countries have not benefited from sustained industrial protection policies after World War II and have even fell into the "List Trap" one after another (Hayami et al., 2005).

Over time, market protection has caused the loss of economic viability of protected industries, thus stagnating economies. Young (2000) argues that market segmentation distorts the price signal of production factors, thus resulting in the inability of a free flow of resources among provinces and reducing cross-regional resource allocation efficiency. Products with comparative advantage cannot be sold to other regions; the comparative advantage of local firms cannot be fully utilized in a fragmented market environment. As a result, productivity cannot be effectively enhanced. Xu and Xie (2016) draw a similar conclusion by using data from Chinese firms. They argue that market segmentation policy aligns with local economic development and the interests of local government officials to some extent. It is therefore not helpful to the local economy to develop a comparative advantage.

Furthermore, market segmentation may reduce firm productivity to the extent that firms may withdraw from the market. This is because market segmentation prevents lower-cost production factors from flowing into the local market, which will virtually increase the production costs of local firms. Melitz and Ottaviano (2008) obtain a similar result in which larger markets have more product variety and host more productive firms that have lower mark-ups. Zhang et al. (2021) use data of listed companies from 2007 to 2015 in China and find that market segmentation inhibits the free flow of factors which causes local enterprises to bear higher production factor costs, such as higher raw material prices, lower labor wages or excessive labor redundancy. It can be seen that the market segmentation initiated by local protection policies does not necessarily reduce the transaction costs among enterprises because of the protection. Under the same conditions, firm productivity will decrease, and the possibility of local firms withdrawing from the market will increase.

Market segmentation may also reduce the innovation activities of firms. First, firms might be encouraged to establish a rent-seeking relationship with local government officials to secure regional competitive advantages. High non-productive rent-seeking costs will be

generated during this process, which will squeeze out the innovation investment of firms. Second, market segmentation will lead to mismatch in the talents of entrepreneurs. At present, China is in the stage of economic transformation and development, but the allocation of key resources is still controlled by the government. Entrepreneurs are also more likely to choose non-productive business activities such as rent-seeking activities over productive business activities, especially with high market segmentation (Huang & Yao, 2020). Rent-seeking firms are more likely to obtain factors with relatively low cost, such as obtaining more long-term bank loans with lower interest rates and paying lower sales expenses (Cao et al., 2018). If the remuneration brought upon by rent-seeking activities is large enough, entrepreneurs will allocate more rent-seeking activities.

Entrepreneurs will use resources directly for rent-seeking activities rather than productive business activities and adopt a "rent-seeking strategy" instead of "strategies that lead to innovativeness," thus resulting in the mismatch of their talents and reducing the survival probability of their firm (Zhang et al., 2017). The survival ability of a firm is ultimately determined by the competitiveness of its products in the market. The competitiveness of products largely depend on the R&D input and innovativeness of the firm itself. Innovation is the internal driving force for firm survival and the premise for firms to maintain competitiveness and vitality in the market. Based on a sample of 121 high-tech firms, Fontana and Nesta (2009) find that the technological frontier position of a firm is an important determinant for its survival. Wagner and Cockburn (2010) also find that R&D has an essential role in promoting firm survival. However, market segmentation may perpetuate status quo and inhibit incentive to innovate, thus increasing the likelihood of exit hazard.

When examining the survival rate of firms, it is important to differentiate SOEs from other types of firm ownerships. Compared with private firms, SOEs often struggle with ambiguity in property rights and low production efficiency (Brandt et al., 2012; Zhang et al., 2017). However, as the pillar of the national economy in China, SOEs require diligence around their economic and social responsibilities such as ensuring employment opportunities, promoting economic growth, and maintaining social order and stability in China. Local governments are therefore mindful of the stability of SOEs.

As a result, the Chinese state-owned sector reaps important advantages from its government affiliations (Reinsch and Slane, 2011). Low interest loans, debt forgiveness, and access to credit are some of the ways that the government subsidizes its business sector (Naughton, 2006). Other subsidies, which are frequently administered through the provincial and municipal governments, include creating regulatory barriers that inhibit the entry of competitors, special treatment from regulatory compliance officers (Koppell, 2007), tax breaks, preference in land allocation, bankruptcy alternatives (Tsai, 2011), and de facto debt forgiveness (Naughton, 2006). SOEs have widely enjoyed ease of obtaining market entry permits and access to finance support from state-owned financial institutions than private-owned and foreign enterprises (Kornai et al., 2003; Zhang et al., 2017). We argue that domestic market segmentation is analogous to an invisible subsidy for SOEs and conducive to enhancing their economic viability.

Briefly, even though market segmentation provides a certain degree of protection against infant industry protection, nevertheless, with the gradual increase in market segmentation, the benefits may be outweighed by rising costs resultant of the market segmentation itself. Local firms might be content with the status quo, and this lack of incentive to advance and absence of an enterprising spirit will reduce their competitiveness in the entire market, which does no favors for their long-term survival. As such, we give special attention to SOEs under the context of the economic transformation in China.

3 | MEASURING DOMESTIC MARKET SEGMENTATION IN China

3.1 | Method of Measuring China's domestic market segmentation

The existing literature on measuring market segmentation can be divided into two categories. McCallum (1995) first proposed a gravity-type measure of aggregate trade barriers based on the traditional gravity model. Several empirical studies have also used this method to measure the degree of regional market segmentation or integration (Poncet, 2003, 2005). However, this measure has been criticized for failing to control for the specific regional characteristics that affect trade (Baldwin, 2004).

The second measure is the relative price index developed in Parsley and Wei (2001a, 2001b). The idea behind this measure comes from the "iceberg cost" model (Samuelson, 1954), which is a modification of "the law of one price." Due to the existence of transaction costs, including physical and geographical barriers as well as institutional barriers, part of the value of goods will melt away like a glacier in the process of trade. Even if completely arbitrage, the price between the two regions will not be absolutely the same. The relative price will fluctuate within a certain range. Reducing transportation costs and institutional barriers are helpful to improve market integration. The range of relative price fluctuations will be narrowed. Some in the literature have adopted this method to measure market segmentation in China (Ke, 2015; Lu & Chen, 2009).

Let the price of a commodity be P_i in province i, and P_j in province j. If the variance $\mathrm{Var}(P_i/P_j)$ tends to narrow with time, this shows that the range of relative price fluctuation is narrowing, thus the trade barriers between the two regions are reduced and the factors that inhibit market integration are also reduced. Three-dimensional ($t * m * k$) panel data are required to calculate the relative price variance, where t is the time, m is the region, and k is the commodity. Our data originate from the retail price index of commodities in different regions based on China's Statistical Yearbook which covers 9 categories of commodities in 30 regions of China from 1998 to 2007.[5] The nine categories of commodities include grains, fresh vegetables, drinks, tobacco and wine, clothing, shoes and hats, medicine and medical supplies, books, newspapers and magazines, cultural and entertainment supplies, daily necessities and fuel.

Following Parsley and Wei (2001a), we calculate the relative price variance of adjacent regions from 1998 to 2007 as follows:

$$\Delta Q_{ijt}^{k} = \ln(P_{it}^{k}/P_{jt}^{k}) - \ln(P_{it-1}^{k}/P_{jt-1}^{k}).$$

The absolute value $|\Delta Q_{ijt}^{k}|$ can be used to measure the band of arbitrage regardless of the direction that the price ratio moves. By modifying the above formula, we obtain the following results:

$$\Delta Q_{ijt}^{k} = \ln(P_{it}^{k}/P_{jt}^{k}) - \ln(P_{it-1}^{k}/P_{jt-1}^{k}) = \ln(P_{it}^{k}/P_{it-1}^{k}) - \ln(P_{jt}^{k}/P_{jt-1}^{k}).$$

As the heterogeneity of different commodities results in the incomparability of price fluctuations between different goods, we exclude the non-additive effect caused by commodity heterogeneity in $|\Delta Q_{ijt}^{k}|$. We assume that $|\Delta Q_{ijt}^{k}|$ consists of two items, a^k and ε_{ijt}^{k}. a^k is only related to the commodity category k, while ε_{ijt}^{k} is related to the market environment of i and j. In order to eliminate a^k, we first calculate the average value of ΔQ_{ijt}^{k} of a given year t and a given commodity k between neighboring provinces. Then we subtract the average value from ΔQ_{ijt}^{k} and get

$|\Delta Q_{ijt}^k| - |\overline{\Delta Q_t^k}| = (a^k - \overline{a}^k) + (\varepsilon_{ijt}^k - \overline{\varepsilon}_{ijt}^k) = \varepsilon_{ijt}^k - \overline{\varepsilon}_{ijt}^k$, where $|\overline{\Delta Q_t^k}|$ indicates the average value between adjacent provinces in year t. Let $q_{ijt}^k = \varepsilon_{ijt}^k - \overline{\varepsilon}_{ijt}^k = |\Delta Q_{ijt}^k| - |\overline{\Delta Q_t^k}|$.

Given the fluctuations in q_{ijt}^k, the variance $\mathrm{Var}(q_{ijt})$ summarizes the price fluctuations of all commodities caused by market fragmentation between provinces i and j in year t. The variance $\mathrm{Var}\ (q_{ijt})$ measures the extent that the two regional markets are divided.

3.2 | Market segmentation in China

We create a regional distribution map of market segmentation in China from 1998 to 2007 (Figure 1) to examine the spatial changes of market segmentation within the region. In 1998, Hubei, Hunan, Chongqing, Sichuan, Beijing, and Tianjin show a deeper purple hue, which indicates that their degree of market segmentation is relatively high, while the eastern and northeast regions are mostly green in color, which indicates that the degree of market segmentation is relatively low. In 2007, almost the entire China is a green color, thus indicating that almost a decade later, the level of market segmentation in all regions has declined, especially in Xinjiang, Qinghai, Gansu and other areas in Northwest China. Moreover, it can also be observed that the regions with similar colors are relatively close to each other, which indicates that market segmentation is somewhat spatially correlated. That is, the local market protection strategy is related to the market protection strategy of adjacent regions. When adjacent regions adopt more stringent market protection measures, the local administration also tends to adopt a more restrictive market segmentation strategy.

4 | RESEARCH DESIGN

4.1 | Model specifications

The purpose of this study is to investigate the impact of market segmentation on firm survival. Consistent with the research methods in the existing literature (Baumohl et al., 2019;

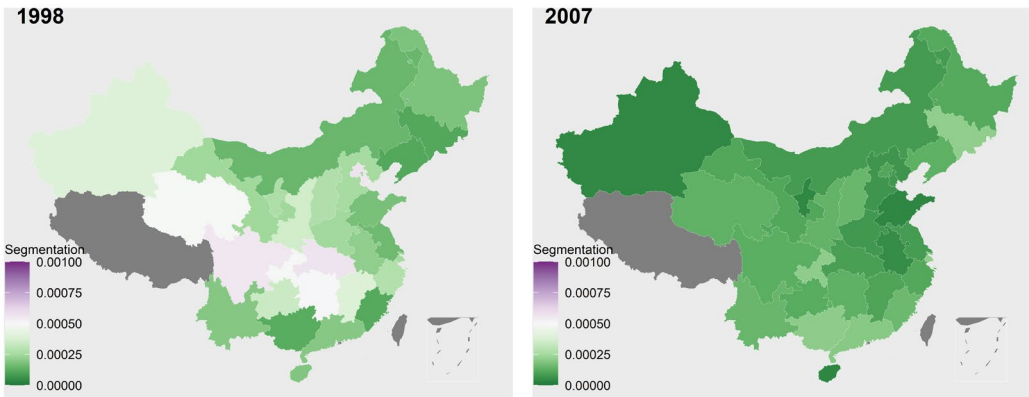

FIGURE 1 Market segmentation in China year

Zhang et al., 2017), the model used in this paper is a Cox proportional hazard model, which is a semi-parametric estimation model and does not carry any restrictions on the distribution of the baseline hazard.[6] This characteristic is precisely in accordance with our needs as our focus is on examining the impact of market segmentation on firm survival hazard, not baseline hazard. Specifically, the Cox proportional hazard model assumes that the firm faces all kinds of dangerous shocks during the process of survival. We assume that $h(t,X)$ represents the hazard rate of the firm with hazard vector X at time t, that is, the probability that firm i survives in t-1 period and withdraws in t period,[7] then the hazard rate function can be expressed as follows:

$$h(t,X) = h_0(t)C(X_i'\beta) \tag{1}$$

where the left side of the equation,$h_0(t,X)$, reflects the conditional exit probability of a firm at time t under the condition that the firm survives at time t-1. The right side of the equation $h_0(t,X)$ represents the baseline hazard at time t, and its parameter form is not set in advance. X is a vector of covariates that may affect the hazard rate of a firm and β is the corresponding coefficient vector to be estimated. Assuming that there are two firms with influencing factors X and X^* respectively, the hazard rate of firms with hazard factor X relative to those with a hazard factor X* is as follows:

$$\frac{h(t,X)}{h(t,X^*)} = \frac{h_0(t)\exp\sum_{k=1}^{p} X_k'\beta_k}{h_0(t)\exp\sum_{k=1}^{p} X_k^*\beta_k} = \exp[\sum_{k=1}^{p}\beta_k(X_k - X_k^*)] \tag{2}$$

$$C(X_i'\beta) = \exp(X_i'\beta) = \exp\sum_{k=1}^{p} X_k'\beta_k \tag{3}$$

Given that the other factors remain the same, $h(t,X)/h(t,X^*) = \exp(\beta)$, thus indicating the hazard rate faced by the firms in a severely segmented market relative to the firms without market segmentation.

4.2 | Data

The data are taken from the Chinese Industrial Enterprises Database (CIED) for 1998–2008, and provided by the Chinese National Bureau of Statistics. The dataset comprises more than 300,000 firms in China with sales of at least 5 million RMB (around 770,000 USD) and an annually detailed balance sheet. The dataset has been widely used in empirical studies (e.g. Baumohl et al., 2019; Cai & Liu, 2009; Zhang et al., 2017). We refer to Brandt et al. (2012) and sequentially identify the same firms over annual waves of CIED according to the legal person code, firm name, telephone number, and other information of the firm, and finally process them into 10-year panel data. We adopt the following criteria for further processing of the original data to enhance the reliability of the data: (a) Firms with a start-up time later than 2008 are removed; (b) firms with fewer than ten employees at the end of the year are removed; and (c) firms that do not offer important financial information are also eliminated. Also, we use the method in Cai and Liu (2009) and Feenstra et al. (2014) and follow general accounting standards. If any of the current, fixed, or net fixed assets are greater than the total assets, the observed value is excluded.

We will face left and right censoring problems with the use of the survival analysis model if we use all of the sample data for analysis.[8] To address the latter, the survival analysis model can

be handled in a flexible way so that it will not interfere with the estimation results (Esteve-Pérez et al., 2013). However, the life span of a firm will be underestimated if we neglect the left censoring problem. Therefore, we exclude the left-censored data and only retain the new firms (based on one variable that clearly specifies the establishment date of the firm) between 1998 and 2007 to resolve this problem.

4.3 | The survival time of Chinese firms

Following Namini et al. (2013), the survival time of a firm is defined as the likelihood that firm *i* in the CIED will continue its operations as opposed to disappearing from the database. If firm *i* exists in year t and disappears in $t + 1$ year, we assume that it has 'died' and "exited" the market.[9]

We calculate the number and ratio of firms that have entered and exited the market during the sample period (Table 1). The row in Table 1 represents the year of entry, and the column represents the year of exit. The first row of each year represents the number of firms that entered the market in the "row" year and exited in the "column" year. The second row of each year indicates the proportion of firms that entered the market in the "row" year and exited in the "column" year to the total firms that entered in the "row" year (the data in 2007 are right censoring). For example, the first cell, 440, represents the total number of firms that entered the market in 1998 and left that year. The second row, 10.32, indicates the proportion of firms that entered the market in 1998 and left that year to all firms that entered the market in 1998.[10] The last column, 4265, indicates that the cumulative number of firms that entered in 1998, and 78.29 indicates the ratio of the cumulative number of firms to the total number of firms that entered in 1998.[11] It can be observed in Table 1 that the market withdrawal rate of Chinese firms is very high, especially in the first three years of a new entry into the market. Take the year 1998 as an example. The market withdrawal rate was 10.32% in that year. However, the rate was 14.54% in 1999, and 20.96% in 2000. That is, the rate reached 45.8% in the first three years, and only 21.71% of the firms survived until 2007.

Figure 2 shows the observed Nelson-Aalen cumulative hazard estimates. In summary, the non-parametric results indicate the following: the groups with below-median market segmentation in the 1st and 2nd quartiles have a lower cumulative hazard than those with below-median market segmentation in the 3st and 4st quartiles. The log-rank, Wilcoxon, Tarone-Ware and Peto-Peto-Prentice tests all indicate that the different survival rates are significant in both cases. Figure 3 shows the observed Kaplan-Meier survival estimates by ownership. It is evident that the SOEs have a higher exit hazard than the non-SOEs.

4.4 | Control variables

We choose the following control variables that may affect the survival of firms based on the findings in the existing literature. Firm size is defined by the natural logarithm of the number of employees. Firm age is represented by the observed year minus the year in which the firm was founded. Profitability is obtained by dividing the profit of the firm by the gross output value of the current year. Export is a dummy variable of whether the firm exported products in that year. The type of property rights is a dummy variable. If it is a state-owned holding, it is 1; otherwise, it is 0. The proportion of foreign capital is expressed by the percentage of foreign shares in registered capital. The meaning and statistical description of the main variables are provided in Table 2.

TABLE 1 Survival time of Chinese firms

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	Accumulation
1998										
No. of firms	440	620	894	295	327	484	89	93	97	4265
Proportion (%)	10.32	14.54	20.96	6.92	7.67	11.35	2.09	2.18	2.27	78.29
1999										
No. of firms		1,493	1,496	500	538	783	198	194	173	7211
Proportion (%)		20.70	20.75	6.93	7.46	10.86	2.75	2.69	2.40	74.54
2000										
No. of firms			1,240	819	738	1,438	359	309	315	8761
Proportion (%)			14.15	9.35	8.42	16.41	4.10	3.53	3.60	59.56
2001										
No. of firms				1,132	2,866	4,626	1,036	931	1000	22,899
Proportion (%)				4.94	12.52	20.20	4.52	4.07	4.37	50.62
2002										
No. of firms					859	3,961	1,097	953	930	19,074
Proportion (%)					4.50	20.77	5.75	5.00	4.88	40.89
2003										
No. of firms						3,309	1,815	1,732	1,609	27,757
Proportion (%)						11.92	6.54	6.24	5.80	30.50
2004										
No. of firms							2,540	6,750	5,852	78,166
Proportion (%)							3.25	8.64	7.49	19.37
2005										
No. of firms								1,412	2,842	31,598
Proportion (%)								4.47	8.99	13.46
2006										
No. of firms									1,131	44,336
Proportion (%)									2.55	2.55

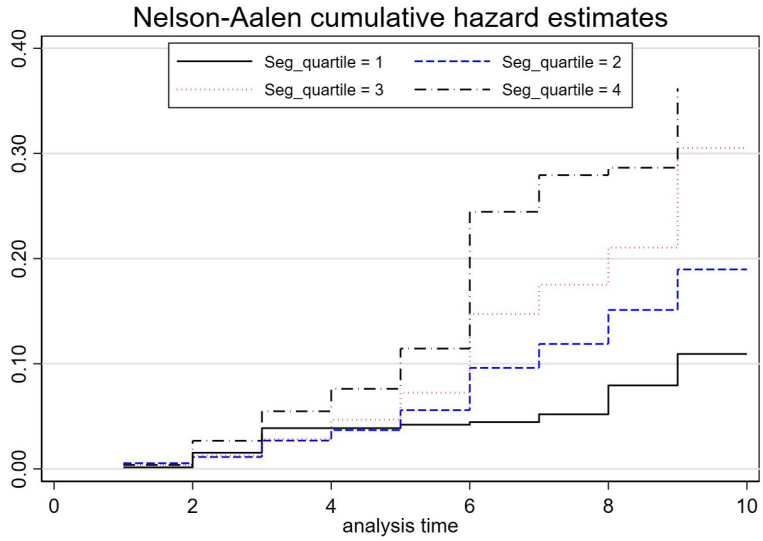

FIGURE 2 Nelson-Aalen cumulative hazard estimates by market segmentation

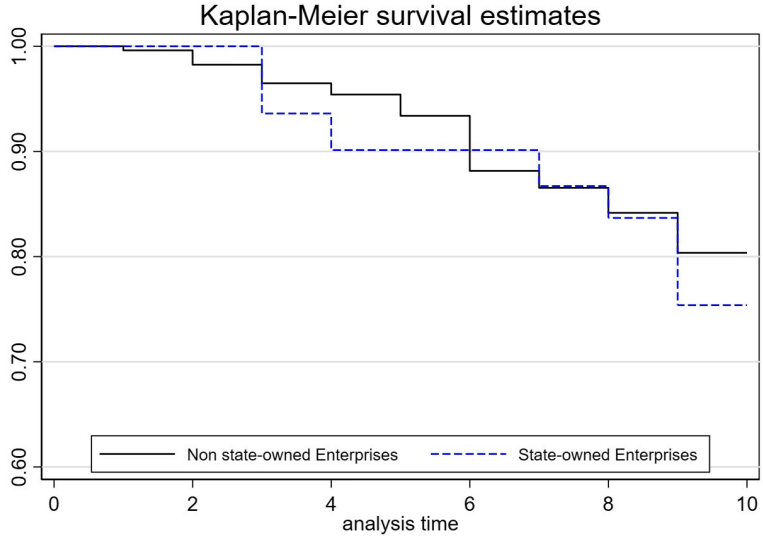

FIGURE 3 Kaplan-Meier survival estimates by ownership

5 | EMPIRICAL RESULTS

5.1 | Baseline results with all firms

The Cox regression model needs to meet the proportional hazards assumption that the risk function of different covariates changes in a fixed proportion and does not change with time. Log-log plot, observed-expected plot, and *Schoenfeld* residuals are often used to test the proportional hazards assumption, but the former two are very much subjective. Thus, we use the

TABLE 2 Descriptive statistics of variables

Variable	Description	Observation	Mean	Standard deviation	Min.	Max.
Seg	Market segmentation index	864,933	0.266	0.240	0.0260	2.649
Firm size	Average annual employment	868,125	200.3	785.7	11	188,151
Age	Firm age	868,125	4.545	2.192	1	10
Profit	Profitability	866,558	0.035	0.085	−0.327	0.352
Capital	Capital intensity: the average annual balance of net fixed assets divided by the average annual number of employees	868,125	82.75	140.0	0.471	956.1
Export	Whether to export or not	868,125	0.256	0.436	0	1
State	Type of property right	868,125	0.035	0.185	0	1
Foreign	Proportion of foreign investment	862,833	0.079	0.253	0	1
Innovation	Proportion of output value of new products in sales revenue	730,635	0.033	0.151	0	1
Productivity	TFP calculated with LP method	721,364	1,892	2,951	1.900	70,574
Highway	Highway mileage per capita	854,545	1.611	0.210	1.139	2.389
Market size	Regional Employment	855,149	3391	1473	118.4	5,960

Note: Score of market segmentation is multiplied by 1000 as the raw market segmentation data are too small. Main variables are winsorized on 1% and 99% percentiles to avoid the influence of outliers.

third method to test the proportional hazards hypothesis, which if correct, the *Schoenfeld* residuals should not change consistently with time. By regressing the *Schoenfeld* residuals with time, we can test whether the coefficient of time is significantly zero. According to the test results, the chi-square value is 12.38, which cannot be used to reject the original hypothesis. This shows that the *Schoenfeld* residual of the variable after proportional adjustment is not significantly related to time, so the application of the model can be considered to be scientific and reasonable.

Table 3 presents the baseline estimation results based on the Cox proportional survival model. Model 1 reports the estimation results without considering the industry effect. Model 2 reports the results after controlling for the industry effect. As our measure of segmentation incorporates not only local protectionism but also includes transportation costs mainly determined by the infrastructure, we report the results after controlling for the highway in Model 3. In Model 4, we further control the effect of market size.

The estimated coefficients of the market segmentation index in all of the models are significantly positive at the 1% level, which confirms that increasing market segmentation dominated by government intervention would increase the exit hazard of firms. To illustrate the effect, let us consider the coefficient on this indicator, as shown in Column 5 of Table 3. Moving from the 10th percentile of the distribution of the market segmentation (Seg, score of 0.0995) to the 90th percentile (score of 0.7084) would increase exit probability by 7.5 percentage points.[12] This result is somewhat different from that in Melitz and Ottaviano (2008) who develop a monopolistically competitive model with firm heterogeneity and analyze how market size and trade affect firm survival. They make one important point that it is difficult for new entrants to survive under large market competition. Thus, production such as larger trade barriers will reduce competition and enable the likelihood of survival. However, this would not apply to the firms in this study as they are all large firms with a market value no less than 5 million RMB. Moreover, the new entrants in Melitz and Ottaviano (2008) flourished as state protected entities, while market protection handicapped the firms in this study and facilitated a reduction in their competitiveness as the firms tend to actively establish a rent-seeking relationship with local government officials.

Firm-specific controls show the expected impact on firm survival probability. Specifically, the firm size indicator (*lnFirmsize*) shows negative (statistically significant) coefficients, as shown in Model 3. Firm size cushion exit hazards as confirmed in the existing literature (Geroski et al., 2010; Klepper & Thompson, 2006). The result is straightforward as it is expected that larger firms face lower exit risks than smaller firms.

Both *age* and age^2 coefficients are statistically significant at the 1% level, thus indicating that firm age has an inverted U-shaped relationship with exit hazard. With respect to firm profits, an increase in profits will reduce the exit hazard, which is consistent with previous evidence (Baumohl et al., 2019; Guariglia et al., 2016). The result is straightforward since higher profits indicate greater ability to self-finance. Hence, less dependence on debt and financial stability are essential factors that contribute to long-term survival.

Whether a firm exports is shown to be an indicator of reduced exit hazard. This means that exporting firms have lower exit hazard than their non-exporting counterparts. Intuitively, exporting firms have more options in a segmented market environment. A firm that is less dependent on the domestic market is less affected by domestic market segmentation.

The two indicators of ownership structure, *state* and *foreign,* exert statistically positive and negative effects on exit hazard, respectively. SOEs have a higher exit hazard than non-SOEs. Firms with foreign investment are less likely to survive than domestic firms. These results are in line with earlier findings (Mata & Alves, 2018; Zaheer & Mosakowski, 1997). Previous studies

TABLE 3 Baseline estimation results of the Cox proportional hazard model

Dependent variable: hazard rate	Model 1	Model 2	Model 3	Model 4	Model 5
Seg	0.192**	0.207**	0.104**	0.102**	0.038*
	(0.014)	(0.014)	(0.015)	(0.015)	(0.016)
lnFirmsize			−0.247**	−0.244**	−0.242**
			(0.004)	(0.004)	(0.004)
Age			0.401**	0.399**	0.399**
			(0.009)	(0.009)	(0.009)
Age[a]			−0.029**	−0.029**	−0.029**
			(0.001)	(0.001)	(0.001)
Profit			−2.141**	−2.130**	−2.109**
			(0.045)	(0.045)	(0.045)
Capital			−0.001**	−0.001**	−0.001**
			(0.000)	(0.000)	(0.000)
Export			−0.162**	−0.162**	−0.156**
			(0.011)	(0.011)	(0.011)
State			0.382**	0.374**	0.357**
			(0.019)	(0.019)	(0.020)
Foreign			−0.247**	−0.258**	−0.270**
			(0.019)	(0.019)	(0.020)
lnHighway				0.215**	0.091*
				(0.037)	(0.037)
lnMarketsize					−0.075**
					(0.007)
Industry Effect	NO	YES	YES	YES	YES
AIC	1,414,668.208	1,413,947.163	1,369,340.202	1,352,012.138	1,351,919.166
Max. R^2	0.805	0.805	0.800	0.799	0.799
Num. events	61,992	61,992	60,507	59,831	59,831
Num. obs.	864,933	864,933	858,241	847,870	847,870

Note: Discrete-time proportional hazard model results are reported. Significance at 10%.

[a]Robust standard errors are presented in the parentheses.

*Significance at 5%; **Significance at 1%.

have confirmed that foreign firms have a lower performance (Miller & Parkhe, 2002) and experience higher exit rates than their domestic counterparts.

Market segmentation is not only affected by local protectionism, but also the transportation infrastructure. The density of highways is controlled for in Models 3 and 4.[13] According to the result of Model 4, after controlling for the effect of highways, the coefficient of market segmentation decreases from 0.104 to 0.102, but is still significant at the 1% level, which means that after controlling for the effect of highways, market segmentation still has a significant effect on exit of firms.

According to the theoretical predictions in Melitz and Ottaviano (2008) and empirical evidence in Ding and Niu (2019), a larger province in China is more likely to eliminate low-productivity firms, given the presence of significant inter-provincial trade barriers. We add an independent variable of province size in the regressions. The coefficient of market segmentation decreases from 0.102 to 0.038, which indicates market segmentation will significantly increase exit hazard.

5.2 | Robustness checks

To verify the validity of our results, we conduct four robustness checks as follows.

First, we refer to Bai et al.(2004), and use the share of industrial output of SOEs as additional measures of market segmentation or local protectionism. Model 1 in Table 4 indicates that the coefficient of this variable is still highly and significantly positive at the 1% level, thus indicating that local protectionism will significantly increase the risk of market exit.

Second, following Ke (2015), we consider a measurement of segmentation that incorporates trade barriers to all other provinces, not just the adjacent provinces. Our earlier measurement only considers adjacent provinces when calculating the relative price variance. However, the informal trade barriers set by provincial governments do not only target adjacent provinces. We now use the approach in Ke (2015) to measure the market segmentation more broadly. The estimation results are reported in Model 2 in Table 4. The variable Seg is still significant at the 1% level, thus confirming that market segmentation increases the risk of market exit.

Third, as trade barriers not only differ across provinces but also across industries (Bai et al., 2004; Poncet, 2003; Young, 2000), we use firms in those sectors that are related to the nine types of commodities mentioned above and drop the irrelevant sectors. Model 3 in Table 4 reports the regression results. The segmentation coefficient is 0.037, which is still significant at the 1% level.

Finally, in order to estimate the effects of segmentation on firm exit within a short period of time, as well as reduce any possible endogeneity, we regress the dependent variable on the first and second order lags of the variable of interest (Seg). The estimation results are shown in Models 4 and 5 in Table 4. It can be seen that the coefficient of market segmentation is 0.040 and 0.042, which are still significantly positive at the 1% level, thus indicating that market segmentation lagging one or two years also significantly increases survival hazard. The degree of regional market segmentation is increased by one unit, so the probability of enterprises withdrawing from the market will increase by 4.1% next year, and 4.3% in the year after that.[14]

5.3 | Differentiated effects on SOEs and non-SOEs

In this section, we discuss whether all firms are equally affected by changes in market segmentation. As mentioned above, market segmentation may have different impacts on SOEs and non-SOEs in the Chinese context. The reasons are as follows. First, the governance system in China places officials at the center of the market, and their authority and power might override market entry regulations (Yao, 2002; Zhang et al., 2019). Therefore, even with serious market segmentation and entry barriers, Chinese SOEs can easily obtain permits and licenses due to their stronger political connections with governments compared to their non-SOE counterparts. Second, SOEs may have "institutional exit barriers" as they provide more job opportunities. The SOEs bear the responsibility of maintaining national security, social stability, and national prosperity and are

TABLE 4 Robustness check: estimation results of market segmentation

	Model 1	Model 2	Model 3	Model 4	Model 5
Stateratio	1.471***				
	(0.060)				
Seg		0.122***	0.037*		
		(0.015)	(0.020)		
Seg_{t-1}				0.040**	
				(0.017)	
Seg_{t-2}					0.042**
					(0.020)
lnFirmsize	−0.253***	−0.242***	−0.258***	−0.357***	−0.362***
	(0.004)	(0.004)	(0.006)	(0.005)	(0.007)
Age	0.403***	0.399***	0.408***	0.016	−0.001
	(0.009)	(0.009)	(0.012)	(0.013)	(0.020)
Age[a]	−0.030***	−0.029***	−0.029***	0.001	0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Profit	−2.012***	−2.117***	−2.324***	−2.476***	−2.622***
	(0.045)	(0.045)	(0.059)	(0.052)	(0.069)
Capital	−0.001***	−0.001***	−0.001***	−0.001***	−0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Export	−0.127***	−0.158***	−0.157***	−0.201***	−0.216***
	(0.011)	(0.011)	(0.012)	(0.012)	(0.016)
State	0.334***	0.354***	0.409***	0.227***	0.284***
	(0.019)	(0.020)	(0.026)	(0.023)	(0.029)
Foreign	−0.249***	−0.272***	−0.208***	−0.219***	−0.195***
	(0.020)	(0.020)	(0.023)	(0.022)	(0.029)
lnHighway	0.324***	0.128***	−0.006	0.188***	0.191***
	(0.038)	(0.038)	(0.049)	(0.043)	(0.056)
lnMarketsize	0.000	−0.053***	−0.070***	−0.053***	−0.042***
	(0.007)	(0.007)	(0.009)	(0.008)	(0.011)
Industry Effect	YES	YES	YES	YES	YES
AIC	1,351,903.096	1,351,887.669	850,541.790	995,945.134	537,423.472
Max. R^2	0.800	0.799	0.786	0.815	0.763
Num. events	59,851	59,831	39,092	45,468	25,483
Num. obs.	847,924	847,870	556,905	595,838	376,953

Note: Discrete-time proportional hazard model results are reported.

[a]Robust standard errors are presented in the parentheses.

*Significance at 10%.; **Significance at 5%.; ***Significance at 1%.

the primary source of local financial revenue. To prevent their collapse, local governments allocate more resources to them and are more lenient on their industry standards. Market segmentation even provides more convenient access to subsidies for Chinese SOEs.

TABLE 5 Estimation of Cox proportional hazard model by different type of ownership

	State-owned enterprises[15]		Non state-owned enterprises	
	Model 1	**Model 2**	**Model 3**	**Model 4**
Seg	−0.225**	−0.218**	0.034*	0.056**
	(0.059)	(0.058)	(0.017)	(0.017)
lnFirmsize	−0.222**	−0.216**	−0.227**	−0.242**
	(0.015)	(0.016)	(0.004)	(0.005)
Age	0.143**	0.143**	0.399**	0.409**
	(0.040)	(0.040)	(0.010)	(0.010)
Age[a]	−0.009*	−0.009*	−0.030**	−0.030**
	(0.004)	(0.004)	(0.001)	(0.001)
Profit	−1.279**	−1.353*	−2.131**	−2.153**
	(0.120)	(0.123)	(0.049)	(0.049)
Capital	−0.001**	−0.000**	−0.001**	−0.001**
	(0.000)	(0.000)	(0.000)	(0.000)
Export	0.079	0.003	−0.161**	−0.154**
	(0.078)	(0.079)	(0.010)	(0.011)
Foreign	−0.009	0.047	−0.286**	−0.270**
	(0.626)	(0.652)	(0.019)	(0.020)
lnHighway	−0.024	−0.099	0.081*	0.119**
	(0.134)	(0.136)	(0.039)	(0.039)
lnMarketsize	−0.072*	−0.091**	−0.091**	−0.075**
	(0.030)	(0.030)	(0.007)	(0.007)
AIC	40,045.869	40,028.278	1,290,792.254	1,289,959.413
Industry Effect	NO	YES	NO	YES
Max. R^2	0.935	0.935	0.790	0.790
Num. events	2,754	2,754	57,077	57,077
Num. obs.	14,739	14,739	833,131	833,131

Note: Discrete-time proportional hazard model results are reported. Significance at 10%.

[a]Robust standard errors are presented in the parentheses.

*Significance at 5%.; **Significance at 1%.

We further investigate the relationship between market segmentation and firm survival under different types of ownership. The empirical results are shown in Table 5. Models 1 and 2 show the impact of market segmentation on the exit hazard of SOEs. The market segmentation coefficient is −0.218, which is significantly negative at the 1% level. This means that a one-unit increase in the degree of regional market segmentation will reduce the probability of withdrawal from the market by 19.5%. Models 3 and 4 report the impact of market segmentation on the exit hazard of non-SOEs. It can be observed that the market segmentation coefficient is 0.056 after controlling for the industry effect, which is still significant at the 1% level, thus indicating that market segmentation significantly increases the survival hazard of non-SOEs. A one-unit increase in the degree of regional market segmentation will increase the probability of withdrawal by 5.80%.

6 | POSSIBLE UNDERLYING MECHANISMS

The above analysis examines the impact of market segmentation on the survival of firms. We find that the so called good intentions of local governments do not increase the likelihood of survival but instead, drives the risk of market exit. How does market segmentation affect the survival of firms? We argue that market segmentation reduces firm survival time by reducing their productivity and motivation to innovate. Previous studies have pointed out that trade liberalization stiffens competition by reducing markups, producing stricter firm selection, and increasing aggregate productivity (Impullitti & Licandro, 2018). These most efficient and innovative firms survive under competition (Aghion & Howitt, 1996). However, competition and motivation to innovate would be significantly weakened under market segmentation. In the long run, market segmentation will inhibit the growth of enterprises and the survival of the market.

We use a mediating effect model to test the possible underlying mechanisms. Based on the existing literature, we test the mechanisms that underlie how market segmentation affects the survival of firms by using three steps: first, the dependent variables are regressed on the variable of interest Seg; second, the intermediary variables (LnProductivity and LnInnovation) are regressed on the variable of interest Seg; and third, the dependent variables are regressed on the variable of interest and intermediary variables at the same time. We use the approach in Levinsohn and Petrin (2003) to measure firm productivity. The innovation output of firms is defined as the proportion of new product sales to total sales. We test the underlying mechanisms through which market segmentation affects firm survival with the following regression model:

$$h(t,X) = h_0(t)\exp(a_0 + \beta Seg_{it} + \phi\vec{Z}_{it}) \tag{4}$$

$$\text{LnProductivity}_{it} = b_0 + \tilde{\delta} Seg_{it} + \delta\vec{Z}_{it} + \varepsilon_{it} \tag{5}$$

$$\text{LnInnovation}_{it} = c_0 + \tilde{\gamma} Seg_{it} + \gamma\vec{Z}_{it} + \varepsilon_{it} \tag{6}$$

$$h(t,X) = h_0(t)\exp(d_0 + \eta \text{Seg}_{it} + \lambda \text{LnProductivity}_{it} + \kappa \text{LnInnovaion}_{it} + \phi\vec{Z}_{it}) \tag{7}$$

where Seg_{it} indicates the market segmentation index, and LnProductivity and LnInnovation represent the firm productivity and innovation output, respectively. Models 1 and 2 in Table 6 report the regression results of Equations (5 and 6), and Model 5 reports the regression result of Equation (7).

According to the estimation results of Model 1 in Table 6, the coefficient of market segmentation is significantly negative at the 1% level, which indicates that local market segmentation has indeed reduced firm productivity to a certain extent. Market segmentation will inhibit the free flow of products and production factors across regions, increase production costs, and reduce productivity. This is consistent with Melitz and Ottaviano (2008) that larger markets provide more product variety and host more productive firms. According to the regression results of Model 2, the coefficient of Seg is also significantly negative at the 1% level, which indicates that market segmentation reduces innovation output.

Models 3 and 4 add the intermediary variables LnProductivity and LnInnovation, respectively. Model 5 contains all of the variables. The market segmentation variable (Seg) coefficient in Model 5 is significantly positive at the 1% level, which confirms that market segmentation increases the likelihood that firms exit the market. The LnProductivity and LnInnovation coefficients are both significantly negative in Model 5, which indicates that a decrease in firm productivity and innovation output will significantly increase the exit hazard. Overall, market segmentation reduces the survival of firms.

TABLE 6 Estimation results of possible underlying mechanisms

	LnProductivity	LnInnovation	Dependent variable: hazard rate		
	Model 1	Model 2	Model 3	Model 4	Model 5
Seg	−0.021***	−0.006***	0.039**	0.038**	0.039**
	(0.004)	(0.001)	(0.017)	(0.017)	(0.017)
lnFirmsize	0.333***	0.006***	−0.194***	−0.251***	−0.194***
	(0.003)	(0.000)	(0.005)	(0.005)	(0.005)
Age	0.229***	−0.005***	0.397***	0.385***	0.396***
	(0.002)	(0.000)	(0.010)	(0.010)	(0.010)
Age[a]	−0.011***	0.000***	−0.029***	−0.028***	−0.029***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Profit	2.314***	−0.008***	−1.472***	−2.085***	−1.471***
	(0.016)	(0.003)	(0.053)	(0.048)	(0.053)
Capital	0.000***	0.000***	−0.000***	−0.001***	−0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Export	0.055***	0.030***	−0.145***	−0.142***	−0.142***
	(0.004)	(0.001)	(0.012)	(0.011)	(0.012)
State	−0.004	0.003**	0.293***	0.323***	0.294***
	(0.007)	(0.001)	(0.022)	(0.021)	(0.022)
Foreign	0.021**	−0.000	−0.218***	−0.256***	−0.220***
	(0.008)	(0.001)	(0.021)	(0.021)	(0.021)
lnHighway	0.731***	0.008***	0.081**	0.062	0.076*
	(0.018)	(0.003)	(0.040)	(0.039)	(0.040)
lnMarketsize	0.184***	0.024***	−0.062***	−0.075***	−0.063***
	(0.016)	(0.003)	(0.007)	(0.007)	(0.008)
lnProductivity			−0.138***		−0.138***
			(0.005)		(0.005)
lnInnovation				−0.173***	−0.143***
				(0.031)	(0.031)
Num. obs.	702,430	712,391	702,430	712,391	702,238
AIC			1,156,282.096	1,186,023.761	1,155,591.781
Max. R^2			0.810	0.813	0.810
Num. events			51,512	52,747	51,483

Note: Discrete-time proportional hazard model results are reported.

[a]Robust standard errors are presented in the parentheses.

*Significance at 10%.; **Significance at 5%.; ***Significance at 1%.

7 | CONCLUSION

Our study investigates whether and how market segmentation determines the survival hazard of Chinese firms. We use the Cox proportional hazard model on a large sample of Chinese firms from 1998 to 2007 and an inter-provincial market segmentation index. Furthermore, we use an

extensive set of firm-specific characteristics and province effect as the controls. Overall, our results are robust in different models. The findings demonstrate that market segmentation substantially increase exit hazards.

Our subgroup analysis differentiates the effects of market segmentation on the exit hazard of SOEs and non-SOEs. The findings show that market segmentation reduces the exit hazard of SOEs. In contrast, the survival hazard of non-SOEs would increase. A one unit increase in the degree of regional market segmentation will reduce the likelihood that SOEs withdraw from the market by 19.5% while increasing the likelihood that non-SOEs withdraw from the market by 5.80%. The reason is as follows. SOEs in China may have stronger political connections, and benefit more from market segmentation. The summarized statistics show that SOEs have higher failure rates than non-SOEs, while our analysis indicates that market segmentation protects them from failing. Together this shows a strong market distortion.

Finally, we further investigate two underlying mechanisms that show how market segmentation affects exit hazards. On the one hand, market segmentation reduces firm productivity due to the obstacles in advancement, rising production costs, and low mobility of production factors. On the other hand, market segmentation also reduces innovation output which has an essential role as a preventive factor that helps firms increase their survival rate.

In conclusion, market segmentation separates regional economic ties and inhibits endogenous competitiveness, thus increasing exit hazards of local firms. Although market segmentation alleviates the pressure of SOEs to survive, it is devastating to most non-SOEs. The "good intentions" of local governments who attempt to support the advancement of local enterprises through market segmentation policies may not be holistic enough. If local governments do not consider the overall economic development benefits, "wishful thinking" by focusing on local economic development will inevitably result in failure. Note that we define firm exit or failure as firms that are removed from the database due to reduced market value (as a common practice in the related literature). Future work can enhance this work when more precise data are available.

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ENDNOTES

[1] http://www.xinhuanet.com/english/2018-09/06/c_137450275.htm.

[2] http://www.fabao365.com/news/507136.html.

[3] The automotive industry in Anhui Province is another good example. In 2009, a document issued by the Anhui Provincial Economic Commission states that "urban taxis are encouraged to use cars produced by Chery". In Wuhu City, where the Chery automobile headquarters are located, almost all of the taxis are produced by Chery. However, as the former leader of China's independent brands, Chery has now been surpassed by Geely Auto Group and other automotive companies.

[4] Taking Hubei Province as an example, the Hubei provincial government issued the "Opinions on the provincial government's efforts to promote the steady and rapid development of industrial economy in the entire province," which directly requires that "government procurement at all levels should give priority to the purchase of

provincial products such as steel, automobiles, building materials, tobacco and wine, household appliances and other products under the same conditions without violating the relevant national laws and regulations". The document "Opinions on promoting steady and rapid growth of industrial economy" issued by Henan provincial government on February 9, 2009, requires the government to prioritize the purchase of products in the province under the same conditions when bidding for procurement of goods.

[5] Tibet is not included due to incomplete data.

[6] The logistic model is based on discrete time periods, which might lead to the loss of information. However, the survival models and, in particular the Cox proportional hazard model, allows the study of time intervals without any classification. Consistent with the logistic model, the parameters of the Cox proportional hazard model can be easily explained since they are the logarithms of the relative risks of the explanatory variables.

[7] Note that a firm with less than 5 million RMB in revenue is removed from the data. We define the firm as a failure if its revenue shrinks to less than 5 million RMB, which is consistent with the threshold in most of the existing literature (Zhang et al., 2017; Zhang et al. (2019)).

[8] When we conduct a survival analysis, we may not have the exact survival times for all of the firms. In fact, survival time data are often censored. There are three major times of censoring: right, left and interval censoring. Right-censoring occurs when the survival time is incomplete at the right side of the follow-up period. For example, a firm does not withdraw from the market during the duration of the study. A firm is said to be left censored if the firm had been founded for a period of time before the study. Interval-censoring occurs in survival analyses when the time until an event of interest is not known precisely (and instead, is only known to fall into a particular interval).

[9] Note that, based on the current data, our definition of the firm exit is that it exits from our database. Similarly, we define the firm entering time as the time to show up in the database.

[10] $440/4265 = 10.32\%$

[11] $(440 + 620+894 + 295 + 327 + 484 + 89 + 93 + 97)/4{,}265 = 78.29\%$

[12] $0.038 \times (\log(0.7084) - \log(0.0995)) = 0.075$.

[13] Note that there are two potential effects of highways on firm survival. One is to decrease survival risk due to lower transportation costs. The other is to increase the risk due to interregional market competition. Our results indicate that the latter dominates.

[14] $0.041 = e^{0.040} - 1; 0.043 = e^{0.042} - 1$.

[15] We classify enterprises according to their registration code. If the enterprise code starts with 11, we call it a state-owned enterprise. The remaining enterprises are non-state-owned enterprises.

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