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**REFORM AND COMPETITIVE SELECTION IN CHINA:  
AN ANALYSIS OF FIRM EXITS**

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# **Reform and Competitive Selection in China:**

## **An Analysis of Firm Exits**

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### **Abstract**

This paper considers aspects of the competitive selection process in China - firm entry, survival, and exit - in an important sector of manufacturing, looking in particular for changes resulting from the latest stage of reforms. Using industry survey data from a province in North-East China, we find substantial differences in the process between ownership types. By conducting a simple decomposition of the aggregate productivity growth and exploring the determinants of firm's exit using a hazard rate model, we observe a substantial rate of churning of enterprises in the sector, and find that the competitive selection processes operate, for small and collectively owned enterprises (COEs), in a manner consistent with a private market economy. In contrast, such processes appear not to be functioning for state owned enterprises (SOEs). We conclude that competitive selection in China is not providing a sufficiently strong substitute for corporate governance based on ownership.

Key Words: Competition; Exit; Productivity, Hazard Models

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## **Introduction**

Since the 1980s, while transforming itself from a centrally planned economy to an emerging market economy, China has achieved a 10% average rate of growth in GDP, with per capita GDP more than quadrupling. However, a central paradox of the recent impressive record in China is that it has been achieved in the absence of a number of factors commonly deemed to be pre-requisites of successful transition. These include reasonably complete market liberalization, large-scale privatisations, secure private property rights, and democracy (Chow, 1997). Resolution of the paradox is important when assessing the role of current and future reforms.

As far as liberalization is concerned, it may however be argued that the ‘competitive selection process’ by which firms enter and leave industries has a vital role in creating a competitive market environment and may act as a partial substitute for the absence of a large scale privatisation process (and for forms of corporate governance based on private ownership). This competitive selection process is shown to be especially important for small firms in the electrical equipment manufacturing sector we investigate. Such a process is based on an exit mechanism for individual enterprises, allowing unprofitable firms to decline and fail. As a result, Alchian (1950) argued that profit-maximising behaviour in a market economy is ensured, since a lack of profits threatens a firm’s survival. In this paper we explicitly model the impact of China’s reforms on this selection process.

Investigating the factors governing the process of exit of enterprises in the Chinese economy is important for a number of reasons. Firstly, China’s idea of gradual reform aims to encourage the entry of new firms and phase out the old inefficient SOEs through bankruptcy and restructuring. Therefore, a study of firms’ exit and survival behaviour can shed light on how gradual reform works. Secondly, exits have played and are playing an important economic role in the transition to a market economy. On one hand, the exit of

inefficient firms releases scarce resources, reducing inefficiency and facilitating the prospects for new firms entering the industry, promoting entrepreneurship (Aghion and Howitt, 1997). On the other hand it provides credible threats to incumbent firms (Jensen, 1988; Hart, 1995), which may then hasten various types of restructuring. However, exits involve costs (Ericsson, 1994), and in special circumstance exits may lead to the disorganisation of the entire economy. *Thirdly*, by studying the firms' exit behaviour and its determinants and comparing it with its counterparts in advanced economies, we can estimate to what extent the market mechanism is functioning and to what extent the old legacy is still in evidence..

As a working hypothesis it seems reasonable to suppose that the old state- owned enterprises (SOEs) - which were designed for the old central planning system and where inefficiency is allegedly pervasive - are less likely to survive in the face of competition from new innovative non-state firms. However, in the Chinese case we suspect that a number of factors contribute to rather strong barriers to exit, in particular the high economic and social costs associated with closure, such as the possible increase in unemployment and the potential for social unrest. In this paper, we are therefore primarily concerned with the questions of what determines the exit of Chinese firms in the process of China's transition to a market economy, what constitute the barriers to firms' exit, and whether these barriers have changed to any great extent as a result of the reforms taking place under the Socialist Market Economy.

The paper is organized as follows. The second section provides an overview of the reform process and its implications for the performance of manufacturing enterprise in China. The third section looks at the dynamics of output, employment, and productivity growth in China. A key objective of this section is to ascertain whether the latest phase of reforms has substantially changed the pattern of growth substantially as it relates to the entry, exit and survival of firms. The fourth section considers in more detail the empirical analysis of exit. In the penultimate section, we employ a hazard rate model to explore the determinants of firm exit. The final section concludes.

## **2. The Transition Process in China**

The 'reform and opening up' policy proposed in the Third Plenum of The Eleventh Congress of the Communist Party on December 18-22, 1978 marked the beginning of China's reform era. At the beginning of the reform process, China's policy makers had reasonably clear objectives relating to the increase of productivity and the improvement of living standards. But at that time, even in the western countries, let alone in socialist countries, deregulation and privatization remained controversial topics. Hence there was no obvious model to serve as a guide. The reforms consequently proceeded by using an experimental method, referred to as 'crossing the river by groping for stones'. The reforms were initially implemented in a few selected cities, before being rolled out at the national level. This initial phase was characterized by the continued dominance of the planning mechanism while trying to establish a 'balance' between the plan and the market.

By the end of 1992, the China's economic system was still halfway between a planned system and a market system. In September of that year however, the Fourteenth Congress of Chinese Communist Party endorsed for the first time the objective of building a 'socialist market economy'. The explicit nature of the target should be contrasted with the earlier philosophy of 'groping for stones' and marked a specific break with the first stage. In 1997, the Fifteenth Party congress made a breakthrough on ownership issues, with private ownership being upgraded to an 'important component of economy' rather than being merely that of a 'supplementary component'. And more recently, in 1999, private ownership and the rule of law were incorporated into the Chinese Constitution, and private ownership was given equal standing with State Owned Enterprises (SOEs).

At the enterprise level, the post 1993 reforms established the foundations of a modern company system. At the outset of this stage, enterprises were merged to take advantage of scale economies as well as to help mobilize resources. Most of the merger decisions were

made by the government rather than at the level of the enterprises themselves. Some enterprises were incorporated, and some accessory services were spun off. Intra-enterprise contracts of various kinds have also been widely introduced. Since 1995, there has been large-scale privatization of small and medium SOEs, and of collectively owned enterprises (COEs), as well as the beginnings of layoffs of state workers on a large scale, with some insolvent enterprises being allowed to go bankrupt. Larger companies were also floated on the stock market, and by the end of 2002 there are more than 1200 listed companies in China's Shanghai and Shenzhen stock markets. Debt conversion to equity is now beginning to be implemented for larger companies to wipe out the debt historically incurred by large and strategically important SOEs. At the same time, monopoly positions in both the telecommunications and electricity supply industry are being dismantled

Ostensibly therefore the reforms since 1992 may have been expected to have impacts on enterprise performance via both product market and capital market effects. Our concern in this paper is limited to the former and to the measurable dimensions of the competitive process, assessing the respective roles played by entry, exit and incumbent firm growth in an important sector of manufacturing within a single province. Accordingly, the next section performs some relatively straightforward decompositions of output and productivity growth

### **3. A Preliminary Analysis of the Industrial Dynamics in the Electrical Equipment Manufacturing Sector**

To begin the analysis it is useful to consider the effectiveness of the competitive selection process by examining measurable characteristics of the processes of entry, exit and growth and how they have changed with reform, using the periodization considered in the last section.

The creation, survival and growth of the newly established firms and the downsizing and possible exit of the traditionally large, dominant state owned firms are both important to the success of both the transition process itself and also to the long-term health of those economies, forming the two sides of Schumpeterian creative destruction (Stiglitz, 1999). Moreover, the process of exit is likely to become much more important as the movement of surplus labor from the countryside to the towns slows down. In the context of China however, the academic and policy communities have concentrated on the role of the entry of new firms (e.g. Jackson et al (1999), Qian (1999)), while largely ignoring the extent and role of the exit of older and less efficient firms.

The data used in this investigation covers almost the complete population of Chinese firms in the electrical equipment manufacturing industry in Liaoning, a Northern China Province, over a ten-year period starting from 1987 to 1996. This province used to be the centre of China's Manufacturing Industry, and is an area where the central planning system had perhaps been most deeply rooted. Of its 14 cities, five are coastal cities; one of these latter - Dalian - was one of the earliest cities to have been opened up to the outside world. Arguably therefore, the enterprise reforms in this province, especially the reform of State Owned Enterprises (SOEs), are representative of the enterprise reform in China's manufacturing sector more generally.

The electrical equipment manufacturing industry is a sector where traditionally the SOEs have dominated, especially in the manufacturing of electric motor, generators, transformers and electricity distribution and control apparatus, but where currently the new entry of non-SOEs has been relatively easy, especially in the manufacturing of domestic appliances, electrical lighting equipment, etc. Arguably therefore the selection of this sector is to some extent representative of the stage of the reform discussed in this paper. This sector accounts for around 5% of the province's gross industry output. The dataset is an unbalanced panel of 3992 firms – the number of different entities appearing at any stage over the whole period examined from 1987-1996; there were 1092 firms in 1986 and 1632 in 1996. Table 1 provides data on the number of firms and size of industry for all the 3 digit industry within electrical equipment manufacturing industry.

Around 98% of the firms are small and medium firms, the markets for which are mainly local or at most provincial.

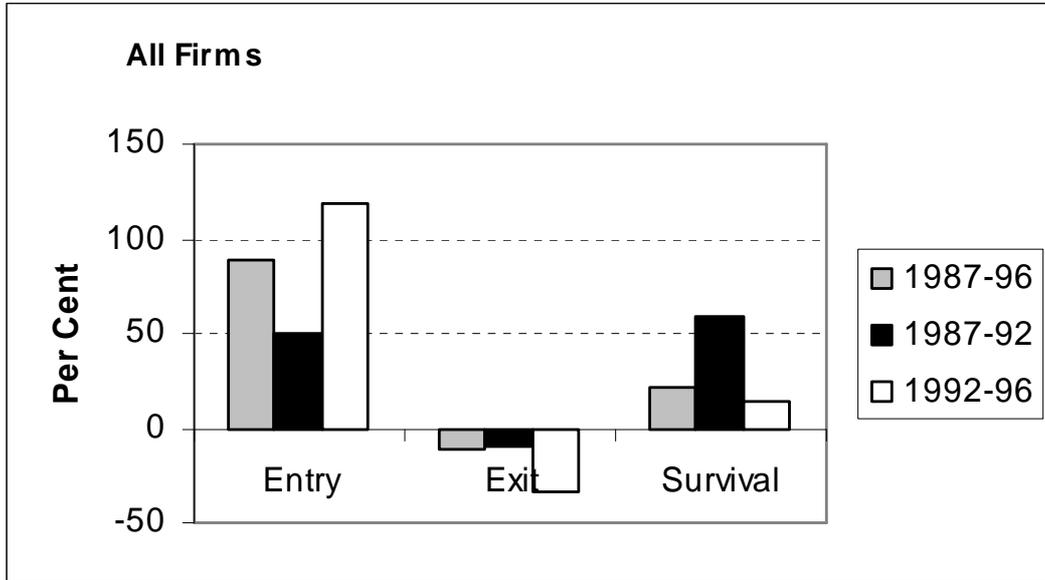
Table 1. Number of Plants, and Industry Size  
Electrical Equipment Manufacturing Sectors for Selected Years

	1987		1992		1996	
	Number of Firms	Employees (in thousands)	Number of Firms	Employees (in thousands)	Number of Firms	Employees (in thousands)
Manufacture of Electricity Generator and Electric Motors	59	33.5	74	39.8	93	46.4
Manufacture of Electricity Transforms, and Distribution and Control Apparatus	430	98.5	558	101.7	628	102.4
Manufacture of Wiring, Wiring Devices, Batteries, and Accumulators	247	52.6	321	59.7	344	49.2
Manufacture of Electric lighting Equipment	96	22.4	100	22.2	104	15.8
Manufacture of Domestic Appliances	108	23.5	182	25.7	214	40.4
Repair of Electrical Equipment	95	3.9	115	5.1	146	11.0
Manufacture of Other Electrical Equipment	57	8.0	68	7.6	109	12.1
<b>Total Electrical Equipment Sector</b>	<b>1092</b>	<b>242.4</b>	<b>1418</b>	<b>261.9</b>	<b>1638</b>	<b>277.3</b>

These industries have undergone different patterns of expansion and contraction over the 10 year period of our data.

In this section we consider some simple decompositions of output change by firm type and in terms of survivorship (the sub-set of firms who exist at both the beginning and the end of the period in question). Figure 1 shows the contribution to the growth of output of entry, exit, and survival for the whole period and the two sub periods. It suggests that there was a big increase in the importance of ‘churning’ of enterprises between the two-sub periods with both the positive contribution of entry and the negative contribution of increasing substantially. Indeed, in the period since the reforms, the net impact of entry and exit is clearly more important than the growth of surviving firms.

**Fig 1 Contributions of Entry, Exit, and Survival to the Output Growth of Chinese Firms, 1987-96**



Superficially, the evidence from Figure 1 suggests a sharpening of the competitive process over the period under investigation. Establishing such a conclusion, however, requires a more explicit assessment of both the hazard represented by exit and the competitiveness of new entrants for which we need a performance measure. Here we focus on labour productivity<sup>1</sup>.

Following the method proposed by Baily et al. (1992) and modified by Haltiwanger (1997), we decompose the growth of labor productivity into the contribution of entrants, exits and survival firms to assess the competitiveness of new entrants, as follows:

$$\Delta P_t = \left( \sum_{i \in C} \theta_{it} (p_{it} - \bar{P}) - \sum_{i \in C} \theta_{it-k} (p_{it-k} - \bar{P}) \right) + \sum_{i \in N} \theta_{it} (p_{it} - \bar{P}) - \sum_{i \in X} \theta_{it-k} (p_{it-k} - \bar{P})$$

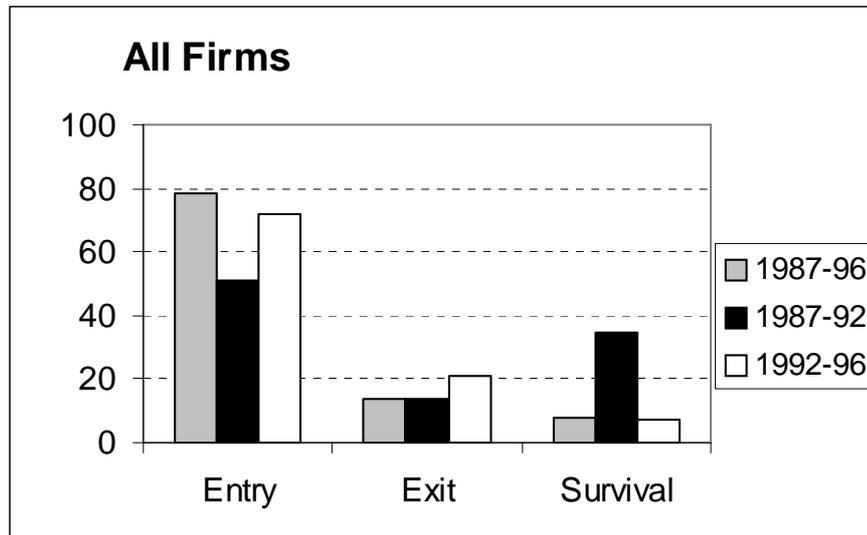
where  $\Delta$  refers to changes over the  $k$ -year interval between the first year ( $t-k$ ) and the last year ( $t$ );  $\theta_{it}$  is the share of firm  $i$  in the given sector at time  $t$ ;  $C$ ,  $N$ , and  $X$  are sets of continuing, entering, and exiting firms, respectively; and  $\bar{P}$  is the aggregate (i.e. weighted average) productivity level of the sector as of the first year  $t-k$ . Hence  $\sum_{i \in C} \theta_{it} (p_{it} - \bar{P}) - \sum_{i \in C} \theta_{it-k} (p_{it-k} - \bar{P})$  represents the change of labour productivity attributed to survival firms,  $\sum_{i \in N} \theta_{it} (p_{it} - \bar{P})$  represents the change of labor productivity attributed to new entry, and  $\sum_{i \in X} \theta_{it-k} (p_{it-k} - \bar{P})$  represents the change of labor productivity due to firms' exit.

The decomposition results for labour productivity are shown in Figure 2 which shows the contribution of entry, exit, and survival to the sector's productivity growth. It suggests that (on the average) all three components made positive contributions to productivity growth over both sub-periods. While the major impact was coming from entrants, survivors and exits also contribute a substantial percentage of overall productivity growth. Moreover, exits do appear to have increased their role over the sub-periods. To progress further, and consider how the reforms may have impacted upon exit behaviour across different firm types, we turn explicitly in the next section to the determinants of exit behavior.

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<sup>1</sup> Ideally perhaps we would want to examine total factor productivity. However, we suspect that within a specific sector, movements in labor productivity may represent a reasonable proxy for movements in total factor productivity.

Fig. 2 Contributions of Entry, Exit, and Survival to the Labour Productivity Growth of Chinese Firms, 1987-96



#### 4. The Role and Determinants of Exit Behaviour

It is helpful at this stage to consider some existing work on economic models of industrial evolution and competitive selection, and the processes that generate entry, exit, and productivity growth. In many of these models, outcomes are depicted as a result of the optimal behavior of forward-looking entrepreneurs with rational expectations but limited information. For example, in the contribution by Hopenhayn (1992) considers a model in which firms differ only in terms of their productivity levels, each of which evolves according to an exogenous Markov process. New firms enter when the distribution from which they draw their initial productivity level is sufficiently favorable for their expected future profit stream, net of annual fixed costs, to cover the sunk costs of entry. Firms exit when they experience a series of adverse productivity shocks, driving their expected future operating profits sufficiently low for exit to be their least costly option. The implications of

this particular model are shared with other representations of industrial evolution as developed by Jovanovic (1982) and Ericson and Pakes (1995). At any point in time, an entire distribution of firms with different sizes, ages and productivity levels coexist, and simultaneous entry and exit is the norm. Young firms have not yet survived a shakedown process, so they tend to be smaller and to exit more frequently. Large firms are the most efficient, on average, so their mark-ups are the largest. Nonetheless, despite the heterogeneity, equilibrium in both Jovanovic's and Hopenhayn's model maximises the net discounted value of social surplus. Thus market interventions generally make matters worse and in this sense the competitive process is optimal. Exit is however crucial to the process – typically firms exit as they learn about their true productivity levels.

From an empirical perspective, a number of studies have examined the dynamic aspects of firm behavior in the context of advanced economies, beginning with Hart and Prais's [1956] pioneering work of the growth of British companies.

Empirical studies of the processes of entry and exit for the developed economies tend to indicate that industry characteristics explain a large amount of the variation observed not only between industries but also within industries over time. The variables associated with observed differences across industries include sunk costs, absolute capital requirements, minimum efficient scale, and market concentration (Bain, 1969). Moreover, as Shapiro and Khemani (1987) showed in a study of 143 four-digit Canadian Manufacturing industries, over 1972-76, these variables tend to be associated with both barriers to entry and barriers to exit. A number of other studies have confirmed the correlation between entries and exits (e.g. Dunne et al. 1988) for US manufacturing industries, Schwalbach (1991) on German manufacturing industries, Geroski (1991) on British firm and Baldwin and Gorecki (1989) on Canadian industries). The positive correlation between entry and exit flows, which appears to be especially marked among small firms, has been described as a 'revolving door' at the bottom of the industry size distribution.

Other studies indicate that entry and exit rates tend to be positively influenced by both expected rates of return in the industry and by its growth rate (e.g. Acs and Audretsch

1989). Firm specific effects have also been found to be important, for example small firm size is found to be positively correlated with higher firm exit probabilities (e.g. Lieberman 1990). However, some of the important features of firms pre-exit, and which may have significant impacts upon firms' closure decisions, such as their performance, leverage or governance structure. Indeed, as far as the transition economies are concerned, we are unaware of similar empirical work on entry and exit for the transition economies, where the focus has tended to be on the role of new entry or on the restructuring of large state owned enterprises. In addition to the effects generally found to be important in the advanced economies, it is clear that a number of additional factors need to be considered in the context of transitional economies in general and the Chinese economy in particular. The extent of heterogeneity across industries found in the advanced economies across industries and evidently related to big differences in growth rates, sunk costs etc, provides an important reason for concentrating on a particular sector – in our case that of electrical equipment manufacturing.

The exit of inefficient firms in transition economies is potentially an important element in reducing social waste and mobilizing resources more efficiently. In addition of course, it also provides a credible threat to the incumbent firms, which may then hasten their own restructuring. As one the objectives of the transition is to eliminate subsidies to the state sectors and reallocate the resources to their best use, the state owned enterprises (SOEs) - which are built for the old central planning system and where inefficiency is allegedly pervasive - are less likely to survive competition from newly established firms. That the old state owned enterprises are more likely to exit seems to be a logical assumption. However, we suspect that, in the Chinese case, the high economic and social costs associated with the closure of state owned enterprises create strong barriers to exit. This prevents the more inefficient state owned enterprises from closing down. We are particularly concerned with the question of whether barriers to exit have changed to any great extent as a result of the reforms taking place under the Socialist Market Economy. However, before proceeding to an empirical model the definition of an 'exit' needs to be considered in the Chinese context.

In China, there were many possible reasons for the disappearance of firms in our dataset. One is that the owner (either a government department in terms of SOEs, the ‘community’ in terms of COEs or private individuals in the case of both foreign and domestic private owned enterprises) may decide to close down an under-performing enterprise. In fact, the first ever public ownership bankruptcy occurred in Electrical equipment manufacturing industry and in Liaoning province. However, it happened in 1986, before the enactment of China’s bankruptcy law, which our dataset unfortunately did not cover. Since then, the number of bankruptcies in China has risen sharply from 98 in 1989 to 5048 in 1997 (Li, 2001). Another important cause is merger and acquisition, quite possibly involving a government prompted merger of a poor performer with a successful one, with the aim of saving the former from bankruptcy. The merger may also happen voluntarily, without the interference of the government. A third reason is a change of ownership. This may take various forms: joint ventures where foreign capital dominates, firms being sold out to the public, firms being sold out to individuals, firms being sold out to employees and management. The last two processes have a characteristic Chinese name, *GaiZhi*, meaning changing mechanisms, yet by international standards, *GaiZhi* really is privatization. The final reason for exit in the current dataset is that a firm may change its main industry.

With the ensuing econometric analysis in mind, we need to consider here the following factors at firm level, industry level, and macroeconomic level.

### ***Firm-level factors***

***Ownership.*** Our data allows us to classify enterprises into 4 groups, State- Owned Enterprises (SOEs), Collectively-Owned Enterprises (COEs), Foreign-Invested Firms, and firms categorised as ‘Others’ including Domestic Privately-Owned Enterprises, and Shareholding Companies, etc. The ownership form is likely to be an important determinant of exit in the Chinese context, though the relationship may be complex. While, for example, SOEs may be inefficient, the probability of their exit may be influenced by a consideration of the social costs and resistance associated with their

closure. Moreover, the differential fiscal and legal treatment of enterprises according to ownership form (and for which we cannot adequately account) may also be important.

***Enterprise age.*** As suggested in the theoretical literature, newer enterprises may still be learning about their true productivity levels. Moreover, those enterprises that have survived the longest have established themselves in the market, and may be better able to survive an adverse shock of given size (e.g., through trademarks, “goodwill” and established links to suppliers or to the capital market). In the context of transition economies, the effect may be strengthened since established firms are frequently the place where traditional planning mechanisms and vested interests are most deeply rooted. However, old firms burdened with established organisation-specific knowledge acquired during the socialist era might be slower in acquiring organisation-specific knowledge adaptable in a market economy, and therefore be slower in learning to survive in a market economy.

***Enterprise size.*** The bigger a firm is, the more likely it is to enjoy economies of scale, and the more likely it is to invest in R&D, marketing strategies and information gathering. They have also survived and grown throughout various internal and external shocks, and have accumulated competitive assets and skills as well, therefore, they are more likely to survive. In China, for administrative purposes, China’s State Planning Committee classifies a firm as large, medium, or small according to its productive capital and its production capacity, and makes policies according to this classification. Therefore firm size captures not just the advantages of large firms over small firms in economies of scale but also controls for differential effects of government policies with regard to enterprises of different size. We expect to see a negative effect of firm size upon firms’ closure probability. We measure firm size by employment, and scale advantages by the deviation of the size of capital stock from the minimum efficient scale (MES), this being defined as the average size of the largest plants accounting for 50% of industry employment. It should be noted that size variables may also capture the characteristics of the sunk cost of firms in an imperfect market environment, which is especially important in transition economies where capital markets and labour markets are underdeveloped. An additional

control for sunk costs is a measure of capital intensity. This may also be important for another reason. In the 1980s, the government targeted the electrical equipment manufacturing industry in ways that may well have encouraged entry by enterprises with less than optimal capital intensity.

***Enterprise performance.*** In a market economy, this is the key to the competitive selection process, with poor performance punished by exit. Of course in the context of transition economies, the relationship may not be so straightforward, as efficient firms may be selectively punished by higher taxation, and inefficient firms may be encouraged by state subsidies. We include three types of performance measure: profitability measured gross profit margin, labour productivity, and an efficiency index estimated by using Data Envelopment Analysis (DEA). In formal models, a firm's closure decision is based on the comparison of expected profit staying in the market and the expected cost of staying in (Dixit, 1989; Jovanovic, 1982; Hopenhayn, 1992). Therefore, firms' current profitability should have negative effects upon firms' closure. In China, as well as in other transition economies, firm profitability may be only a poor signal of its viability, as both SOEs and COEs have to take on social responsibilities in addition to their economic objectives. A Firm's efficiency index is included for two reasons: firstly, the firm's survival ability is a test of firms' efficiency in a competitive market (Bain, 1969), and the exit of less efficient firms is normal in a market economy; secondly, productivity might not be a good indicator of enterprise performance in the context of transition economies, and higher productivity might actually lead to greater allocative distortion, lower profits, and lower efficiency - as suggested for example by Bai et al. (1997).

***The hardening of financial constraints.*** The hardening of financial constraints will eliminate support for under-performing firms, increasing the probability of firm closure. In this study, we use ratios of interest payment to fixed capital as an indicator of the degree of financial constraint faced by individual firms.

***Firms' social burden.*** In China, where the social security system is just beginning to be set up, SOEs, which had been designed to satisfy both economic and social duties,

have heavy social security and social welfare responsibilities. Those social responsibilities take the forms of in-house schools, hospitals, employees' housing, health care, and pension schemes etc., and are represented by 'unproductive capital'. In this paper, the share of fixed 'productive' capital is used to capture the effect of social burdens upon firm exit. The potential social burden is also captured by the numbers of employees. On one hand, higher unproductive capital ratio decreases the level of return, which in turn increases the closure probability; on the other hand, in transition economies with a poor social security system, those social obligations should predict against exit.

Industry-level and macroeconomic factors play an important role in determining firms' exit probability as well; here we consider the following factors:

***Market competition.*** In a more concentrated market, the existence of monopoly makes smaller firms more prone to failure. In order to allow for differences in the market environment, we also include indicators of the degree of market competition. We use the four largest firms' output ratio at the three digit industry level within a city as an indicator of the degree of market competition.

***The growth of the industry.*** In a fast-growing industry, as Bradburd and Caves (1982) have found, price-cost margins tend to be high, and market penetration can be achieved without causing much harm to competitors, therefore firms tend to live longer. The higher expected profit rate of an industry will tend to attract more firms to enter the industry and increase the market competition. In this study, we use the percentage of industrial output in the electrical equipment manufacturing industry as a proxy for the growth of the electrical equipment manufacturing industry.

***Reform stages.*** As discussed in section 2, the Fourteenth Party Congress held in September 1992 marked a roughly two-stage process of economic reform. We use a dummy variable to incorporate the impact of the post-1992 reforms.

## 5. Modelling the Exit Hazard of Chinese Enterprises

This section sets up the empirical methodology for analysing the determination of Chinese firms' exit behaviour, and reports the results of the estimates. To analyze firms' exit behaviour and to account for the right censoring nature of the dataset, we utilized methods from the literature on economic duration data (see, e.g., Kalbfleisch and Prentice, 1980; Kiefer, 1988; Lancaster, 1979), to model firm exit as a hazard rate, which is defined as the conditional probability that an enterprise exits in a small interval of time. Hazard rate (or event history) analysis has been used extensively in the study of organizational mortality (Hannan and Carroll, 1992) and new firm survival (Audretsch and Mahmood, 1995).

Theoretically, the hazard analysis can be described in terms of the probability of a firm exiting in any period of time over our sample period. Let  $T$  be a random variable measuring the duration of a particular firm during 1987-1996 with a continuous probability distribution  $f(t)$ , where  $t$  is a realization of  $T$ . The cumulative probability is:

$$F(t) = \int_0^t f(s)ds = \text{Pr}(T \leq t).$$

The survival function defining the probability that a firm survives at least  $t$  is given by:

$$S(t) = 1 - F(t) = \text{Pr}(T > t)$$

The so-called hazard rate  $\lambda(t)$  can then be derived as follows:

$$\begin{aligned}\lambda(t) &= \lim_{dt \rightarrow 0} \frac{P(t \leq T < t + dt | T \geq t)}{dt} \\ \lambda(t) &= \lim_{dt \rightarrow 0} \frac{F(t + dt) - F(t)}{dtS(t)} \\ \lambda(t) &= f(t) / S(t)\end{aligned}$$

In other words the hazard rate is the instantaneous probability that a firm exits, given that the firm has survived up a certain point in time  $t$ .

A widely used methodology - and that pursued here - is first to use univariate analysis such as Kaplan-Meier to provide non-parametric estimates of the hazard rate, before proceeding to multivariate regression methods. The univariate approach discloses the general trend of firms' hazard rates, providing useful information for the appropriate specification for the multivariate regression which then allows for the analysis of the specific determinants of the hazard rate.

In empirical applications the distribution of the hazard rate has taken various forms. The exponential distribution is a widely-used model for durations that do not exhibit much variation, which defines the hazard rate as  $\lambda(t) = \gamma$  with parameter  $\gamma > 0$ . The exponential distribution is sometimes termed 'memory-less', as the hazard function is constant and reflects no duration-dependence. More flexibility is introduced at the expense of additional parameters. Here a popular choice is the Weibull model, where the hazard function is defined as  $\lambda(t) = \gamma\alpha t^{\alpha-1}$ , where  $\gamma > 0$  and  $\alpha > 0$ . In this specification, the hazard function is monotonically increasing in duration (positive duration dependence) if the scale parameter  $\alpha > 1$ , and monotonically decreasing if  $\alpha < 1$ , and constant if  $\alpha = 1$ , which is exactly the exponential model. The log-logistic model is another choice, the hazard rate of which is defined as  $\lambda(t) = \frac{\gamma\alpha t^{\alpha-1}}{1+t^\alpha}$ . While the Weibull model exhibits a monotonic hazard, the log-logistic specification, has a non-monotonic hazard. For  $\alpha > 1$  the hazard first increases with duration then decreases. If  $0 < \alpha \leq 1$ , the hazard function decreases with duration.

### ***5.1 Nonparametric Estimation of the Hazard Function: Kaplan-Meier Estimator***

The Kaplan-Meier Estimator is a strictly empirical approach to survival and hazard function estimation. Assume  $t_1, t_2, \dots, t_i, \dots, t_n$  denote the exit times of the firms in the

dataset, and  $t_1 < t_2 < \dots < t_i < \dots < t_n$ . Let  $h_j$  be the number of firms that exit after  $t_j$ , and  $n_j$  is the number of firms at time  $t_j$ , then the estimator of the hazard rate at is

$\hat{\lambda}(t_j) = \frac{h_j}{n_j}$ , and the corresponding estimator for the survival function

$$\text{is: } S(t_j) = \prod_{i=1}^j (n_i - h_i) / n_i = \prod_{i=1}^j (1 - \lambda(t_i))$$

In this section we present the smoothed Kaplan-Meier estimation of the firms' hazard function. First, a Kaplan-Meier estimation of hazard function including all firms is presented. Then, the estimated hazard functions for firms stratified by ownership, size, and age are presented. The results are illustrated in Figures 3 to 6. Meanwhile, the Mantel-Cox log-rank test, and the Wilcoxon-Breslow-Gehan test are conducted to check whether the difference in survival patterns among stratified firms are significant.

Figure 3 shows the cumulative survival function for all the firms in the sector during the period between 1987 and 1996, 95% confidence band are shown by the lighter lines. It can be seen that the hazard rate increases between 1987 and 1993, peaks in 1993, and decreases rapidly thereafter.

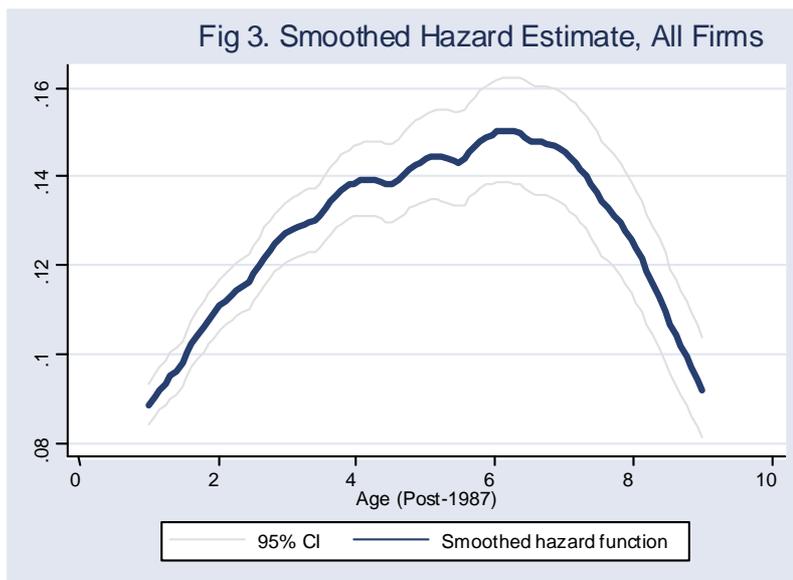
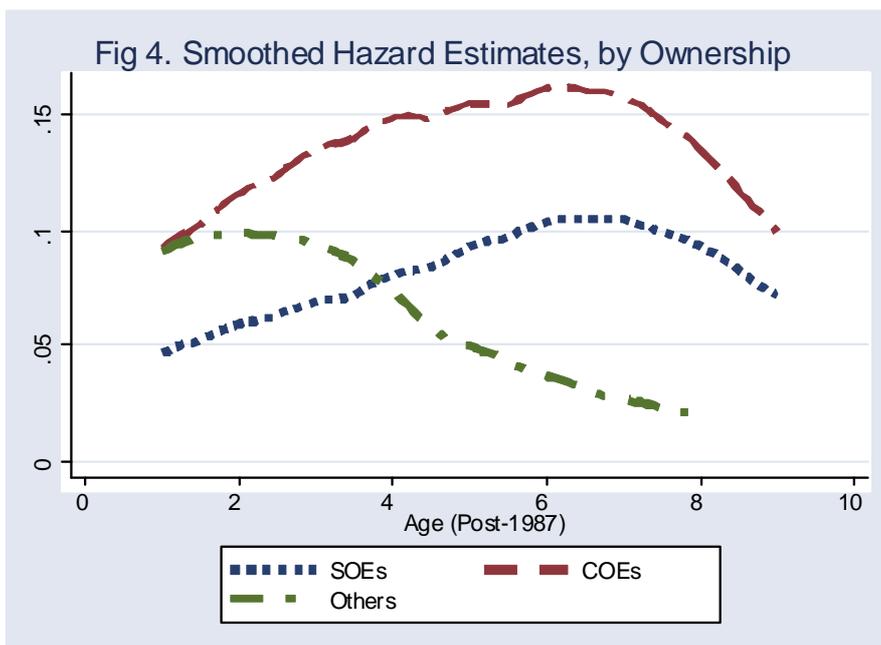
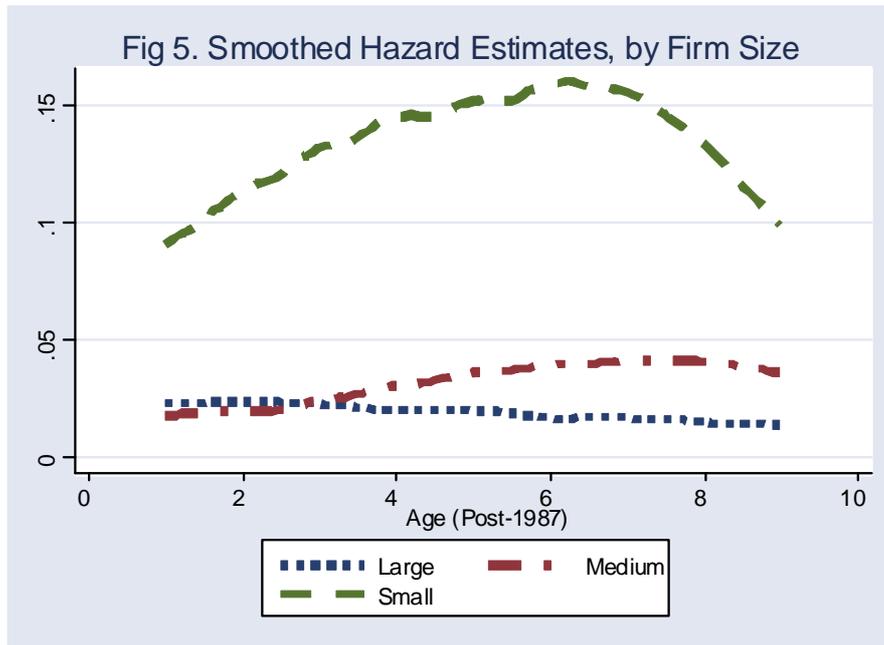


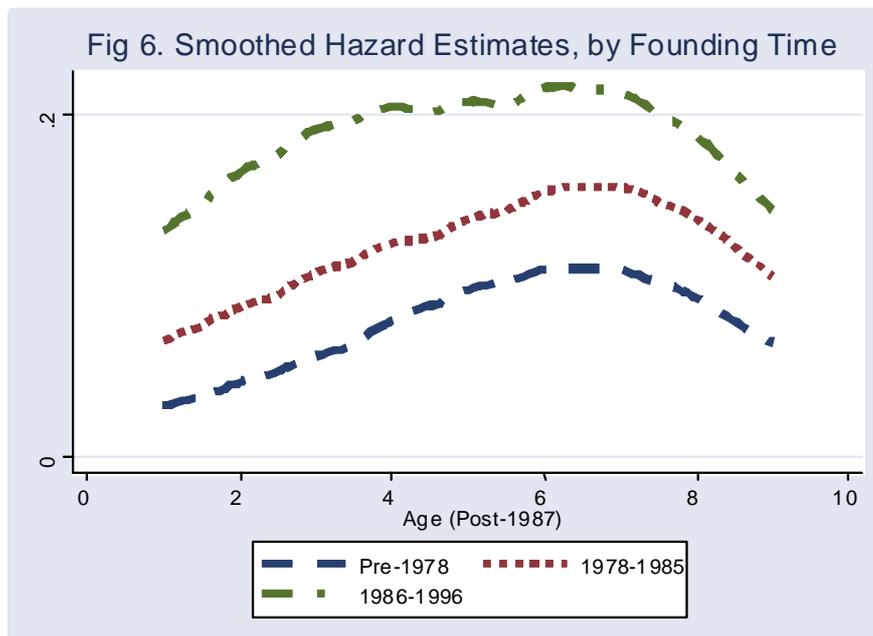
Figure 4 shows the cumulative survival of the firms stratified by ownership. It indicates that significant differences in survival probability exist between state-owned enterprises firms and collectively-owned firms. The probability of a state-owned firm surviving in the near future is higher than that of a collectively-owned firm. However SOEs tend to be bigger than other firms. Accordingly, Figure 5 shows the hazard rate by size of firm. It suggests that the exit probability of small firms is significantly higher than that of medium sized and large firms over the 10-year period. As we approach the end of the sample period, the exit behaviours of medium firms and large firms begin to show differences, with the pace of exit of medium firms increasing.





Large and medium firms are more likely to survive, with small firms most likely to exit. This result is consistent with the literature: firm size matters in determining the probability of exit decisions.

Finally, Figure 6 shows the smoothed hazard estimates stratified by founding periods, with firms divided into three groups according to when they were established: firms established between 1987-1996, firms established between 1977 and 1986, and firms established before 1977. It suggests that the date at which firms were founded is important for survival and exit behaviour. The first two groups are firms founded after the start of economic reform, and the third group were founded before reform. Those three groups display different survival and exit behaviours. Firms that were established prior to reform have the lowest hazard rates, while the most recently created firms experienced the highest hazard rates.



For all the above estimations, both the Mantel-Cox log-rank test and the Wilcoxon-Breslow-Gehan test were conducted. They all suggested that the differences in survival and exit patterns among different types of firms are statistically significant.

### ***5.2 Semi-parametric Estimation of the Hazard Function: Cox Proportional Hazard Model***

Through the non-parametric estimations, we have already found that firms displayed different survival and exit patterns; in this section we will analyse the underlying causes for the different survival and exit patterns through multivariate regressions. As discussed, both firm-specific characteristics, such as firm size, age, and performance, and industry-specific characteristics, such as competition, entry and exit barriers, are likely to have effects upon firms' exit behaviour. Furthermore, during the process of China's transition, various economic reform policies also have effects upon firms' exit behaviour. To account for such effects, we allow the firm hazard rate at a particular point in time to depend on the realization of a set of industry and firm-specific time-varying covariates.

Two popular methods are used for such multivariate analysis of the hazard rate. One is the proportional hazard model, referred as semi-parametric model. In this model the hazard function depends on a vector of explanatory variables  $x$  with unknown coefficients  $\beta$  and  $\lambda_0$ , and the hazard function of which takes the form of  $\lambda(t, x, \beta, \lambda_0) = \phi(x, \beta)\lambda_0(t)$ , where  $\lambda_0$  is called the 'baseline hazard', which is an unknown parameter representing an individual specific constant needing to be estimated. The effect of explanatory covariates is to multiply the baseline hazard by a factor  $\phi$ , which however does not depend on duration  $t$  and is generally defined as  $\phi(x, \beta) = \exp(x'\beta)$ . The other method is the accelerated failure time model, referred as parametric model, in which the effect of covariates is incorporated by specifying the hazard function as  $\lambda(t, x, \beta) = \lambda_0[t\phi(x, \beta)]\phi(x, \beta)$ . This specification allows the regressors to rescale the duration time directly. The proportional hazard model has seen the most wide usage in industrial organization literature, for example Audretsch and Mahmood (1995) on new firm survival, Bandopadhyaya (1994) on US firm bankruptcy, Karshenas and Stoneman (1993) on new technology diffusion, and Disney et al. (2003) on firm survival in the UK manufacturing sector, etc. In our study of the influence of a set of industry-specific-and firm specific time variant covariates upon firms' exit behaviour, we do not have any strong *a priori* reasons for imposing a particular functional form for the dependence of a firm's hazard rate on its survival time, and we are more concerned about the effect of various industry-specific and firm-specific factors upon firms' hazard rate than the actual hazard rate. Therefore, we choose to report here a semi-parametric estimation method, although experimentation with a variety of functional forms of hazard function, such as those using Weibull, Lognormal, and Exponential distributions (see appendix), and the differences were not found to be important. This finding is in keeping with other econometric studies of hazard rates (e.g., Karshenas and Stoneman, 1993).

Following Kiefer (1988), and Kalbfleisch and Prentice (1980), we allow the firm hazard rate at a particular time to depend on the realization of a set of common and firm-specific

time-varying covariates, with  $X_i(t)$  denoting the  $i$ th firm's covariates at time  $t$ . Therefore we construct our model as follows:

$$\lambda_i(t) = e^{\beta' X_i(t)} \lambda_0(t).$$

In estimating the proportional hazard model, Cox (1972) suggested a semi-parametric estimation in which the proportional hazard model can be estimated in a two-step procedure, where  $\beta$  is first estimated through a partial likelihood approach without specifying the form of the baseline hazard function  $\lambda_0$ , and then  $\lambda_0(t)$  is estimated non-parametrically. The relevant likelihood in estimating  $\beta$ , due to the proportionality of  $\lambda_i(t)$  and  $\lambda_0(t)$ , as was shown in Kalbfleisch and Prentice (1980), can be given by:

$$L(\beta) = \prod_{i \in D_j} \frac{\exp(\beta' X_i(t_j))}{\sum_{k \in R_j} \exp(\beta' X_k(t_j))}$$

where  $t_j$  are the ordered failure times,  $D_j$  is the set of observations fail at  $t_j$ ,  $R_j$  is the set of observations that are at hazard at time  $t_j$ ; the parameter  $\beta$  is estimated by maximising the partial log-likelihood function:

$$\ln L(\beta) = \sum_{i \in D_j} \delta_i \{ \beta' x_i(t_j) - \log \sum_{k \in R_j} \exp(\beta' x_k(t_j)) \}.$$

The most important assumption of the Cox proportional hazard model is that the hazard ratio is proportional over time.

Following our discussion of the factors determining firm exit in the previous section, the variables used in the regression analysis are shown in Table 2. In order to investigate the specific impact of reforms on the competitive process, we consider reform as a specific covariate, included as a straight dummy variable ( $P92 = 1$  if  $t > 1992$ ), which represents the impact on the hazard rate facing all enterprises in the sample. We also considered the possibility of entirely different hazard functions by ownership type or firm size, estimating different equations by ownership type, for small firms, and for new firms established

between 1986 and 1996. However, a separate estimation for larger firm sizes was precluded by the limited numbers of observations.

**Table 2 Hazard Model Covariates**

Variables	Definition
<b><i>Firm Level Factors</i></b>	
COE	Collective Owned Enterprises
Foreign	Foreign Funded Enterprises (joint ventures and foreign owned)
Others	Firms other than SOEs, COEs and Foreign , they are mainly domestic private ownership
Efficiency Index	DEA efficiency Index
Profit Margin	The ratio of gross profit to sale revenue
LN(Productivity)	Logarithm of labour Productivity
Age	Firm's age
LN(Capital/MES)	Logarithm of firm's fixed capital normalised by Minimum Efficient Scale (EMS)
LN(Employment)	Logarithm of the number of employee
Interest	The ratio of interest payment to fixed capital
Interest*P92	The interaction of Interest and P92
Capital Intensity	Capital intensity, defined as the ratio of capital to employment, normalised by the 3 digit industry average.
Capintal Intensity *P92	The interaction of capital intensity and P92
<b><i>Industry Level Factors</i></b>	
Industry Growth	Share of the industrial output from electrical equipment manufacturing industry to provincial Manufacturing Industry output
Concentration (CR4)	4 firm Concentration ratio at 3 digit industry level within a city, defined as the output ratio of the four largest enterprises within a 3 digit industry under electrical equipment manufacturing in a city.
<b><i>Macroeconomic Environment</i></b>	
GDP Growth	The growth rate of National GDP
P92	Dummy variable, P92=1 if year>1992, P92=0 if year<=1992

Table 3 presents the results from semi-parametric estimation. Using the complete sample, column (1), column (2), and column (3) of Table 3 alternate three performance measures – the DEA efficiency index, profitability, and labour productivity. Column (4) includes all three. In all estimates the SOE form of ownership is the benchmark ownership type. The results of this first set of experiments reported as shown in Table 3 consistently show that a number of co-variates have significant and correctly signed influences on the hazard rate. Significant positive impacts on the hazard rate result from collective ownership (COE), while the effect of domestic private ownership is only marginally significant. By way of example, the hazard rate facing a COE was nearly 30% or more above that for a SOE. Ratio of interest payment to fixed capital, 4 firm concentration ratio at 3 digit industry level within a city, national GDP growth, and 1992 reform dummy (P92) exert positive influences as well. Negative impacts are coming conversely from foreign ownership, the age of the enterprise, employment as a measure of the enterprise’s social burden and socialist legacy, and from the relative strength of the electrical equipment manufacturing industry in the Chinese economy as a whole. Whether entered alternately, all three performance measures, efficiency, labour productivity, and profitability exerted significant negative effects upon an enterprise’s hazard rate. However, the efficiency index and labour productivity are stronger predictors of firm exit than profit margins, the latter being only significant (at the 10% level) when all three indicators are considered.

**Table 3 Estimated Hazard Functions for Enterprises in Liao Ning Province 1987-96: Semi-Parametric Estimation**

	1		2		3		4		5		6		7		8	
	All Sample with DEA Index as Performance Measure		All Sample with Productivity as Performance Measure		All Sample With Profit Margin As Performance Measure		All Sample With all three Performance Measures		SOE		COE		Small Enterprises		New Enterprises Founded During 1986-1996	
	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z
COE	0.269***	0.01	0.251**	0.02	0.244**	0.02	0.260**	0.02					0.260**	0.03	0.326	0.11
Foreign	-1.009**	0.02	-0.987**	0.02	-1.044***	0.01	-0.980**	0.02					-0.826**	0.05	-0.773*	0.09
Other	0.041	0.89	0.132	0.65	0.002	1.00	0.140	0.63					0.200	0.51	0.805**	0.02
Age	-0.228***	0.00	-0.245***	0.00	-0.221***	0.00	-0.247***	0.00	0.050	0.72	-0.263***	0.00	-0.244***	0.00	0.105	0.11
DEA Efficiency Index	-0.630***	0.00					-0.291**	0.04	-1.425	0.11	-0.271*	0.06	-0.286**	0.05	-0.366**	0.04
Ln(Productivity)			-0.189***	0.00			-0.171***	0.00	-0.256**	0.03	-0.167***	0.00	-0.171***	0.00	-0.104***	0.00
Profit Margin					-0.017***	0.00	-0.009*	0.09	-0.007	0.93	-0.009*	0.10	-0.009*	0.09	-0.007	0.28
Ln(CAPITAL/MES)	0.003	0.82	0.027*	0.07	0.000	0.98	0.025*	0.09	-0.071	0.39	0.028*	0.07	0.025*	0.09	0.015	0.43
LN(EMPLOYMENT)	-0.233***	0.00	-0.265***	0.00	-0.234***	0.00	-0.264***	0.00	-0.256**	0.02	-0.258***	0.00	-0.260***	0.00	-0.246***	0.00
Unproductive Capital Ratio	-0.020	0.81	0.094	0.23	0.086	0.27	0.045	0.59	0.043	0.92	0.062	0.47	0.050	0.54	-0.074	0.48
Interest	0.070***	0.01	0.061***	0.01	0.044*	0.07	0.072***	0.00	-0.026	0.93	0.075***	0.00	0.072***	0.00	0.061**	0.02
Capital Intensity	0.000	0.61	0.001	0.24	0.000	0.87	0.001	0.22	0.008*	0.06	0.001	0.24	0.001	0.23	0.000	0.85
Industry Growth	-3.703***	0.00	-3.386***	0.00	-3.387***	0.00	-3.553***	0.00	-4.540***	0.00	-3.435***	0.00	-3.549***	0.00	-5.362***	0.00
Concentration	0.732***	0.00	0.619***	0.00	0.746***	0.00	0.602***	0.00	0.965	0.14	0.582***	0.00	0.577***	0.00	0.699***	0.00
GDP Growth	0.071***	0.00	0.065***	0.00	0.069***	0.00	0.067***	0.00	0.092***	0.01	0.063***	0.00	0.066***	0.00	0.087***	0.00
P92	0.964***	0.00	0.938***	0.00	0.975***	0.00	0.938***	0.00	1.503***	0.00	0.902***	0.00	0.933***	0.00	0.862***	0.00
No. of Obs	11776		11776		11776		11776		1335		10124		11167		4200	
Log-Likelihood	-11179.12		-11187.78		-11082.15		-11078.65		-424.05		-10131.93		-10919.61		-5522.87	
LR Chi(2)	680.65		663.34		711.93		718.93		81.19		568.54		645.74		299.07	

Note: \*\*\* Significant at the 1 per cent level. \*\* Significant at the 5 per cent level. \*Significant at the 10 per cent level.

Column (5) examines SOEs only. Note first that we observe a positive and potentially large impact coming from the reforms (*P92*), although this is determined very imprecisely. Secondly, it may be observed that neither the efficiency index nor profitability appear to be significant. However, productivity is a significant factor in determining the hazard rate.

Column (6) offers a contrast by considering only COEs. Here we obtain results that are more consistent with a standard competitive selection process. Unlike SOEs, the efficiency index and labour productivity are important influences on exit rates, as is the new regime itself. This pattern is largely replicated in column (7) for small firms; this is not surprising since the samples are largely coextensive.

Column (8) focuses on new enterprises established between 1986 and 1996. While the regression results are largely similar to those in column (4), column (6) and column (7), we should note that the coefficients for *COE* and for *Other* are higher although less statistically significant, and that the effects of *Other* become significant at 5% level. This might indicate that newly-established non-state enterprises are exposed to a higher exit hazard than newly-established SOEs.

Through all regressions presented in Table 3, the impact of the reforms is always statistically insignificant. The impact of the reforms on SOEs is particularly large. We suspect that this might have captured the impacts of other industry-level and macroeconomic factors. Hence, in order to estimate directly whether the acceleration of economic reform since 1992 has any impact upon firms' exit behaviours, we interacted all our firm-level variables with *P92*, and the regression results are presented in Table 4. Column (1) applies to the complete sample, column (2) and column (3) apply to SOE and COEs respectively, while column (4) and column (5) apply to small enterprises and newly-established enterprises during the period between 1986 and 1996.

The addition of the interaction between the efficiency index, labour productivity, employment, capital intensity, and *P92* appear to sharpen the estimates. For example,

while the efficiency index, and labour productivity now exert a larger negative impact on the probability of firm exit, the interactive terms are here all positive. We believe that this may be reflecting a higher propensity under the new regime for firms, probably more efficient firms, to exit as a result of their acquisition. We also now observe that employment exerts a larger (negative) impact on the probability of firm exit, while the interactive term exerts a significant and positive effect. This may indicate that under the new regime, employment poses a less important barrier to firm exit. The significant negative effect of high capital intensity exists only after 1992. All these seem to suggest the post-1992 reforms have changed the determinants of exit behaviour. However, the additions of interactions between capital, the unproductive capital ratio, interest and P92 are not statistically significant. It should be noted here that for SOEs, the negative effect of interest upon exit probability is larger in the post 1992 period, indicating a possible 'lock-in' effect between SOEs and state banks.

These results indicate that, compared to SOEs, the probability of enterprises to exit during 1986-1996 tends to be higher for COEs and for firms categorized as 'other', suggesting that SOEs do enjoy some advantages in regard to the exit hazard and which arises from their unique place in the transition. By contrast, foreign-funded enterprises tend to have the highest survival probability even after controlling for other variables. The firms categorised as *other*, which can be regarded as China's *de novo* firms, are the least likely to survive over the sample period. This may be due to the fact that most of the firms so classified are private or partially private firms, and it was not until 1996 that they acquired their legitimate status; before 1996 they were discriminated against in accessing bank loans and applying for investment quotas, etc.

Looking at the effect of firm performance measures on exit probabilities, we find that the impact of labour productivity is negative and statistically significant at the 1% level for all regressions. Similarly, the effects of the individual efficiency index and profit margin upon exit probabilities are also negative, and are statistically significant once again with the exception of SOEs and new firms. In general, we find that labour productivity is a better predictor of the hazard posed by exit, and this is true even when all three

performance measures are included. Our results suggest that a doubling of labour productivity tends to reduce firms' hazard rate by around 19%.

In estimating the effect of size on the exit hazard, our analysis suggests a significantly negative effect of both size (as measured by employment) and relative scale advantage in some regressions. On the one hand, this indicates that scale advantage and associated sunk costs play an important role in exit determination, while on the other hand also capturing the effect of resource reallocation costs associated with firms' exit in China where the capital market and labour market are underdeveloped, and the social security system has just begun to emerge. Capital intensity – which may also be associated with sunk costs - shows a negative effect upon hazard rates in our regression with interactive terms, indicating that the higher the capital intensity the lower the closure probability since 1992.

In estimating the impacts of financial constraints upon their exit probability, our proxy for this effect, the interest ratio, appears to have different effects upon SOEs and non-SOEs. While for COEs, small enterprises and newly-established enterprises, this effect is positive and significant at 10% level for COEs, for SOEs it is negative though not statistically significant, and this negative effect seems to have increased since 1992. This suggests that SOEs are still facing soft budget constraints.

As to whether the acceleration of reforms since 1992 has had any impacts upon firms' exit hazard, by using a reform period Dummy (P92) and by interacting firm-level factors with P92, our analysis suggests that reform since 1992 has generally increased hazard rates especially among SOEs, with the signs of coefficients for the firm-level variables and the signs the corresponding interactive terms generally taking opposite signs.

Other industrial and macroeconomic factors have also played an important role in shaping firm closure in China. Our analysis suggests that industry growth has a significant negative effect on the hazard posed, while the three digit industry concentration ratio at city level and GDP growth both have significant positive effects.

**Table 4 Estimated Hazard Functions for Enterprises in Liao Ning Province 1987-96: Semi-Parametric Estimation with Interactive Terms**

	(1) Whole Sample		(2) SOE		(3) COE		(4) Small Enterprises		(5) New Enterprises	
	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z	Coef.	P>z
COE	0.295***	0.01					0.296***	0.01	0.377*	0.07
foreign	-0.877**	0.04					-0.743*	0.08	-0.632	0.17
other	0.166	0.57					0.234	0.44	0.854***	0.01
AGE	-0.243***	0.00	0.008	0.95	-0.258***	0.00	-0.240***	0.00	0.086	0.19
Efficiency Index	-0.543*	0.06	-3.906**	0.04	-0.463*	0.08	-0.550*	0.06	-1.086**	0.03
Efficiency Index *P92	0.384	0.23	2.904	0.15	0.309	0.34	0.398	0.22	0.847	0.11
Ln(Productivity)	-0.300***	0.00	-0.394	0.15	-0.311***	0.00	-0.296***	0.00	-0.116	0.13
Ln(Productivity) * P92	0.157***	0.00	0.184	0.54	0.175***	0.00	0.153***	0.00	0.017	0.82
Profit Margin	-0.009	0.54	0.022	0.97	-0.009	0.54	-0.010	0.51	-0.011	0.51
Profit Margin * P92	0.002	0.91	-0.049	0.94	0.002	0.91	0.002	0.88	0.006	0.74
Ln(Capital/MES)	-0.013	0.57	-0.254*	0.06	-0.004	0.86	-0.009	0.72	-0.044	0.27
Ln(Capital/MES) *P92	0.032	0.18	0.255*	0.06	0.019	0.45	0.027	0.27	0.043	0.27
Ln(Employment)	-0.330***	0.00	-0.322	0.12	-0.301***	0.00	-0.321***	0.00	-0.369***	0.00
Ln(Employment) *P92	0.133***	0.00	0.078	0.70	0.107***	0.01	0.126***	0.00	0.179**	0.02
Unproductive Capital Ratio	-0.111	0.58	-1.542	0.22	-0.053	0.79	-0.096	0.63	-0.653*	0.07
Unproductive Capital Ratio *P92	0.160	0.46	1.633	0.22	0.101	0.65	0.146	0.50	0.578	0.13
Interest Ratio	0.049	0.38	-0.065	0.79	0.053	0.33	0.050	0.37	0.051	0.52
Interest Ratio*P92	0.032	0.60	-0.251	0.68	0.029	0.63	0.031	0.61	0.016	0.85
Capital Intensity	0.018***	0.00	0.016***	0.00	0.021***	0.00	0.018***	0.00	0.021***	0.00
Capital Intensity *P92	-1.845***	0.00	-1.587***	0.03	-2.181***	0.00	-1.849***	0.00	-2.178***	0.00
Industry Growth	-3.043***	0.00	-4.132**	0.02	-2.845***	0.00	-3.026***	0.00	-4.460***	0.00
Concentration	0.640***	0.00	1.170*	0.07	0.615***	0.00	0.616***	0.00	0.777***	0.00
GDP Growth	0.061***	0.00	0.093***	0.01	0.056***	0.00	0.061***	0.00	0.084***	0.00
No. of Obs	11776		1335		10124		11167		4200	
Log-Likelihood	-11043.85		-419.14		-10100.28		-10886.71		-5502.39	
LR Chi(2)	788.53		91.02		631.84		711.54		340.02	

Note: \*\*\* Significant at the 1 per cent level. \*\* Significant at the 5 per cent level. \*Significant at the 10 per cent level.

## **6 Conclusions**

This paper has argued that the competitive selection process in China is likely to be increasingly important for two main reasons. First, as the agricultural sector as a source of surplus labor begins to decline, the release of resources for the continuing growth of manufacturing may have to come from elsewhere and increasingly from the exit of relatively inefficient enterprises. Second, the peculiarities of the reform process in China place additional emphasis on the role of competition (and probably for small firms in particular) as a substitute for more traditional forms of corporate governance. Accordingly the paper provides an empirical examination of this competitive selection process in an important sector of Chinese manufacturing, looking in particular at the hazard posed by firm closure, and for changes resulting from the latest stage of reforms, namely the transition to the 'socialist market economy'.

Our analysis suggests that for small firms and COEs, the competitive selection process operates much as we would expect it to in a private market economy. The study also suggests that it is insufficient to analyze the competitive process from the point of view of new firm entry and incumbent firm growth alone. Indeed the substantial rate of 'churning' of enterprises that we observe in this sector means that a study of exit is just as important as that of entry for output and productivity growth. Moreover this rate of churn (for both entry and exit) appears to have increased substantially in the latest phase of reform. Our estimates from a hazard model of exit probabilities suggest that exits do contribute to efficiency within the small firm/COE sector since performance indicators serve as useful predictors of rates of industrial exit. However we do not find evidence that profits or efficiency indices are any better predictors of exit as a result of the latest reforms for firms with this ownership structure.

On the other hand, our analysis indicates a largely different story for SOEs: conventional enterprise performance measures are not good predictors of their demise and we find no conclusive evidence that things have changed since 1992. While their role in the economy

is declining as other sectors have established faster growth rates, their continuing privileged status does not yet appear to have come under serious threat. Consequently, we do not as yet find that competitive selection is providing a sufficiently important substitute for corporate governance mechanisms based on ownership and monitoring of management. This may well represent a considerable challenge for economic policy in the future.

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