Iran. Econ. Rev. Vol.18, No.3, 2014.

Life Duration of New Firms in Iranian Manufacturing Industries Using Cox Proportional Hazard Model

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Received: 2014/10/05 Accepted: 2014/12/19

Abstract

In this paper, the Cox proportional hazard model is used to answer several questions. In general, fourteen variables are applied in four groups: firm, industry, expenditure human resources specific characteristics as well. According to the previous literature in this field, the findings of this paper also show that the factors which affect life duration of firms are different between industries. Summing up, the life duration of manufacturing firm in Iran are positively affected by start-up size, profitability, efficiency, concentration rate, minimum efficient scale, industry growth rate, investment, advertising and education expenditure as well as labor force skills. While, entry rate of firms affect the life duration of firms, inversely. In term of policy, the findings of this paper confirm the importance of industry on the firm's life duration and the necessity of paying more attention to this variable.

Keywords: Cox Hazard Function, Life Duration, Manufacturing Industries of Iran, New Firms.

1- Introduction

The combination of agriculture, industry and services and development level of these sectors can be considered as the appearance of national development level in each economy. Therefore, various indices are used to investigate each economic sector and in this manner, the entry of new firms into

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economy can be considered as dynamic of economy and therefore economic development. Nevertheless, the entry of new firms is not single factor of economic growth but, the survival of firms after entry is also very important. Therefore, the life duration of firms in each sector is a basic index to investigate the position of economic sectors.

Although, the firms life duration is focused in foreign studies frequently but, this subject is examined in few studies in Iran especially in the case of manufacturing industries. Accordingly and in line with Feizpour and Hajikhdazadeh (2013), this research attempts to investigate the life duration of new firms in Iranian manufacturing industries. In this regard, the rest of this paper is organized in five sections as follows: after the introduction, section 2 discusses theoretical and empirical aspects of firm life duration. Section 3 introduces the variables that affect the survival of the new firms and presented the research methodology. The estimated results are explained in section 4. The final section is allocated to the conclusions and policy recommendations.

2- New-Firm Life Duration: Literature Review

Feizpour and HajiKhodazadeh (2013) in the study entitled "Life Duration of New Firms and Its Determinants" presented the evidences from food products and beverages industries during second, third and fourth development plans in Iran. They have reviewed the previous studies in the field of life duration of new firms. Similarly, Evans (1987) showed there is a significant relationship between firm survival and two characteristics, the firm start-up size and firm age, so that the probability of firm′s survival increased with firm age and firm size. Also, in the Dunne et al. (1989) study, the firm age and firm size are considered as important determinants of firm′s life duration. The results of this study showed that the small firms in comparison to the large firms had a lower probability of survival. Whereas, Audretsch and Mahmood (1995) considered more variables to analyze the new firms survival and plants in U.S manufacturing industries. In addition to start-up size, they used ownership structure, price cost margins, industry growth rate, capital intensity of industry and innovation. In a more complete study, Mata and Portugal (1994) examined the Factors affecting the survival of new firms in both firm-specific and industry-specific characteristics. The results showed a significant positive effect of firm start-up size, profitability,

optimal size, concentration ratio and size of manufacturing industries plants on firm life duration in Portugal. In another study Audretsch et al. (1997) showed the debt structure affect survival rates negatively and startup size and capital intensity of firms are positively related to firm survival. Also, all of the coefficients of the industry specific characteristics debt structure, price-cost margin, growth rate and optimal size are statistically positive. However, Nenonen and Littunen (1998) in their study investigated the impacts of education levels and skills of employment on firm survival. They concluded the life duration of firms are increased with rising levels of education and skills of workers. Also and in line with this study Nystrom (2007) found a positive and significant relationship between life between industry profitability, industry growth, high concentration ratio, economics of scales and survival of firm in Sweden. Helmers and Rogers (2010) analyzed the survival of UK manufacturing. They used the number of registered innovations and trademark of firms and showed that about 14 percent of firms with more patent survived more and the life duration of firm have been affected by trademark about more than 5.15%.

In addition to these studies, Perez and Castillejo (2004) in a study entitled "Life Duration of Manufacturing Firms" examined the factors influencing the Life Duration of 2028 Spanish manufacturing firms during the period 1990 to 2000. To do this, they emphasized only on firm-specific characteristics such as start-up size, productivity and profitability. They used the Cox proportional hazard model and concluded that there is a significant positive correlation between firm survival and these factors. Saridakis et al. (2008) investigated the determinants of the survival of 622 small firms in England between 2001 and 2004. The concentration ratio, profitability, labor force gender and unemployment rate were the main explanatory variables that used in this study. The Cox proportional hazard model and log normal distribution used to estimate the life duration of firms. They found the positive relationship between survival of firms and the concentration ratio, profitability and unemployment and also showed that small firms in comparison to large firms are much less likely to survive.

In a recent research in this field, Halldin (2010) investigated how employee characteristics influence survival rates with a special focus on Sweden manufacturing industries during 1997-2008. He used the employee characteristics as determinant for survival rates and a Cox proportional hazard model used to find the influence of education,

labor force age and employer discrimination on the life duration of firms. The results of this study showed the labor force age is negatively related to firm survival and education levels affect survival rates positively. He used Becker (1957) model of employer discrimination and concluded the firms with higher shares of immigrants or women survive longer. Because, these groups, which are subject to discrimination, are only hired if it is possible to pay them lower. If these groups are paid lower wages, it becomes profitable to hire them that it can increase the competitiveness and life duration of firms.

Despite the increase of studies on factors affecting the life duration of firms, this topic due to the unavailability of data has been less considered in most developing countries. However, these studies have increased in recent years. For example, the study entitled "Entry, Survival and Growth of Manufacturing Firms in Ethiopia" which is performed by Shiferaw (2006) during 1996-2002 has used an establishment level panel data of manufacturing industries in Ethiopia covering all establishments that employ at least 10 persons. The variables of this study were start-up size of firm, productivity, capital intensity, industry growth, investment and advertising expenditures. Like most of these studies, he used the Cox proportional hazard model to estimate the impact of these factors on the Survival and Growth of Manufacturing Firms. According to the results of this study, the risk of exit of firm varies is inversely related to initial size, productivity, capital intensity, industry growth and advertising expenditures. Gunalp and Cilasun (2006) in other study in Turkey, as a developing country, determined the effective factors on the survival of firms during 1993 and 1999. They used a dynamic panel model and the variables such as entry rate, the industry optimal size, industry growth and advertising expenditures. They showed the industry optimal size, industry growth and advertising expenditures are positively related to the firm survival and only entry rate affect survival rates negatively. In addition to this study, Demirgil et al. (2010) presented another study entitled "Determinants of Firm Survival in Manufacturing Industry" in the manufacturing sector of Lakes Region in Turkey from 2003 to 2009 and classified their study variables base on three firm, industry

and environmental characteristics. While age and firm size were considered as firm characteristics, the optimal size of the industry and the industry growth rate formed industry features. However, the location of the firm represented the environmental characteristic. They used a Logistic Regression model and showed the significant positive relationship between life duration of firms and these factors.

Similar to previous studies, the factors affecting the life duration of new firms can be classified in five groups included: firm-specific characteristics, industry-specific characteristics, expenditures characteristics, Human and environmental features which are presented in Table 1.

Table1: The Expected and Observed Effects of Variables on the Life Duration of Firm

Variable / Characteristics	Variables	Expected Effect base on theory	Observed Effect base on Existing Studies
Firm-Specific characteristics	Start-up size	+	+
	Firm age	+	+
	Firm ownership	?	-
	Capital intensity	+	+
	Number of firms	?	+
Industry-Specific Characteristics	Entry rate	?	+,-
	Industry growth	+	+
	Optimal size	+	+
	Concentration Rate	+	+
	Economics of Scales	+	+
	profitability	?	+,-
Expenditures Characteristics	R&D Expenditures	-	-
	innovation	+	+
	Trademark	+	+
Human Characteristics C	Ratio of Women to Total Labor Force	-	-
	Education Level	+	+
	Skill level	+	+
Environmental Characteristics	Unemployment Rate	?	-
	Real interest rate	?	+
	wage	+	+
Current used models	Likelihood , OLS, Cox hazard model, Cox proportional hazard model, probit or logit models, panel data model		

The firm age (Evans(1987), Dunne et al.(1988), Audretsch and Mahmood (1995) and Demirgil et al. (2010)), ownership type (Dunne et al (1988), Audretsch and Mahmood (1995) and Mata and Portugal (1994)), firm size (Evans(1987), Dunne et al. (1988), Audretsch and Mahmood (1995), Mata and Portugal (1994), Audretsch et al. (1997), Segrra and Callejon (2002), Shiferaw (2006), Perez and Castillejo (2004) and Demirgil et al. (2010)), productivity (Perez and Castillejo (2004) and Shiferaw (2006)) and profitability (Perez and Castillejo (2004) and Saridakis et al. (2008)) are introduced as the most important firm characteristics in these studies. Concentration rate (Mata and Portugal (1994), Nystrom (2007) and Saridakis et al. (2008)), industry growth rate (Audretsch and Mahmood (1995), Mata and Portugal (1994), Segrra and Callejon (2002), Nystrom (2007) and Gunalp and Cilasun (2006)), entry rate (Audretsch et al. (1997), Segrra and Callejon (2002) and Demirgil et al. (2010)) and capital intensity (Audretsch and Mahmood (1995), Audretsch et al. (1997), Nystrom (2007) and Perez and Castillejo (2004)) are considered as major industrial features. However, advertising and R&D expenditures (Audretsch et al. (1997), Segrra and Callejon (2002), Shiferaw (2006) and Gunalp and Cilasun (2006)) are the expenditures characteristics and environmental characteristics (unemployment, The real discount rate, wage and place of firm) are used in Audretsch and Mahmood (1995) and Demirgil et al. (2010) studies. Also, human gender (Rosa and Hamilton (1996) and Saridakis et al. (2008)), level of education, skills and labor force age (Nenonen and Littunen, (1998) and Halldin (2010)) are some human characteristics.

Table 1 show the expected and observed influence of variables which affect the life duration of firms based on existing studies. As can be seen, the expected effects of variables are consistent with observed effects in the most of these studies and hence these variables can be used to estimate effects of factors on the life duration of new firms. In other words, the existing theories are able as well as to indicate the factors that influence the survival of the new firms. It should be noted that the studied period of new firms survival had varied from five years (refer to Evans (1987), Audretsch and Mahmood (1995), Mata and Portugal (1994), Segrra and Callejon (2002)) to 14 years (see Audretsch et al. (1997)). Also, in these

studies, different models are considered to examine the effective factor on life duration of new firms. In this study, the Cox Proportional Hazard Model is used to investigate the effective factors on life duration of new firms in Iranian manufacturing industries in line with most other studies such as Mata and Portugal (1994), Audretsch et al. (1997), Shiferaw (2006) and Perez and Castillejo (2004).

3- Methodology

3-1- The Variables and Their Calculations

In the most studies, the effective factors on survival of new firms have been divided into five categories namely the firm-specific characteristics, the industry-specific characteristics, the expenditure characteristics, the human characteristics and the environmental characteristics. However, in another perspective these factors can be classified into two categories, internal and external factors. While the first four characteristics can be considered as internal factors, the environmental characteristics are known as external factors. This study attempts to present the factors affecting the life duration of Iranian manufacturing firms based on the first division and previous studies with consider to data accessibility.

3-1-1- Firm-Specific Characteristics

Start-up Size: perhaps Start-up size is used almost in all existing studies as the main variable to determine the life duration of firms. This is because of many researchers are agree with the small and medium firms in comparison to the large firms. Nonetheless, almost all of the existing literature has shown that small firms than large firms had lower survival. Hence, it can be expected if the firms enter with larger size therefore can more survive. Evans (1987), Dunne et al. (1988), Audretsch and Mahmood (1995), Mata and Portugal (1994) in their studies showed that the life duration of firms is related to start-up size positively. It should be noted that, the log form of start-up size in instead of real size has been used in all of the industrial economic studies in order to reduce the skewness of start-up size distribution and becomes closer to the normal distribution. Therefore, start-up size of firms can be calculated as bellow:

$$SE = Ln\ (NE) \quad (1)$$

where, SE and NE denote start-up size and the number of employees respectively.

Price Cost Margin (PCM): The firm profitably can be considered as a performance criterion which is related to the firm behavior due to its structure. The profitability provides the basis for entrance the new firms and encourages the growth of existing firms and thus provides Changes in the life duration of firms. Hence it is expected with increasing the profitability the firm life duration increases. Also, Geroski (1995) found the positive relationship between firm profitability and its life duration. Accordingly, in this study, the profitability is calculated as Equation 2:

$$PMC = \frac{Value\ Added - Wages\ and\ Salaries\ Paid\ Annually}{Output\ Value} \quad (2)$$

Efficiency: Based on the performed studies on the life duration of firms, efficiency is a fundamental variable that influence the performance of firms. Many studies have tried to estimate the efficiency. The Data Envelopment Analysis (DEA) is one of the most widely used methods in these studies. This method, in addition to measurement of efficiency, presents the type of returns to scale for each firm. Accordingly, the firms that produce base on minimum cost principle are located on isoquant production function and therefore their efficiency is equal to 100 percent. Also, DEA is most popular method because of it can determine the productivity component. This method is not limit to the use of data and inputs. The pre-assumption is no need to estimate the efficiency. Another advantage, this method is not sensitive to the unit of the outputs and inputs. The measurement of efficiency according two approaches, minimizing the inputs and to maximizing the outputs, are based on two assumptions, constant returns to scale (CRS) and variable returns to scale (VRS). It should be considered that CRS assumes that producers are scale efficient but, in the real conditions and because of existence the competition effects, not all producers are operating at optimum scale. Hence, in this study DEA model is calculated base on the first approach and under assumptions of VRS.

Capital intensity: The manufacturing firms in term of production technique can be divided into two groups, capital intensive and labor

intensive. According to the previous studies, the capital intensity has a positive impact on the life duration of firms (For example, Audretsch et al. (1997) and Nystrom (2007)).

In this study, the ratio of capital to labor capital has defined to measurement the capital intensity and according to camps (2006) the equation (3) is used to estimate the capital of firms.

$$K_t = (1-\delta)^t \overline{K} + \sum_{i=0}^{t-1} (1-\delta)^i " I_{t-(i+1)} \quad (3)$$

where, δ denotes the depreciation rate. The $\overline{K}$ represents the amount of initial capital and I_t is investment in per year.

3-1-2- Industry- Specific Characteristics

Concentration rate: The concentration rate is used to determine the market structure in the empirical studies. To realize the kind of market structure can be considered two important points, the number of active firms in the market and the international market distribution business. It is expected that when the number of firms is fewer and a market is occupied by a large number of firms market hence the market structure is closer to monopoly. Therefore, the life duration of firms increases with increase of concentration ratio. This subject is observable in numerous studies (for example see Audretsch et al. (1997) and Nystrom (2007)). Among the various indices that can be used to calculate the concentration rate (firm Concentration Ratio (CR), 'Herfindahl-Hirschman Index (HHI), Hannah and kay index, the entropy index, etc.), the HHI is used in this study. It is calculated by squaring the market share of each firm competing in a market, and then summing the resulting numbers. The HHI number can range from close to zero to 10,000. It approaches zero when a market is occupied by a large number of firms of relatively equal size and reaches its maximum of 10,000 points when a market is controlled by a single firm. The HHI increases both as the number of firms in the market decreases and as the disparity in size between those firms increases. The HHI is expressed as Equation 4:

$$HHI = \sum_{i=1}^{N} S_i^2 = \sum \left(\frac{X_i}{X}\right)^2 \quad (4)$$

Optimal Size of the Industry: The life duration of firm can be considered as a function of the difference in firm size and the optimal size of industry that the firm operates in it. The entry rate to the industry is depended on the optimal size of industry, so that whatever the optimal size of industry is bigger, the industry would be more difficult to enter. Hence, it is expected that proximity the optimal firm′s size to the optimal size of industry increases the firm life duration. Mata and Portugal (1994) in their study showed the life duration of firm is related to the optimal size of the industry, positively. Therefore, the calculation of optimal size of the industry is important. However, the different methods have been presented for the estimation of optimal size of the industry in the economics literature. In this study, Comanor–Wilson (CW) index is used to evaluate the optimal size of the industry as Equation 5:

$$MES = \sum_{i=\frac{n}{2}}^{n} x_i \Big/ \frac{n}{2} \tag{5}$$

Industry Growth Rate: Economic policies and environmental conditions can encourage the growth of some industries or reduce the growth in other industries and hence, the firms in each of two groups may be have different life duration. The growth of industry provides better life duration for firms and in the other hand the decrease of industrial growth reduces it. Therefore, the firm′s life duration can be affected by industrial growth conditions and it can be expected that the firm′s duration increases with the growth rate of the industry. Mata and Portugal (1994) in their study showed that the survival of new firms is related to the industry growth rate positively. In this study, industrial growth rate is calculated by the Equation 6:

$$INDG = \frac{E - E(-1)}{E(-1)} \tag{6}$$

Entry Rate: The Life duration of existing firms can be affected by entry rate of new firms in the next period. In other words, the entry rate of new firms influences the survival of existing firms in the market and it is expected that the increase in the rate of entry of new firms reduces the life

duration of existing firms in the market. Dunne et al. (1988), Audretsch and Mahmood (1995), Mata and Portugal (1994) and Geroski et al. (2007) showed that the life duration of firms is affected by the entry rate of new firms inversely. It should be in this study, the entry rate is calculated by the ratio the number of new firms to the number of existing firms at 4-digit industry levels.

3-1-3- Expenditures Characteristics

Investment: Although the capital stock of firm affect the life duration of firm but investment as a flow variable, can always adapt the firm with the variable conditions in every time. Accordingly, in addition to capital intensity (as previously mentioned) the volume of investment affect the life duration of firm. Therefore, the different life duration is expected for firms with similar capital intensity and different investment volume. In addition to the capital intensity, the volume of investment variable is used as the positive effective factor on life duration (for example see Shiferaw (2006)).

Advertising Expenditures: Advertising is considered as an effort of firm or industry to sell or gain more market share. The main objective of advertising is economic profits. Advertising causes consumers to be more inclined towards the advertised products with changing consumer preferences. Advertising has two important effects on the performance of the market. First, it reduces the price elasticity of demand for the products of firms and thus decreases the price changes due to changes in the quantity of demand. Second, Advertising increases the customer loyalty via creating the brand or trademark and stick the firm name in the consumers' minds. Therefore, the advertising is considered as development strategy of firm and it is expected that the expansion of market as a result of advertising increases the life duration of firms. Therefore, there is positive and significant relationship between the advertising and life duration of firms. Audretsch et al. (1997), Segrra and Callejon (2002) in their studies found a positive relationship between advertising expenditures and the survival of the firms. In this study, the share of the advertising expenditures in inputs is used to calculate the advertising spending.

Expenditure on Research and Development (R&D): The life duration of firms can be depended on the type of goods which supply in the markets. Every goods has specific life duration after that it presented in the market.

Accordingly, the life duration of firms is synonymous with the life duration of generated goods. However, research and development expenditures can update the goods produced by the firm to influence the survival of firms. Hence it is expected that R&D expenditures have a positive impact on the life duration of firms. And this subject is considered in several studies such as Audretsch et al. (1997) and Demirgil et al. (2010). In this study, the share of the R&D expenditures in inputs is used similarly.

Education Expenditures: The education can affect the life duration of firms in different ways. The education increases the labor productivity which provides efficient use of resources and increases the profitability of firms. The increase of profitability affect the life duration of firms in the next stage positively. Hence, it is expected the spending on education increases the survival of firms. Accordingly, several studies examined the impact of education on life duration of firms. In this study, the share of the education expenditures in inputs of firms is used to assess the effect of education on their life duration.

3-1-4- Labor Force Characteristics

Labor Force Education Levels: The study of the effect of education on firm's life duration can be provided by analysis of labour combination in terms of education levels. While, education expenditures provide the basis for increase the firm's education level in different periods, the labor force knowledge level indicates the fitness of labor force with the subject of firm. Hence, it can be expected that the higher level of fitness increases the firm's survival. Demirgil et al. (2010) showed a positive relationship between labor force knowledge and the firm's life duration. In this paper the ratio of the number of higher educated labor force to total employed labor is used to evaluate the labour force education.

Labor Force Skills: Although, at the first glance, it may be is not visible the difference between levels of education and skills, but these two factors have a specific distinction. Skills can be introduced as proper use of tools and resources that may be is not related to the education levels. Therefore, people with high skills may be having low education levels. Hence, the effect of skill on firm's life duration is different from the impact of education in the same period. The share of skilled workers in the total labor force is

considered to evaluate the effect of Skills of Labor force on firm's life duration.

Gender of Labor Force: Although, at the first step, the impact of gender on firm's life duration is somewhat intangible but it is essential factor for the operating performance of the firm. However, according the previous studies the effect of gender on the firm's life duration is a dual impact. In perfect competition conditions, the amount of labor force is determined base on the share of labor force from marginal production value or $W=V.MP_L$. Accordingly, when the value of the marginal product of labor due to gender discrimination that caused by knowledge discrimination is different, the gender does not have effect on firm performance only when the wages is different. But when the wage is determined base on the minimum wage law – not the share of labor force in the marginal production value- it is expected that the firm performance is different. According to this, increase of the share of women in the labor force reduces the firm survival. In the other hand, firms with higher shares women survive longer if these groups are paid lower wages it becomes profitable to hire them. Thus, hire these discriminated groups resulting in more profitable firms which are more likely to grow and survive. Halldin (2010) has mentioned this subject. Accordingly, gender discrimination has a paradox impact on the firm performance. In this study, the share of women in total employment is used to investigate the effect of gender on manufacturing firm life duration.

3-2- Data and Their Characteristics

As previously noted, the industry sector has been considered as a basis of economic development in Iran. However, evidence indicates that the distribution of industrial sub-groups is highly heterogeneous and therefore industrial sector of Iran is mainly made up several parts. For example, in 2007, only about 60 percent of industrial firms of Iran have concentrated in four industries, 15, 17, 26 and 28. While about 40 percent of firms have formed the two industries, 15 and 26. It is also true about new manufacturing firms in Iran. For example, in 1995 (the first year of this study) about 25 percent from the total 606 new firms have entered in industry 15. However, the second and third positions have been located to the industries 26 and 17 in by 19 and 15 percents, respectively. These results are presented in Table 2

and figure 1. As can be seen, Figure 1 shows that numerous industries have only a very small proportion in new firms so 13 industries (37, 16, 32, 22, 30, 33, 35, 23, 18, 20, 27, 34, and 36) have included about 11 percent of total new firms.

However, to evaluate the effect of type of industry on the life duration of new firms only seven industries are considered into accounts which contain at least 4 percent of the firms. These seven industries are concluded about 80 percent of the new firms in the first year of study.

Table 2: The Number of Iranian Industrial New Firms in 1996

ISIC	Manufacturing activities	Number	Percent
15	Manufacture of food products and beverages	148	24.42
17	Manufacture of textiles	94	15.51
18	Manufacture of wearing apparel; dressing and dyeing of fur	8	1.32
19	Tanning and dressing of leather; manufacture of luggage, handbags, …	17	2.81
20	Manufacture of wood and of products of wood and cork, except furniture; …	9	1.49
21	Manufacture of paper and paper products	15	2.48
22	Publishing, printing and reproduction of recorded media	2	0.33
23	Manufacture of coke, refined petroleum products and nuclear fuel	5	0.83
24	Manufacture of chemicals and chemical products	36	5.94
25	Manufacture of rubber and plastics products	24	3.96
26	Manufacture of other non-metallic mineral products	115	18.98
27	Manufacture of basic metals	11	1.82
28	Manufacture of fabricated metal products, except machinery and equipment	34	5.61
29	Manufacture of machinery and equipment n.e.c.	39	6.44
30	Manufacture of office, accounting and computing machinery	2	0.33
31	Manufacture of electrical machinery and apparatus n.e.c.	14	2.31
32	Manufacture of radio, television and communication equipment and apparatus	1	0.17
33	Manufacture of medical, precision and optical instruments, watches and clocks	3	0.50
34	Manufacture of motor vehicles, trailers and semi-trailers	12	1.98
35	Manufacture of other transport equipment	5	0.83
36	Manufacture of furniture; manufacturing n.e.c.	12	1.98

Source: Calculated by Authors

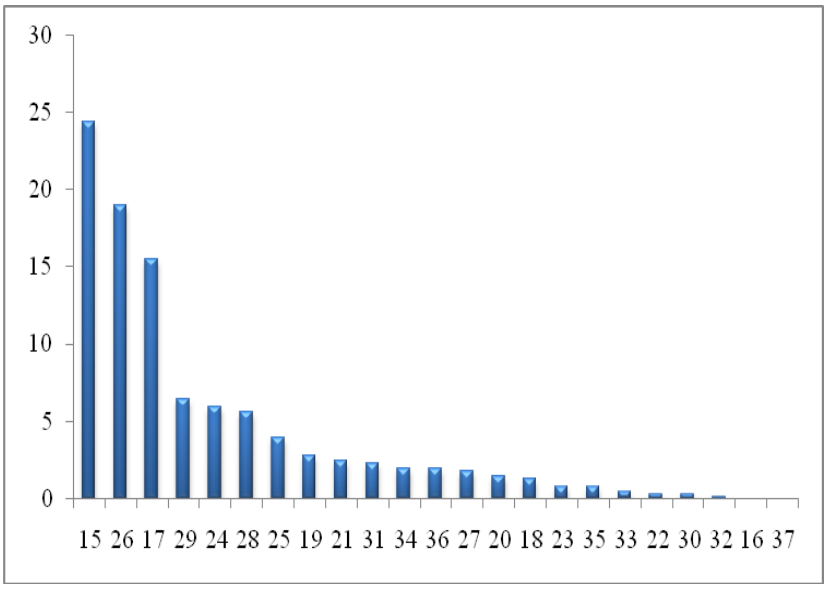

Figure 1: The Share Industries in Terms of New Entry Firms (1996)

It should be noted that the data used in this study have been collected by the Statistics Center of Iran (SCI) during 1996-2005 and used in this study for the first time. This sample contains 607 new firms. Also, the life duration of new firms can be defined in many different perspectives. For example, how should be considered the re-exit and re-entry of a firm in the market? The provisional exist of a firm should consider in life duration or not? In addition, this is possible that a firm changes its activity and continues in another industry. In this case, which could consider as life duration, the course of activity or the period of activity in an industry? However, in this study, only those firms are considered in the final analysis with following conditions:

1. The activity of firm should not be changed during the study period.
2. The activity of firm should not be changed after re-entry to the market.

The statistic characteristics of 15 variables are presented in Table 3.

Table 3: Descriptive Statistics of Variables

Characteristics	Variables	Average	Minimum	Maximum	St. Error	C.V
firm-Specific Characteristics	Start-up Size	68	10	1688	157.40	2.31
	profitability	20.35	0	29.17	1.85	0.09
	productivity	0.35	-0.20	7.30	0.27	0.78
	Capital Intensity	1.471	-7.66	242	5.59	3.80
Industry-Specific Characteristics	HHI Index	700	0	10000	0.09	1.38
	Optimal Size	217000	10	27000000	1490000	6.87
	Industry Growth	0.26	-0.83	9.98	0.34	1.31
	Entry Rate	0.03	0.00	0.67	0.04	1.68
Expenditures Characteristics	Investment	1720	-26400	2270000	41200	23.95
	Advertizing Expenditures	43.6	0	16100	391	8.97
	R&D Expenditures	8.04	0	1990	73	9.08
	Education Expenditures	29.2	0	10900	370	12.67
Human Characteristics	High Education	0.03	0	1	0.08	2.91
	Skill Level	0.45	0	1	0.29	0.64
	Gender	0.90	0	1	0.17	0.19

Source: Calculated by Authors

As can be seen, the average of the start-up size of firms in term of employment is 68 but it varied from 10 to 1688 employees. The Firms in term of productivity, profitability and capital intensity are different from each other. In addition, in the industry-self characteristics group there are also major distinctions between industries. For example, the structures of industries which new firms entered into them are very different and the growth rate levels of these industries are extended. Also, there are significant differences for new firms in term of expenditures characteristics that is visible in the third part of Table 2. For example, while the average of advertising expenditures is about 43,000 million Rials, this amount for some firms is about 16,100 million Rials. This is true for spending on research and education. Also, the significant differences are visible in terms of education,

skills and gender in the human characteristics groups. Summing up, the results of this section show that only about 3 percentage of labourforce have high education level in 1996 and about 45 percent of them have skills. While 90 percent of employees in these firms are male and the share of female is only 10 percent. Accordingly, Table 2 shows that the new firms are different in all 15 variables and hence, it is expected that the impact of these variables on the life duration of new firms is also diverse.

3-3- The Cox Proportional Hazards Model

Although, the Cox Proportional Hazard Model has been used in Biology and Health due to the availability of data needed for this model, however, the access to the required data with special characteristics in this model has been recently provided even in many developed countries. Hence, this model has been used even the most recent economic studies to explain economic phenomena that life duration is one of them. According to the author's knowledge of this study, the use of this model for explaining economic issues in Iran due to lack of access to the required data for this model is not very common.

In order to analyze the life duration of firms, following the information is needed about the firm characteristics over time. Therefore, a key analytical problem called "censoring" is inevitable and application of conventional statistical models is not good in the most survival analyses. This means that to analyze the factors affecting survival of firms over the period of study, it is possible that some of firms leave out. In essence, censoring occurs when there is some information about life duration of firm, but there is not information about the survival time of firm exactly. If a firm is lost to follow-up after study end, the time of event is not observed because it happened after the study period. This subject is right-censored. Suppose a firm had an event before the study start but the exact time of the event is unknown because the event happened to the left of study period on the time line. This subject is left-censored. Suppose a subject had an event between the study start and study end period (exact time unknown) this subject is interval-censored (Fig. 2).

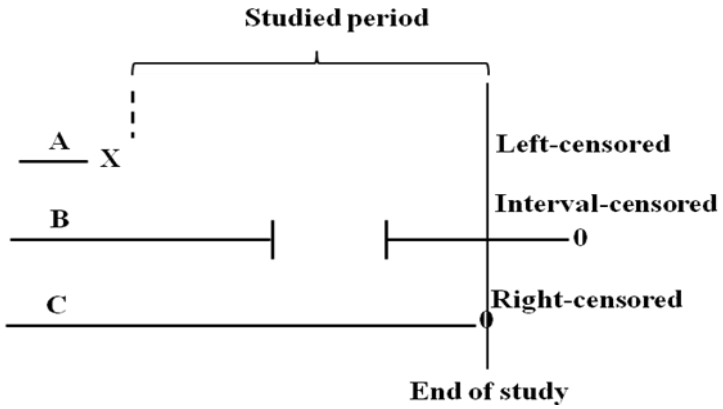

Figure 2: Types of Variables Censorship

Using the censored data causes a bias in the estimation of conventional models and therefore leads to the unreliable results. To solve the above problems, one of the main types of semi-nonparametric models for survival analysis has been presented by Cox in 1972. It is assumed that the semi-parametric hazard function is function of the explanatory variables and time that is called Cox proportional hazard model. Accordingly, despite the different models such as maximum likelihood, ordinary least squares, Cox hazard model, Cox proportional hazard model, probit, logit models and panel data, in line with most studies, the semi-parametric Cox proportional hazard model is used to estimate the impact of factors affecting the survival of Iranian new firms. Cox model is superior to the logit and probit models that use one and zero to determining the occurrence or non-occurrence of an event. In addition, unlike the Cox model, these models do not consider the time of event occurrence. The hazard function h(t) depicting the instantaneous escape rate from operation, may be written:

$$h(t) = \lim_{\Delta t \to 0} + \frac{P(t \le T \le t + \Delta t | T \ge t)}{\Delta t} = \frac{f(t)}{s(t)} \qquad (7)$$

where T is the firm′s life duration, f(t) is the probability density function and S(t) is the survival function. Associated with the hazard rate is the notion of duration dependence. Positive (negative) duration dependence implies that the hazard rate increase (decrease) with time, that is $\frac{dh(t)}{dt} > 0 (\frac{dh(t)}{dt} < 0)$.

The general form of Cox proportional hazard (PH) model is introduced as equation ():

$$Lnh(t) = Lnh_0(t) + X\beta$$

where h0(t) is the baseline hazard function, X is a vector of explanatory variables and β is a vector of parameters. STATA program is one of the most popular programs that have been designed for estimating the factors affecting the life duration of firms. The CPH model is presented as bellow:

$$h(t, X) = h_0(t)\exp(\sum_{i=1}^{p}\beta_i x_i$$

The CPH model formula says that the hazard at time t is the product of two quantities. The first of these, h0(t), is called the baseline hazard function. The second quantity is the exponential expression e to the linear sum of βi Xi, where the sum is over the p explanatory X variables. An important feature of this formula, which concerns the proportional hazards (PH) assumption, is that the baseline hazard is a function of t, but does not involve the X's. In contrast, the exponential expression shown here, involves the X's, but does not involve t. The X's here are called time-independent X's. It is possible, nevertheless, to consider X's which do involve t. Such X's are called time-dependent variables. If time-dependent variables are considered, the Cox model form may still be used, but such a model no longer satisfies the PH assumption, and is called the extended Cox model.

4- Estimation of Model and Results

As mentioned before, 15 variables have been used to investigate the factors affecting the survival of firms which ranked in four groups, firm-specific characteristics, industry-specific characteristics, expenditures features and characteristics of human resources. The start-up firm size, profitability, productivity and capital intensity are the firm characteristics in this study. Also, the industry-specific characteristics is included the concentration rate, the optimal size of the industry, Industry growth rate and entrance rate of firms to the industry. The expenditure characteristics are consists of investment, advertising, R&D and the education of labor force expenditures. In addition, three variables, education, labor force skills and gender characteristics are the aspects of human resources characteristics. It should be noted, the proposed method by kamps (2004) has been used to estimate the capital intensity of firm. However, the results of estimating the investment of firms using this method is not compatible with realities of manufacturing industries in Iran and hence, this method has not used in the final estimation. Therefore, 14 variables has considered in the final estimation. The results of Model are presented in Table 4.

Table 4: The Results of Estimation

Variable	Total	15	17	19	21	25	26	27	29
SE	-0.513*** (0.108)	-1.14*** (0.315)	-	-3.25*** (0.818)	-0.43* (0.346)	-1.18** (0.557)	-0.94*** (0.314)	-	-
PCM	-0.095*** (0.033)	-0.071* (0.042)	-0.52*** (0.103)	-	-	-	-0.219* (0.131)	-	-
EFF	-0.305*** (0.119)	-	-	-	-	-	-0.36*** (0.066)	-	-
HHI	-1.165** (0.565)	-	-16.26*** (5.232)	-	-	-16.64*** (5.043)	-	-15.29*** (3.722)	-2.64** (1.171)
CW	-0.0015* (0.0009)	-	-	-	-	-	-	-0.0001* (0.00006)	-
INDG	-0.497** (0.244)	-	-	-	-	-4.148* (2.469)	-1.365* (0.755)	-4.171* (2.468)	-
ER	2.213* (1.227)	-	15.937* (9.601)	64.62** (28.905)	41.265* (23.815)	-	-	-	-
INV	-0.061*** (0.015)	-0.053* (0.032)	-0.083* (0.046)	-	-0.14*** (0.057)	-0.117* (0.069)	-	-0.75*** (0.165)	-0.097** (0.053)
ADV	-0.014* (0.008)	-0.028* (0.015)	-	-	-	-	-	-	-0.058** (0.029)
R&D	-1.059 (1.116)	-	-	-	-	-	-	-	-
EDUEXP	-0.064** (0.029)	-	-0.176** (0.076)	-	-	-0.148* (0.089)	-	-	-0.181** (0.082)
HEDU	-1.831*** (0.22)		-1.236** (0.492)	-	-	-	-	-	-
SKILL	-1.594*** (0.207)	-	-	-	-	-	-	-	-
GEN	-0.334 [-1.35] (0.249)	-1.16*** (0.439)	1.39** (0.614)	-6.27*** (1.356)	-	-	-	-	-

Note: values in () are standard error and *, **, *** indicate the 10%, 5% and 1% significance levels respectively. Source: Calculated by Authors

As can be seen, the life duration of Iranian manufacturing firms has been affected from 12 variables significantly. While the start-up size, profitability and productivity as the firm-specific characteristics have affected the life duration of Iranian manufacturing firms significantly. On the other hand, this true for some of industry-specific characteristics included concentration rate, the optimal size, growth rate and the rate of entry into the industry. Also, the survival of firms has been affected by the education and skills of employees as well as the amount of investment, advertising and education spending variables as the expenditures characteristics. This is considerable that coefficient signs of all variables are compatible with the results of previous empirical studies and literature. The results of this show that there are the positive and significant relationship between the start-up size, profitability and productivity of firms, concentration rate and the optimal size of the industry, the advertising expenditures, education and skills level of labor force. But, only the entrance rate of firms is negatively related to the life duration of Iranian manufacturing firms. This means that the life duration of firms has reduced by increase of the entrance rate of firms in the industry.

5- Conclusions and Policy Recommendations

Although, based on the existing literature, the life duration of firms is affected by various factors but, this subject about the Iranian manufacturing firms has investigated by 15 variables, classified into four groups (firm characteristics, industry, money, manpower) in this study. Accordingly, as the most important result, the life duration of firms, could be evaluated with consider to these factors and their severity. Therefore, the life duration of firms is not a random variable and this variable could be affected by some variables significantly. Whereas, these factors could be strongly influenced by the industry in which the firm is active. Hence, from a policy perspective, the following issues could be considered in this context:

Consistent with previous studies, this study has also shown that the start-up size of the firm is the most important factor between other firm characteristics factors, so the life duration of firms is affected by the start-up size positively. This means that small firms had shorter life duration. However, the recent policies has focused on the development of small and medium firms and hence, these policies cannot attach to the expected results,

that the creation of employment opportunities is an important purpose of those, regardless of life duration of new firms.

The productivity and profitability are other variables affecting the life duration of firms and this means that a new firm can only achieve to reasonable life duration when increase its productivity, profitability. Accordingly and in terms of policy, it cannot be expected a long life duration especially for small firms.

Based on the findings of this study, entrance rate is the most important characteristics of the industry and consistent to the previous studies, it has affected the life duration of Iranian manufacturing firms negatively. However, the industry concentration ratio, growth and the optimal size of the industry had significant and positive effect on survival of firms in line with previous studies. Therefore, all of the decisions and policies that affect the industry performance (e.g., tax policies, tariff rates and transitive payments) could be affected the life duration of manufacturing firms.

Also, the education spending, investment, and advertising expenditures have influenced the survival of firms positively and significantly. However, based on the findings of this study, the effect of education expenditures on the life duration of Iranian manufacturing firms is more than the impact of advertising and investment expenditures. It is also about education and skill levels of employees and the increase of these factors has increased the survival of firms significantly. Summing up, the empirical of this study support the non-monetary policies to increase the life duration of firms whereas, the monetary policies has emphasized in recent years.

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