Industrial Effects and Firm's Survival (Case Study: Iran- East Azarbaijan Province)

Ghaffar Tari

Abstract—The aim of this paper is to investigate the effect of mean size of industry on survival of new firms in East-Azarbaijan province through 1981-2006 using hazard function. So the effect of two variables including mean employment of industry and mean capital of industry are investigated on firm's survival. The Industry & Mine Ministry database has used for data gathering and the data are analyzed using the semi-parametric cox regression model. The results of this study shows that there is a meaningful negative relationship between mean capital of industry and firm's survival, but the mean employment of industry has no meaningful effect on survival of new firms.

Keywords— Firm's Survival, Hazard Function, Mean Capital of Industry, Mean Employment of Industry.

I. INTRODUCTION

TODAY in all countries small and medium firms have an important role from the various social aspects, manufacturing, and service providing. In some countries these industries are the major providers of employment, basis of change and innovation, and pioneer in creating of new technologies. These industries with considerable export have an important role on economic growth of their countries [1]. However, some developed countries as U.S. were inattentive to small businesses up to 1980's because of special Fordism perspective ruling on their industrial development policies, but plenty of countries whose small and medium businesses had a considerable role on their industrial structure, since last few decades, have made supportive policies about this part of industries.

In addition to small and medium firms' entry importance, the study of these firms' survival and factors affecting it can be considered to be of greater significance in terms of meeting long-term policy objectives related to employment and growth of the economy. Over the past two decades considerable work has been undertaken on the post-entry performance of new firms in U.S. and Europe,(see, for example, [5], [29]), however, to date there has been a paucity of work about survival of SME's in Iran.

In spite of considerable quantitative presence of small and medium firms in Iran, these businesses have confronted with many difficulties, due to the policies which had made without considering their scale. Therefore, they were unable to play the expected role as in developed and developing countries. In this paper we study the effects of industry's mean size on survival

Gh. Tari, Department of Management, Marand Branch, Islamic Azad University, Marand, Iran (Phone: +989144173448; gh_tari@marandiau.ac.ir)

of new firms established in Iran- East Azarbaijan province through 1981-2006 using hazard function

II. THEORETICAL BACKGROUND

A number of studies have been undertaken on industry dynamics or about the process by which new firms survive and grow, or else exit from the industry. A new literature has emerged in the last few years, which focuses on the question, "what happens to new firms subsequent to their entry?", both in terms of their likelihood of survival and their growth patterns. Most of the studies have used the theory of "organizational ecology" by Hannan and Freeman [22], which emphasizes organizational characteristics and environmental conditions; particularly the number of employees and invested capital. There has also been a similar argument about the influence of firm specific characteristics on their survival by Audretsch [2] using the 'industrial organization theory". For example, a greater start-up size of the firm increases the likelihood of survival, since the greater the size, the less it will need to grow in order to exhaust potential scale economies and ultimate survival. Both a positive relationship between firm size and post-entry growth rates have been found in the United States [21], [19], [3], [5], the United Kingdom [18], Portugal[29], [30], Germany[32], [28] and Canada[8]. In addition other studies [17] show that firm-specific factors such as capital intensity and the use of advanced technologies have affected the firms' survival.

Jovanovic [25] suggests in theory of "learning by doing" that the firms which aren't able for successful learning and adoption, will force to exit from the industry. So the new firms in industries which are capital intensive and the scale economies have an important role, will have low survival rate. Dixit [15] and Hoppenhayan [24] argue that new-firm survival will be influenced by the amount of sunk costs in the industry. A greater degree of sunk cost should reduce the likelihood of exit and lead to lower observed growth rates for surviving firms.

Audretcsh [2] suggest that the post entry performance of firms will be influenced by the degree of scale economies in an industry. Empirical evidence for the United States [3], [5], United Kingdom [18], Portugal [29], and Germany [32] supports the theory that the likelihood of survival tends to be lower in industries characterized by a greater degree of scale economies.

According to view of scholars who focuses on initial resources, the entrepreneurial and firm initiating process is one in which the entrepreneurs acquire and develop resources. In

this perspective the new venture outcome is to a large extent determined by the nature of the resources the entrepreneurs are able to acquire [16]. As suggested by Boeker [11], [12] and Bamford et al.[9], early decisions and founding conditions, in the formative stages of an organization, have lasting effects which imprint the firm, limit its strategic choice, and continue to impact its long-term performance.

Kato found firms which invest on research and development and have more innovation have more survival chance [26]. Cefis & Marsili found that despite the relationship between innovation and firm's survival, there are little empirical evidence about the relationship between survival probability and innovative activities [13].

The study of small and medium firm's survival and the affecting factors are important because of some reasons such as:

1. Small and medium firms are the major means by which unemployment might be constrained or reduced [23].

2. The SMEs perform an equilibrating function in the market, in that the levels of profitability and price should be restored to their long-run competitive levels [7].

3. Entry of small and medium firms is the mechanism by which profits in excess of the long-run equilibrium are eroded [31].

4. Manufacturing economies through formation of small and medium firms adjusts their specification over time towards more competitive products [23].

5. The SMEs are an important counterbalance to contraction and closure.

In this paper we assumed that industry's mean size affect the new firms' survival. So we hypothesized as below:

H1. The mean employment of the industry has effect on survival of new small and medium firms.

H2. The mean capital of the industry has effect on survival of new small and medium firms.

III. Variables

Duration (Survival): It is the dependent variable of this study that is measured by the active duration of a firm (The interval between entry and exit of the firm).

Mean size of Industry: It is the independent variable of this study. This variable is measured by two criteria including mean employment of the industry (Memp) and mean capital of the industry (Mcapital). The amounts of these two criteria have calculated for each industry in East Azarbaijan province and are seen in table I.

IV. Methodology

In order to investigate factors affecting the firm survival, it is necessary to examine data concerning the duration of the life of a firm [23]. As Audretsch and Mata in [6] note, "in order to analyze the post-entry performance of firms, a large longitudinal database to track firms subsequent to their entry is needed". Event-history data analysis is usually used to study survival [10]. In this paper, the hazard function is used for analysis, using the event-history data analysis approach.

TABLE I
VARIABLES AND THEIR AMOUNTS

ISIC	Industry	Mcapital	Memp
15	Food	4232.37	14.57
17	Textile	667.94	8.54
18	Apparel	163.35	10.14
19	Leather	969.85	11.96
20	Wood	808.12	7.97
21	Pulp and Paper	967.14	6.7
22	Publishing	4901.96	8.22
23	Petroleum	6199.61	12.3
24	Chemicals	1952.05	9.72
25	Rubber and Plastics	1104.46	5.76
26	Mineral Products	1849.02	13.34
27	Basic Metals	3568.61	10.93
28	Metal Products	1231.53	7.46
29	Machinery	674.27	7.75
30	Computers	529.52	5.7
31	Electrical equipment	565.71	8.8
32	Telecommunications	981.8	7.23
33	Instruments	484.84	6.85
34	Automobile	863.27	8.74
35	Other Transportation	847.52	9.56
36	Other Manufacturing	485.14	7.93
37	Recycling	284.4	4.4

The hazard function, also known as the failure rate, intensity function, or hazard rate, is defined mathematically as:

$$h(t) = \lim_{\substack{\Delta t \to 0 \\ \Delta t > 0}} \frac{1}{\Delta t} [t \le T < t + \Delta t \mid T \ge t] \quad (1)$$

The hazard function represents the instantaneous probability that an event occurs in the small interval from duration t to time t + Δt, provided that the event has not yet occurred before the beginning of this interval. The hazard rate is the instantaneous "event rate" at time t.

Some previous studies such as [3], [5], [19], [20], do not offer a parametric distribution model for durations in their analysis. Kiefer [27] says the exponential distribution is widely used as a model for duration analysis because it is "simple to work with and to interpret, and is often an adequate model for durations that do not exhibit much variation". He also suggests the use of Weibull and log-logistic distributions. The log-normal distribution is applicable for describing the growth of firms that follow Gibrat's Law of Proportional Effect. In this paper we used the semi-parametric method of proportional hazard for hypothesis test. This model which has suggested by Cox [14] is defined as:

$$r(t) = h(t) \exp(A(t)\alpha) \quad (2)$$

The transition rate, *r(t)*, is product of an unspecified baseline rate, *h(t)*, and a second term specifying the possible influences of a covariate vector *A(t)* on the transition rate. The implementation of the Cox model in TDA is based on the following model formulation:

$$r_{jk}(t) = h_{jk}(t) \exp\left\{ A^{(jk)}(t)\alpha^{(jk)} \right\} \quad (3)$$

$r_{jk}(t)$ is the transition rate at time t for the transition from origin state j to destination state k. $h_{jk}(t)$ is the unspecified baseline rate for the same transition. $A^{(jk)}(t)$ is a (row) vector of covariates, specified for the transition (j,k), and $\alpha^{(jk)}$ is a vector of associated coefficients. The covariates may have time-dependent values [10].

V. DATA

In this paper we used the Iran Industry and Mine Ministry dataset (IMM) to recognize small and medium firms that have established through 1981-2006 in East-Azarbaijan province. Total number of firms established in this period was 6500 firms. At the end of survey period (2006) 6197 firms were still alive while 303 firms were exited from the industry. The number of 600 firms is sampled using the method of categorized sampling method.

First exploratory information about data processed by TDA software is seen in table 2. The first row shows the number of firms that the transition isn't done yet (censored observations) and the second row presents the firms that changed their origin situation (exit from the industry). So from the 600 firms the number of 571 firms was alive at the time of observation and 29 firms were dead. The mean duration of existing firms is 78 months and for dead firms is 67 months. TS and TF presents the earliest start time and the latest finish time respectively in terms of month. The latest finish time on first group is 304 month and on second group is 249 month.

TABLE II
FIRST EXPLORATORY INFORMATION ABOUT DATA

edef (...)							
Definition: org=ORG, des=DES, ts=TS, tf=TF							
SN	Org	Des	Episodes	Weighted	Mean Duration	TS Min	TF Max	Excl
1	0	0	571	571.00	78.41	0.00	304.00	-
1	0	1	29	29.00	66.88	0.00	249.27	-
	Sum		600	600.00				
Number of episodes: 600								

The nonparametric descriptive methods are used to describe the selected data. Because these methods do not make any assumption about the distribution of the process, they are particularly suited for first exploratory analyses. There are two methods, life tables and Kaplan-Meier (product- limit) estimator. Both of these methods are helpful for graphical presentations of the survivor function (and their transformations) as well as the transition rate [10]. In this paper the product- limit estimator is used. This method, compared with life table method has the advantage that the researcher doesn't have to define discrete time intervals. The product- limit estimator is based on the calculation of a risk set at every point in time where at least one event occurred [10].

If the survivor function is plotted against the duration, it will be more understandable. This plot that is plotted with the TDA for product- limit estimator is seen in Fig. 1. The plot of the survivor function shows estimates of the proportions of firms that have not yet changed their state up to a specific point in time.
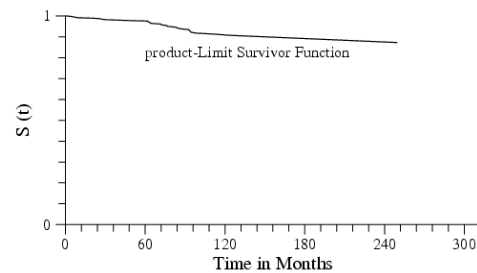

Fig. 1 Product –limit (Kaplan-Meier) survivor function

As seen in the Fig. 1 the exit of firms has a very slow trend as at the 5th year about 96 percent of firms are still active, and after 21 year (250 month) about 87 percent of firms are still active.

VI. RESULTS

TABLE III
THE RESULTS OF COX REGRESSION ESTIMATION

Idx	SN	Org	Des	MT	Variable	Coeff	Error	C/Error	Signif
1	1	0	1	A	MEmp	-0.0975	0.0864	-1.1280	0.7407
2	1	0	1	A	MCapital	0.0003	0.0002	2.2981	0.9784
Log likelihood (starting values): -718.5157									
Log likelihood (final estimates): -673.0195									

The results of Cox regression estimation is seen in table III.According to the estimations in table II the correlation coefficient between mean employment of industry (MEmp) covariate and dependent variable is -0.0975, and it shows that there is a negative relationship between mean employment of industry and SME's hazard rates. As the hazard rate is the supplementary of the survival rate, so it is concluded that there is a direct relationship between mean employment of industry and survival of small and medium firms. Also the significance coefficient calculated for this covariate is 0.7407. It should be noted that TDA displays the probability that the parameter is different from zero, that is, accepting a significance level of 0.05 requires a look for values that are greater than 0.95. So regarding to the estimated significance (0.7407) it is concluded that at level of 0.05 there is'not a meaningful relationship between mean employment of industry and survival, so the first hypothesis is rejected.

Also the estimated correlation coefficient for mean capital of industry (MCapital) is 0.0003, and standard error is 0.0002. Because these statistics according to table 2 are negative for mean capital of industry, it is deduced that, the relation between mean capital of industry and hazard rate is positive. On the other word, there is an indirect relationship between mean capital of industry and firm's survival. Looking at significance column at the table 2, the coefficient estimated for this covariate is 0.9784 and it confirms the meaningful

relationship between mean capital of industry and survival at significance level of 0.05.

To investigate the significance of used regression model and to test its coefficients that denote the significance of relationships between dependent and independent variables, usually F statistic is used. But in event-history analysis for this purpose the log-likelihood ratio statistic is used, that is defined as below:

$$LR = 2(LL_1 - LL_0)$$

Where LL1 is the log likelihood of the present model (i.e. "log likelihood final estimates") and LL0 is the log likelihood of a model with no covariates, a so called null model. (Note that what is displayed actually is the log likelihood of the model with which the estimation started, which may be different from the null model when, for instance, you have provided starting values). The LR statistic has a chi-square distribution with degrees of freedom equal to the number of parameters omitted. For calculation of this statistic we get

$$LR = 2[-160.4967 - (-163.7051)] = 6.4168$$

If we compare this value with the chi-square distribution, which gives a critical value of 5.99 at the 0.05 significance level for 2 degrees of freedom, then the estimated LR is greater than the critical value and takes place on H1 part. This test says that the model at hand (with 2 parameters) can indeed explain significantly more of the "variation" in the dependent variable than a model with no information about covariates, i.e. a model assuming that the hazard rate is the same for all observations.

VII. CONCLUSION

The results of Cox regression shows that mean employment of industry hasn't a meaningful effect on the survival of firms in that industry. Although the data of this study didn't confirm statistically the existence of such effect, but the coefficient shows that there is a positive relationship between mean employment of industry and firms survival. It seems this relationship is related with the concept of cost per each unit of employment. Although the excess employment cause to enlargement of firms and they could benefit the advantages of being large, but the manpower could be considered as the source of cost. Excess of employment involves the costs of training, improvement, maintenance and other costs that is required for best operation of manpower. In front of these costs if the firm won't benefit the manpower optimally, in this case excess employment will be a restraining factor to firm's survival. At the other hand, in industries with high mean of employment the firms in competition must give better services and more welfare to their manpower. Meanwhile the firms in industries with high mean of employment could take advantage of this factor as a positive element. Although most of previous studies have showed a positive relationship between initial size of firms and their survival, but the analysis of the results show that in industries with high mean of employment, the smaller initial size of firm may result to the higher chance of survival because of agility and flexibility.

The second result of Cox regression is that there is negative meaningful relationship between mean capital of industry and new firms established in that industry. This relationship maybe is because the new firms established in industries with high mean of capital don't have ability to compete with the rivals that have more capital. In industries with high mean of capital the firms are benefiting from scale economy's advantages and if a firm can not achieve to such financial resources couldn't invest on better technologies and subsequently couldn't take advantage of scale economies. Such firms are confronting the danger of destruction and they must struggle to achieve the minimum economic scale (MES) in order to survive. This result is consistent with the findings of Audretsch, Houweling and Thurik [4]. They find a negative relationship between mean size and capital intensity of industry and survival. They explained that the minimum saving from scale will have disadvantage of high costs for small firms.

REFERENCES

[1] Z.J. Acs, B. Carlsson, and A.R. Thurik, Small Business in the Modern Economy, Basil Blackwell Publishers, Oxford, 1996.

[2] D.B. Audretsch, Innovation and Industry Evolution, MIT Press, Cambridge, 1995.

[3] D.B. Audretsch, "New Firm survival and Technological Regime", The review of Economics and Statistics, 1991,Vol. 73, No. 3, PP. 441-450.

[4] D. B. Audretsch, P. Houweling and A. R. Thurik (1997), "New-Firm Survival: Industry versus Firm Effects", http://www.tinbergen.nl/discussionpapers/97063.pdf.

[5] D.B. Audretsch, and T. Mahmood, "New firm survival: new results using a hazard function", Review of Economics and Statistics, 1995, Vol. 77, No.1, PP. 97–103.

[6] D.B. Audretsch and J. Mata (eds.), "The post-entry performance of firms: Introduction", International Journal of Industrial Organization, 1995, 14, 413-419.

[7] D.B. Audretsch, E. Santarelli and M. Vivarelli, "Start-up size and industrial dynamics: some evidence from Italian manufacturing", International Journal of Industrial Organization, 1999, Vol. 17, PP. 965-983.

[8] J.R. Baldwin, The Dynamics of Industrial Competition: A North American Perspective, Cambridge University Press, Cambridge, 1995.

[9] C.E. Bamford, T.J. Dean and P.P. McDougall, "An examination of founding conditions and decisions upon the performance of new bank start-ups", Journal of Business Venturing, 1999, 15, 253–277.

[10] H.P. Blossfeld and G. Rohwer, Techniques of Event History Modeling. 2nd ed., Lawrence Erlbaum Associates, Inc. 2002, pp. 4-37.

[11] W. Boeker, Organizational origins: entrepreneurial and environmental imprinting at the time of founding, In: Carrol, G.A., (Ed.), Ecological Models of Organizations, Ballinger Publishing Company, Cambridge, MA, 1988.

[12] W. Boeker, Strategic change: the effects of founding and history, Academy of Management Journal, 1989, 32(3), 489–515.

[13] E. Cefis and O. Marsili (2005), "A matter of life and Death:Innovation And firm Survival", Industrial and corporate change, vol. 14, No. 6, pp. 1167-1192.

[14] D.R. Cox, "Regression Models and Life Tables", Journal of the Royal Statistical Society, Series B, 1972, Vol. 34, No. 2, pp. 187-220.

[15] A. Dixit, "Entry and exit decisions under uncertainty", Journal of Political Economy, 1989, 97 (2), 620–638.

[16] M.J. Dollinger, Entrepreneurship: Strategies and Resources. Richard D. Irwin, Homewood, IL., 1999.

[17] M. Doms, T. Dunne, and M.J. Roberts, "The role of technology use in the survival and growth of manufacturing plants", International Journal of Industrial Organization, 1995, 13 (4), 523–542.

[18] P. Dunne and A. Hughes, "Age, size, growth and survival: UK companies in the 1980s", Journal of Industrial Economics, 1994, 42 (2), 115–140.

[19] T. Dunne, M.J. Roberts, and L. Samuelson, "Patterns of firm entry and exit in US manufacturing industries", Rand Journal of Economics, 1988, vol. 19, No. 4, PP. 495–515.

[20] D. Evans, "Tests of Alternative Theories of Firm Growth", Journal of Political Economy, 1987, 95, 657-674.

[21] B. Hall, "The relationship between firm size and firm growth in the US manufacturing sector", Journal of Industrial Economics, 1987, 36 (2), 583–606.

[22] M.T.Hannan, and J. Freeman, Organizational Ecology, Cambridge, MA: Harvard University Press, 1989.

[23] P. Holmes, I. Stone and P. Bradford, An Analysis of New Firm Survival using a Hazard Function, 1999.

[24] H. Hopenhayn," Entry, exit, and firm dynamics in long run equilibrium", Econometrica, 1992, 60 (5), 1127–1150.

[25] B. Jovanovic, "Selection and Evolution of Industry", Econometrica, 1982, vol. 50, PP. 649-670.

[26] M. Kato (2009), " Firm Survival and the Evolution of Market Structure: The Case of the Japanese Motorcycle Industry", http://gcoe.ier.hit-u.ac.jp/CAED/papers/id127_Kato.pdf

[27] N. Kiefer, "Economic duration data and hazard functions", Journal of EconomicLiterature, 1988, vol. 26, pp. 646- 679.

[28] T. Mahmood, "Survival of Newly Founded Businesses: A Log-Logistic Model Approach", Discussion Paper FS IV 97-32, Social Science Research Center, Berlin, 1997.

[29] J. Mata and P. Portugal, "Life Duration of New Firms", Journal of Industrial Economics, 1994, vol. 42, No. 3, PP. 227–246.

[30] J. Mata, P. Portugal and P. Guimaraes, "The survival of new plants: start-up conditions and post-entry evolution". International Journal of Industrial Organization, 1995,vol. 13, No. 4, pp. 459–482.

[31] D.C. Mueller, The Dynamics of Company Profits: An International Comparison.Cambridge University Press, Cambridge. 1990.

[32] J. Wagner (1994), The post- entry performance of new small firms in German manufacturing industries, Journal of industrial economics 42(2), p. 141-154.