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The Influence of Industry Characteristics on New Firms' Survival: Iranian Study

Mehrdad Madhoushi and Azar Nasiri

Department Of Business Management, Faculty of Economics and Administrative Science (FAES), University Of Mazandaran Campus, Babolsar, Iran.

Abstract: The aim of present research is examination the influence of industry characteristics on the survival of newly established firms of processing industries in Mazandaran province, Iran. Thus using data on 2021 firms established between 1981- 2007, semi-parametric Cox hazard models are estimated. At result, a meaningful relation between industry growth rates, measure mean and entrance rate on firm survival has been confirmed. Also, in this research a comparison between firms' survival functions according to entrance rate mean and different converting industries has been checked.

Key words: Industry characteristics, new firm, converting industries, survival analysis, mazandaran province.

INTRODUCTION

Fritsch (and *et al,* 2006) argued that Entering to market and competing is subject to severe uncertainty and requires diverse qualifications that are rarely contained in one single person. As a result, a many of new firms leave the market relatively soon after entering; thus, in some industries or regions only a minority of the entrants is able to survive for a longer period of time.

Since creation of the new companies as a tool to reduce unemployment and job growth of a region is very important, the new company bankruptcy and the consequences of economic and social need to study to reveal the survival of new firms (Acs and Audretsch, 1993).

Many studies about the survival of new companies have been done. Farinas and Moreno (2000) used Jovanovich model and confirmed that the probability of exit and growth rate of successful companies reduces with size and age. These findings in studies of Dunn, Roberts and Samuelson (1989), Evans (1987), Phillips and Krichhoff (1989) Geroski (1995) and Segarra and Callejon (2002) also can be seen. Many studies have introduced innovation as the basis of survival of companies (Schumpeter (1942), Christensen (1997), Agarwal and Audretsch (2001), Lee *et al* (2001).

In this study, the data on 2021 companies created in conversion industries of mazandaran province during the years of 1360-1386 by using the approach event-history analysis and Hazard function model to investigate the effect of industry factors on the survival of new company have been studied. Therefore, the product-limit estimation method (Kaplan-Meier) and life table approach is used, and also semi-parametric Cox regression model for hypothesis testing has been used.

Conversion industries are industries that rely on various products and agricultural products and any products or agricultural products and livestock as a raw material during the production process are designed to be converted to use. Conversion agriculture Industries also of units refers to the processing of vegetable or animal material deals. Deformation processing includes protection from physical and chemical changes, storage, packing and distribution (Austin, 1992).

In Dictionary administrative and technical systems, conversion industries such are defined as:

In these industries processing such that after the primary process, materials and products obtained again for final processing as feed for other industries that have been established for that purpose, will be sent. Such as chemical and petrochemical industries. Overall industry conversions from natural resources are inference.

The remainder of the article is organized as follows: Section 2 discusses Experimental/Materials and methods used in this study. In Section 3 we set out the relationships to be examined in this article between firm survival and industrial variables. Results are presented and discussed in Section 4. Section 5 provides a summary and concluding remark.

Corresponding Author: Mehrdad Madhoushi, Department Of Business Management, Faculty of Economics and Administrative Science (FAES), University Of Mazandaran Campus, Babolsar, Iran.
Phn: +98(112)5245415, Fax: +98(112)5222179
E-mail: madhoshi@umz.ac.ir

2. Experimental/materials and Methods:

In order to analysis the survival of the company, review the company lifetime is essential. The data as "censored" exist among these data. The censorship data are a group during the study may not been fully participate or until the end of time study work has not happened yet. In other words, transfer in their situation never occurred. Thus, Cox semi-parametric regression model for analyzing historical- event is used and in some cases where data set has been censored is appropriate.

Models in which the only a function for the independent variables effect is identified and will be put aside the transfer rate form, are called semi-parametric models. Proportional hazard model or Cox model presented by Cox (1972) is defined as follows:

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

The transition rate $r(t)$ depends on an unspecified baseline rate, $h(t)$, and on a vector of covariates $A(t)$ with coefficients α. The covariates may depend on the process time, t. Implementation of the Cox model in TDA is based on the following model formulation.

$$r_{jk}(t) = h_{jk}(t) \exp\{A^{(jk)}(t)\alpha^{(jk)}\}$$

r_{jk} (t) is the transition rate at time t for the transition from origin state j to destination state $h_{jk}(t)$ 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 $\alpha^{(jk)}(t)$ is a vector of associated coefficients.

In this study, to test the theories of semi-parametric model Cox is used.

The total companies have utilized operating license during the period of study in conversion industries from province industries and Mines were 2021 until the end of the study period (March 2007) 971 license revocation of company were done and the number of companies also were active in 1050. This issue in the form of table (1) is shown.

Quotas Sampling was done in the conversion industries of province, but by considering the small number of companies and increase the probability of error and sample test, analysis on all the existing companies took. Table 2, shows grouped conversion industries separately by the number of licenses issued in each group. Initial data from the TDA software about existing companies in dataset are there in table (3).

In this table there are two rows. The first shows the number of companies in which their status (transfer) has not been done; in other words, this row shows the number of censored episodes.

An episode, or spell, is the duration an individual stays in a specific state. The episode begins at the time of entry into that state, and it ends when a new state is entered. Each of the episodes can be described formally by an expression like:

$$(0_i, d_i, s_i, t_i, x_i, (t)) \quad i = 1, \ldots, N$$

s_i and t_i are the starting and ending times, respectively. The basic convention for TDA is that starting and ending times are coded such that $t_i - s_i$ is the duration of the episode. o_i is the origin state, the state held during the episode until the ending time, and d_i is the destination state defined as the state reached at the ending time of the episode. $x_i(t)$ is a vector of covariates connected with the episode and possibly depending on the process time, t (Rohwer and Poetter, 2002, p:140).

Second row shows the transfer status from origin status (org, zero) to target condition (Des,one). It means companies which are in their change of status have been taken out of the industry. So in 2021 the numbers of existing companies, 1050 companies in the time of observation were active (censored) and 971 companies have left the industry. Mean Duration shows the average lifetime of companies. This column, for companies that are still active is, 129 months and for canceled companies is, 168 months. TS Min indicates the earliest beginning time and TF Max indicates the latest ending time by month.

To describe data collections have been used from nonparametric descriptive methods. For this purpose, there are two methods of life table and product-limit estimator (Kaplan - Meier). Life table method requires grouping of longevities during time intervals. Based on the operational definition of GEM, new firms are called that time Spent in the industry is less than 42 months, so grouping of episodes in the intervals between 42 months is required. Product limit method based on calculated risk set at any point of time that at least one event has happened. Thus, the information in the episodes efficiently to be used. In this study, both methods have been used and the results of both methods are compared.

2.1. Life Table Method:

Life table estimation, like some other methods for episode data, requires a specification of time periods (intervals) for the process time axis that was used to define the episode data. This is done by defining split points on the time axis

$$0 \le \tau_1 < \tau_2 < \tau_3 < .... \tau_q$$

Using these basic quantities, it is easy to define all other concepts used in the life table setup. First the conditional probabilities of having an event in the lth interval, q_l, and for surviving the interval, p_l are

$$q_l = \frac{E_1}{R_1} and\ p_l = 1 - q_l$$

Which is E_l equal to the number of episodes with events in I_l. Defined for the intervals (time periods) I_l (l = 1, . . . , q). The next important point is the definition of a risk set, R_l for each of the time intervals, that is the set of units (episodes) that are at risk of having an event during the lth interval. Thus the survival function will be as follows:

$$G_1 = 1, G_l = p_{l-1} G_{l-1}$$

Graph of survival function in Figure (1) is shown by using the life table. This diagram shows values of newly arrived groups' survival in 42-months intervals (3 and half years).

Based on the above chart, there are 7 groups in 42 months intervals. As is noted, after 42 months 96 percent of newcomers are remaining, while after 210 months (17.5 years) 58 percent have survived. Life table analysis up to 294 month based on 42 months intervals will remain, and the rest will participate in the eighth category that an 11-month interval is included.

2.2. Product Limit Estimator Method (Kaplan-Meier):

In this procedure, the first step is to consider the points in time where at least one of the episodes ends with an event. There are, say, q such points in time.

$$\tau_1 < \tau_2 < \tau_3 < .... \tau_q$$

With this assumption Product- limit estimator of the survivor function is defined as:

$$G(t) = \prod_{l:\tau_1 < t} \left(1 - \frac{E_1}{R_1} \right)$$

Which E_l is the number of episodes with events at τ_l and R_l is the number of episodes in the risk set at τ_l, denoted R_l, i.e. the number of episodes with starting time less than τ_l and ending time τ_l. If the survival function graph plotted against the lifetime can be easily measure survival rate of existing companies during the time. This chart is drawn by TDA software to estimate the product limit in drawing (1) can be seen. In this diagram, Companies which are maintained at any point of time is shown.

2.3. Relationship Between New Firm Survival and Industrial Variables:

There are a various factors to explain the survival. In Industrial economics, structural factors such as firm size play a key role. The differentials in survival probability among firms are seen the outcome of the market selection process on heterogeneous firms (jovanovic, 1982). Another source of inconsistency in firm survival referred to by economists, is the level of intangible assets and quality of capital stock. For example, Hall (1987) relates survival probability to the technological capabilities of firms measured by R & D and patent statistics. She points out that R & D activities by the firm contribute to building a stock of knowledge that increases the market value of the firm and consequently its likelihood of survival (Cefis and marsili, 2005). Other studies link survival to capital quality and show that firms that adopt a range of advanced manufacturing technologies have higher chance of survival (Doms *et al*, 1995).

However, any study about the difference between survival rates of companies and the cause of it in conversion industries has never been done. The absence of any such studies is particularly striking since a growing body of literature on firm entry, exit, mobility and turbulence has shown that industry- specific characteristics play an important role in explaining intra-industry dynamics.

Many of researchers found that firms have a lot of innovations have a greater chance of survival (Christensen, 1997; Banbury and Mitchell, 1995; Audretsch 1991; Esteve and others, 2004; cefis and Marsili, 2005; Kato, 2008).

Audretsch (1991), Audretsch *et al* (1997) and Meta and Portugal (1994) a significant relationship between industry growth and survival of the company gained. Meta Research and Portugal (1994), Audretsch, Houweling and Thurik (1997), Dunn, Roberts and Samuelson (1998), Barbot (2001), Fritsch, Brixy and Falck (2006) and Taymaz (2007) examined the effect of entry rate value to the survival of company and found a significant negative relationship between both of them.

Audretsch, Houweling and Thurik findings (1997), according to the industry-level variables showed that larger initial size has a positive relationship with survival. However, *Capital intensity* has a positive influence on survival rates on the firm-level and a negative influence on the industry-level. As capital intensity is usually seen as a measure of economies of scale, these findings suggest that new-firm survival rates are lower in industries with substantial economies of scale and hence greater cost disadvantages for small firms. The impacts of the industry-specific factors R & D, growth rate and entry rate on the likelihood of survival are all negative. This supports the hypothesis that survival is more difficult for firms entering an industry with a high level of turbulence. The empirical evidence provided in this paper suggests that Heterogeneity of survival rates across firms is apparently more attributable to firm-specific characteristics than to industry-specific characteristics. This heterogeneity is one of the main engines of change in the industry.

Barbot (2001), did an analytical method in determinants of the entry and survival industry in Portugal, he got the result that new firm prefer industries with a smaller minimum efficient scale (MES) and industry benefit and medium size due to related with less transaction costs, affect the significant and positive effect on rates of entry.

Considering the Variables Used in Previous Studies, the Variables in this Study as Independent Variables Considered Are:

1- Industry Growth Rate:

It means average annual growth rate that is measured based on industry employment growth rate. Growth rate is usually based on employment growth and export growth rates are considered. Since the analysis is based on the database as well as many companies have not be exported, so the rate of employment in companies during period of the study to operating define this variable has been used. Cefis (2005) also has used employment growth rates for the determination of industry growth.

2- Average Size of Industry:

The employment rate of the number of companies that are operating license has been calculated. In other words, is equal to employment ratio to Companies licensed operation in particular year. Spilling (1998) and barbot (2001) to have used the index for the definition of this variable.

3- R & D:

This variable has been merged with the variable of degrees of innovation in the industry and the companies are grouped in active and inactive according to invest in. Cefis (2005) and Fritsch (2006) to enter the variable in calculating survival, these practices have to work.

4- Capital Intensity:

Investment value existing companies in conversion industries of mazandaran province per each of their staff. Audretsch (1991) has used this definition.

5- Average Arrival Rate:

Equal to the average number of licenses issued in the desired timeframe and the industry is studied.

In this study Dependent variable or target is survival and is based on activity years of company and is defined as the distance between entry and exit years of the industry.

3. Discussion:

Table (4) results from the estimated Cox model shows.

According to table (4) results for growth rate show there are a significant correlation between this variable and the survival of the company. In other words, with increased industry growth rate, exit rate is increased and chance of survival decreases. This result with findings of Audretsch, Houweling and Thurik (1997) is compatible. Achieved results of the Audretsch (1991) and meta and Portugal (1994)is based on an direct relationship and significant this variable with a probability of survival of companies and is inconsistent with the findings of this research. Between growth rate variable and rate of entry there is an interactive relationship that affects negatively to relationship between growth rate and the survival of the company.

Regression results confirm positive affect of average size of the industry on survival rate of the company. Namely whatever the average size increases the probability of exit from the industry reduces and finally survival rate increases. These results are agree with findings of Steve *et al* (2004) and with findings of Audretsch, Houweling and Thurik (1997), Lawrence and Marx (2000) and Barbot (2001) is inconsistent. Barbot research shows the average size of industry due to costs associated with low trading volume, has significant positive effect on the arrival rate and also the survival rate industry is reduces. There was not found a significant relationship between R & D Variable and capital intensity. However, most previous studies significant relationships between these variables with the survival of the company have confirmed.

Positive sign of regression coefficient arrival rate variable in Cox regression output represent the positive impact of arrival rate on the probability of leaving the company. In other words, with increased rates of entry to exit level industry companies also increased and thus the probability of survival in the industry decreases. In addition, can be seen that the error level of 5% significant relationship exists between these two variables. These findings are according to the results of meta-research and Portugal (1994), Audretsch, Houweling and Thurik (1997), Dunn, Roberts and Samuelson (1998), Barbot (2001), Fritsch, Brixy and Falck (2006) and Taymaz (2007). Since the high arrival rate in the industry is accompany with increasing competition between companies and competition is also largely eliminate the weaker companies hence positive relationship between arrival rate and survival of firms has not been observed.

In event-history data analysis, often compare the survival functions and review significant difference between them. To do this, there are two methods. In the first method confidence interval for each survival functions is calculated and overlapping them to be tested. This procedure in both life table and product limit estimator is possible.

Another method is calculating specific test statistics for comparing two or more survival function. These statistics are based on product limit estimates of survival functions therefore not usable in life table method. In this study, comparison between survival functions of companies according to average rate entering the industry and survival functions between companies in different industries has been done. Based on this comparison between survival functions of firms' average arrival rate are significantly different.

Chart (3) can see that industries survival functions after almost 240 months do not overlap and industries with low arrival rate has lower slope than densely and crowded industry. This indicates that the survival probability of industries that face lower entry rate is more than dense industry and confirms inverse relation between arrival rate and survival rate of companies; it means the survival probability of companies in an industry is more that lower arrival rate is.

The results of the test statistics for comparing survival functions based on the average arrival rate in the table (5) are shown.

Table (5) can be seen significant statistics coefficients in the 10% level of error are significant. So, with 90 percent confidence we can say that the survival functions of dense industries and industries with low entry rates vary together. As a result, zero assumption based on lack of difference between the survival functions of different industries with entry rates will be rejected. Based on the comparison chart below shows the life table method.

In Life table method, survival differences based on difference in the rate of entry to the industry, only at the last two groups are seen. In other words, newcomers that have been entered to the industry after 21 years (252 months), most are influenced by entry variable. Can also be said that entry in these years is more than the previous years respectively. Comparing the results of the survival functions of companies in different industries based on comparing the two methods is given.

As is noted in the chart in the food industry companies with survival rates less than other industries face. Survival functions Graph of oil and recycle industries recovered after approximately 96 months with no overlap and can be separated. Not Step Chart of recycle survive because of the recycling companies in this industry are low and by the end observation time have been censored.

Thus, the survival rate of each industry can be compared due to drawn survival chart with industry custom.

Calculated test statistics to compare survival functions of industries in the table (6) has come. Zero assumption is based on that there is no difference between the survival functions of companies in various conversion industries.

As can be seen, all significant coefficients are calculated at 5% significant level of error and zero assumption based on the lack of difference between the survival functions for different industries will be rejected. In other words, there are significant differencesbetween the survival functions of existing companies in different conversion industries of mazandaran province.

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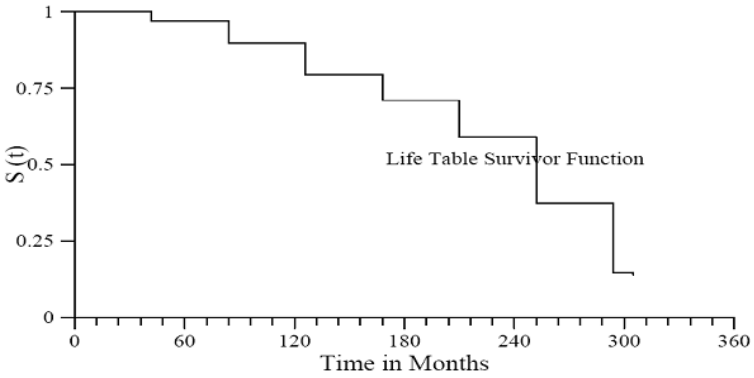

Fig. 1: life table survival function.

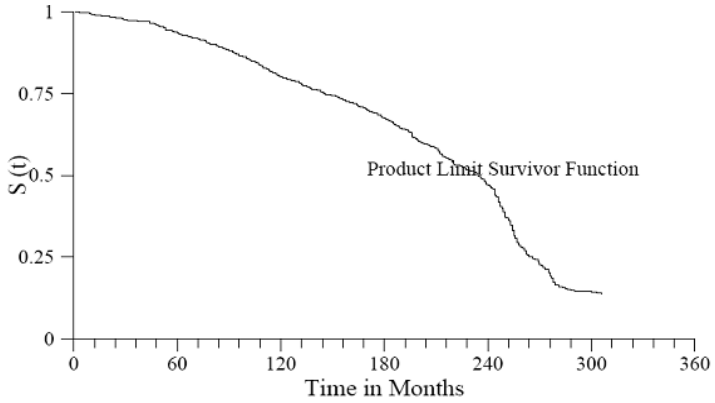

Fig. 2: product limit survival function.

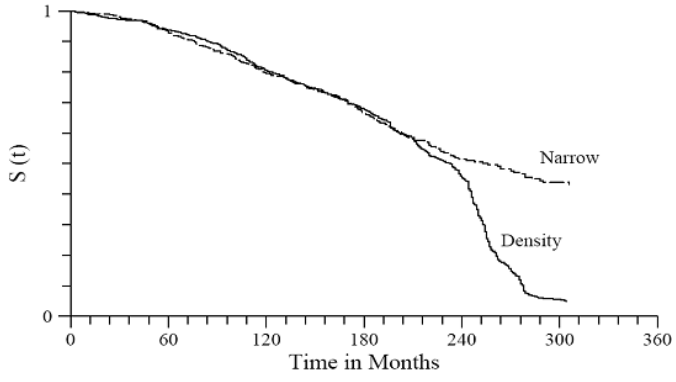

Fig. 3: Compares the survival functions of companies based on the average participation rate of entry - the product limit method

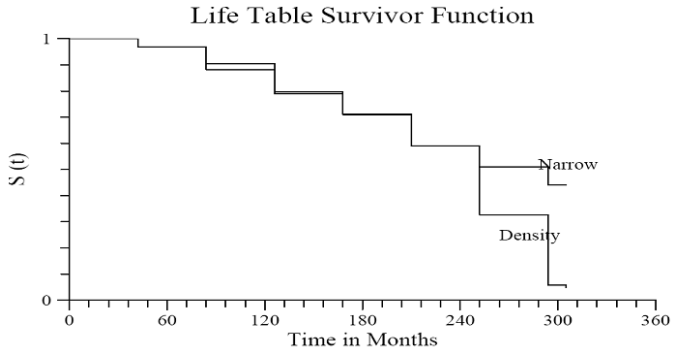

Fig. 4: Compares the survival functions of companies based on the average participation rate of entry - life table method

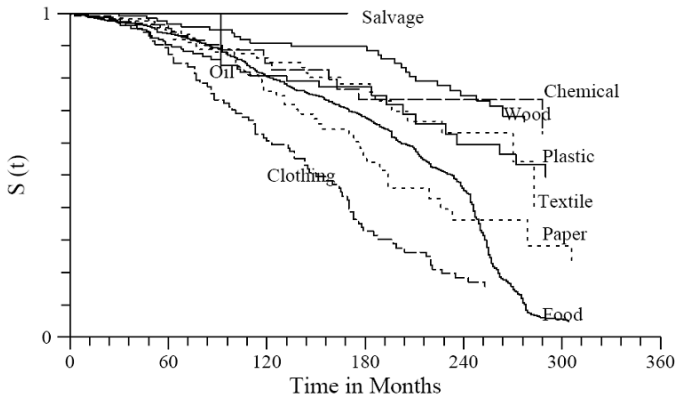

Fig. 5: Compared the survival functions of existing companies in various industries translational.

Table 1: license structure of the utilization in conversion industries of Mazandaran province in the years 1981-2007.

Active companies in march 1386	Utilization license revocation	Total utilized license issued
1050	971	2021

Source: Database of Mazandaran Industries and mines – May 2009

Table 2: conversion industry groups and the number of firms in each group.

ISIC code	Industry groups	Total issued licenses	Exploitation license	Active
15	Food Products and Beverages	1127	736	391
17	Textiles Manufacturing	130	26	104
18,19	Clothing and fur skin processing fu- tanning, leather, bags, suitcases, shoes	105	76	29
20	Wood and wood products except furniture	134	27	107
21	Paper manufacturing and paper products	120	44	76
23	Coke and petroleum products from oil	12	1	11
24	Material manufacturing and chemical products	117	17	100
25	Rubber and plastic products	268	44	224
37	Recycling	8	-	8
	Total	2021	971	1050

Table 3: Classifying dataset in active and inactive companies.

				Mean				
SN	Org	Des	Episodes	Weighted	Duration	TS Min	TF Max	Excl
1	0	0	1050	1050.00	129.11	0.00	349.00	-
1	0	1	971	971.00	168.92	0.00	306.00	-
Sum			2021	2021.00				

Number of episodes: 2021
Successfully created new episode data.

Table 4: Estimates derived from Cox regression model.

Idx	SN	Org	Des	MT	Variable	Coeff	Error	C/Error	Signif
1	1	0	1	A	Growth	0.0906	0.0288	3.1504	0.9984
2	1	0	1	A	Averagesz	-0.0178	0.0041	-4.3446	1.0000
3	1	0	1	A	RD	-10.8543	108.0478	-0.1005	0.0800
4	1	0	1	A	Capital	-0.0004	0.0002	-1.6952	0.9100
5	1	0	1	A	Entry	0.0173	0.0035	4.9978	1.0000

Log likelihood (starting values): -6321.8046
Log likelihood (final estimates): -6273.3225

Table 5: Comparison of survival functions of companies based on average arrival rate.

Comparing survivor functions.

SN	Org	Des	Test Statistic	T-Stat	DF	Signif
1	0	1	Log-Rank (Savage)	57.6956	1	1.0000
1	0	1	Wilcoxon (Breslow)	2.8427	1	0.9082
1	0	1	Wilcoxon (Tarone-Ware)	15.8787	1	0.9999
1	0	1	Wilcoxon (Prentice)	10.0455	1	0.9985

Table 6: compares the survival functions of companies in different industries translational.

Comparing survivor functions.

SN	Org	Des	Test Statistic	T-Stat	DF	Signif
1	0	1	Log-Rank (Savage)	129.0239	8	1.0000
1	0	1	Wilcoxon (Breslow)	78.6319	8	1.0000
1	0	1	Wilcoxon (Tarone-Ware)	102.3192	8	1.0000
1	0	1	Wilcoxon (Prentice)	99.4031	8	1.0000

Table 7: variable values for each industry.

Industry group	Average arrival rate	Average size	Growth rate
Food Products	45.65	14.3	0.41
Textiles Manufacturing	6.2	69.24	7.66
Clothing	4.15	16.6	2.66
Wood and wood Product	5.6	37.5	2.27
Paper manufacturing	4.9	18.8	8.07
Petroleum products From oil	0.57	4.3	0.99
Chemical products	5.2	14.6	4.71
Plastic products	11.8	10.3	2.53
Recycling	0.3	4.57	2.43

Conclusion:

In this study the survival of 2021 new companies in conversion industries of Mazandaran during the years 1386-1363 using Cox model has been analyzed. The overall goal of this research is answer the following questions: 1– How much is a significant relationship between industry characteristics and survival of new firms in conversion industries of mazandaran province? 2-Which one of the industry features on new firm's survival in conversion industries of mazandaran province important role to play?

To answer these questions, Cox regression was used and achieved the below conclusions:

1- There is a significant relationship between the industry growth rate, the average size of industry and average arrival rate variables with dependent variable.
2- R&D and capital intensity not important effect on new firm's survival in conversion industries of mazandaran province.
3- Arrival rate as an important factor in the survival of conversion industries of mazandaran province. For analyzing, it is necessary that chart related to comparison the survival functions of existing companies in conversion industries be reviewed.

As can be seen, the food industry (Food) with lower survival rates than other industries is faced. This could be due to the high arrival rate in this industry. According to available data, the average annual 45 companies are entering the food industry. However, the arrival rate in other industries is less than 12 years. This data table (7) is shown.

On the other hand, most average size is related to the textile industry but the industry after the paper industry with high growth rate also is facing, so the average size of positive impact on the survival of this industry is not quite evident.

In the Industry such as wood, arrival rate is less than the industry average and the average size is more than the industry average, the more survival is observed. Survival rate based on the rate of entering to the industry, has a clear analysis more than other variables. So can be said the variable arrival rate as an important factor in the survival of conversion industries of Mazandaran province. From this study, four propositions have been developed.

Propositions:

P1- Representation of policies from the industry organization to determine the maximum level to enter the industry (especially food) and licensing in accordance with this level, to prevent reducing survival rate in the industry.

P2- Considering the larger initial size to create new firm in industries with high entry rates and thus increase its chances of survival of the industry.

P3- Developing policies encouraged and supported to create a company in an industry with high growth rate when the arrival rate above the industry with other industries is equal.

P4- Create new firms in an industry such as recycling that has become in recent years into the industry and conditions are improving and growth.

P5- Incentive policy development in macroeconomics Using industrial wastes, particularly in feed conversion industries that face with lower survival rates than other conversion industry.

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