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The Effect of the Behavioral Elements on the Growth of Iranian Firms

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Abstract

There are many factors that could have a potential impact on the growth of a firm. In this research, we examined the relationship between the following economic elements: Size of the firm, Research and development expenditure, Advertisement cost, and the growth of Iranian firms of manufacturing industry. For this purpose, four digit ISIC standard data in manufacturing industry sector have been gathered (based on the published data of the Iran Statistics Center during 1997 to 2007). Then, the effects of the size of the firm, research and development and advertisement on the firm growth were tested. Results showed that research and development and advertisement expenditure factors have positive and significant impacts on the firm growth. In contrast, there was not any significant relation between the initial size of the firm and the growth. Based on the findings of this study, the Gibrat law was confirmed. In addition, the direct relation between the behavioral elements and firm performance was verified.

Keywords: *Advertisement, Firm growth; Gibrat law, Research and development*
JEL classifications: *D92, L25, M37*

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1. Introduction

The growth of a firm needs suitable conditions. It is a function of different and complex factors including: Management, Control, Innovation, Coordination and Cooperation. The view that the small and medium firms necessarily create higher growth and employment seems premature. In the process of growth, firms are affected by different factors including: Age, Size, Level of competition among them, Level of available human capital, Advertisement expenditure, as well as the research and development (R&D) cost.

Therefore, the main aim of this paper is to examine the relationship between the size of the firm, the research and development (R&D) expenditure and advertisement cost on one hand and the growth of the firms of manufacturing industry in Iran, on the other. Panel regression technique is used for this purpose.

Reviewing the practical researches about the Gibrat law shows that it is not always possible to compare them because of the sample differences and various techniques used. In most of the previous researches, advertisement is used as one of the important behavioral variables and the evaluation of the effect of other behavioral variables, like research and development, on the market performance, has not been considered yet. Hence, conducting the current research and discussing the effect of other variables like size, research and development and advertisement costs on the firm growth is necessary and important.

Unfortunately, no researches that focus directly on the firm's growth have been carried out in Iran. Iranian literature on the topic has been mostly devoted to the characteristics of the small and medium size firms and has tried to come up with solutions to lead them to improvement.

To examine the relationship between the size of the firm, the research and development (R&D) expenditure and advertisement cost and the growth of the Iranian firms of the manufacturing industry, the published data of the Iran Statistics Center is used. The index used to show the size of the firm is its sale amount. The four digit ISISC data of the period 1997-2007(Solar calendar of 1386-1376) for Iranian manufacturing industry is used in this analysis.

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2. Literature Review

The research about the firm growth started in 1931 by Gibrat and after that, the issue has gained attention by the researchers from the 1950s on. Some of them will be discussed here:

Hart and Prais (Hart 1956) analyzed the business concentration of some British firms. The period of the analysis was 1885 to 1950 and the growth of firms was calculated every six years. The chosen factories were brewery, distillation, iron, coal and steel. In this research, two different ways are used. In the first approach, all factories were classified in three categories (large, medium and small). In addition, the growth rate of a firm was defined as the final size of the firm divided by the initial size of it. Then, the distribution of growth rates was analyzed for large, medium and small firms. The findings show that the distribution of growth rates is equal in all three categories and hence, the Gibrat law is verified.

In the second approach, like the first one, the firms were analyzed in the period 1885-1950 and the sample was just like that of the first approach. In the second approach, dynamics of firms were analyzed for five periods and the distributions of firms and the standard deviations of firm size from the mean were calculated and ranked.

In the analysis of Hart and Prais, the entrance of new firms, the exit of current firms and the change in the distribution of size of firms were considered separately. The findings of the second approach show that:

1. There are smaller firms that become inactive and hence exit the industry in each period.
2. The Gibrat law is verified for the period 1885-1939.
3. In the period 1939-1950, the smaller firms used to grow faster than the bigger firms and the Gibrat law failed in this period.

Simon and Bonini (Simon 1958) explored 5000 industrial firms chosen from among the largest American firms in the period 1954-1956. The sample used by Hart and Prais (Hart 1956) was used in this article as well. Here also the chosen factories are classified in three

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categories (large, medium and small) and the distribution of growth rates is analyzed and compared for large, medium and small firms. The conclusions show that the distribution of growth rates is equal in all three categories and hence the Gibrat law is confirmed.

In addition, Simon and Bonini computed the linear regression of the growth rates on the initial size of the firms that confirmed the Gibrat law; in their model there was no sign of hetroscedasticity. The outcomes of the Simon and Bonini work were published in a paper named: "The size distribution of business firm".

Pagoulatos and Sorensen (Sorensen 1981) provide a simultaneous equation analysis of advertising, concentration and profitability and evaluate the relation between these three. The method employed in this study is to estimate the simultaneous equations between structure, behavior and performance using American food industry data. The results show that the concentration of advertisement has an important effect on the concentration and profitability and is an obstacle to entry in the American food industry.

Using simultaneous equations system and three-round least square technique, Uri and Coate (Uri 1989) evaluated the relation between the concentration, advertisement, the research and development cost and performance in the American manufacturing industry. The results show that advertisement, concentration and research and development costs have positive effect on performance and there is a one-sided causal relation from the advertisement concentration toward growth and profitability in these industries.

Hart and Oulton (Hart 1996) evaluated the relation between the growth and the size of firms. In this paper, another model of firm growth is provided and the Gibrat law is examined. According to this model, if the size distribution of the firms (which is a sign of employment) is lognormal, which means that the size of the firm (x) has the form of $x \approx \wedge(\mu, \delta^2)$, then the distribution of normal logarithm of employment is normal itself and has the form: $y \approx N(\mu, \delta^2), y = \ln x$; in which $y_i(t)$ is the normal logarithm of the i[th] firm in time *t* where: $i = 1,.....,n$ and $t = 0,....,T$ and standard deviation is: $y_i(t) = Y_i(t) - \mu$. The stochastic shocks which affect the

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stochastic logarithmic distribution of the firm size are shown by: $\varepsilon_i(t)$; which is independent of $y_i(t-1)$ and also: $E[\varepsilon_i(t)]=0$ and $E[\varepsilon_i{}^2(t)]=\delta^2$.

Hart and Oulton discussed the central limit theorem (CLT) provided by Veiner, Linderberg and Lyapunof. Each of these theories state different assumptions about $\varepsilon(t)$ but in all processes and under all assumptions about $\varepsilon(t)$ lognormal distribution is produced.

Generally, these assumptions explain why we use lognormal distributions frequently in evaluation of the firm size. Each of these three theories may be used to conclude and derive the Gibrat relative effect law; according to which the relative change of the firm size is independent of its initial size.

Trying to explain why firms are different, Pfaffermayr and Bellak (Pfaffermayer 2002) evaluated data related to 700 manufacturing firms in Australia during 1996-1999. In this research, the standard estimation of the Gibrat law is done; it means that the regression of growth on the logarithm of the initial size is conducted. The Gibrat law is not rejected and the growth of the firm is meaningfully and stochastically determined.

Pirguani et al. (Piergiovanni 2003) discuss the Gibrat law and the relation between the size of the firm and its growth. In this paper, 9051 infant firms chosen from five Italian service industries are evaluated in the period 1994-1998. The gathered observations about the size of the firms are classified in different categories and then this question is answered: are the growth rates for different classes of size distributed equally? The results show that the Gibrat law is rejected in 4 categories (out of five) and it is the case only for the camps that the size and growth are independent statistically and hence the Gibrat law can be verified.

Delmonte and Papagni (Papgni 2003) discusses the relationship between the research and development and the growth of the firms. In this paper, a sample of 659 Italian manufacturing firms are chosen and analyzed for the period 1989-1997. The size of the firm, total sale and employment are the criteria for evaluation. A unit root test is

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conducted using the time series information. The null hypothesis is that $\beta=0$ and the Lagrange Multiplier Test is done. The Gibrat law test was conducted using the unit root test of panel data and the final result was the acceptance of the law and the stochastic characteristics of the growth rates of the firms.

Considering the fixed asset as a criterion for the firm size, Chen and Lu (Chen 2003) evaluates the information of 258 Taiwanese firms in the period 1988-1999. The unit root test of panel data is performed to study the relation between the logarithm of the firm size in the beginning and at the end of the periods. The independent and identically distributed (iid) assumption and evaluation of the partial correlation of data has been paid attention to in this paper. The results show that under the independent and identically distributed (iid) assumptions, the Gibrat law is held in 4 industries (out of 18) and when the partial correlation is considered itself, the Gibrat law is held in 6 industries (out of 18). So, generally the result is that different outcomes may happen when different estimators and assumptions are considered.

Adretsch et al. (Audretsch 2004) and Pirguani et al. (Piergiovanni 2003) tried to verify the Gibrat law, which means that the growth rates of firms are independent of the size of the firms, for low-scale firms in the service industry in the Netherlands and Italia. These endeavors proved useless and without any results. In the Netherlands firms, there were a kind of tendency toward the verification of the Gibrat law; but it was not the case for the Italian firms. These findings do not contrast with that of Geroski (Geroski 1995), Sutton (Sutton 1997) and Caves (Caves 1998). Geroski (1995) shows that the growth rates of the studied firms declines when the size of the firms increases systematically.

Adrech et al. (Audretsch 2004) evaluates the Gibrat law in 1170 firms in the Italian service industry, up to four digit code, between 1987-1991. The annual observations of the firms are gathered from the CBS database and the criterion for firm size is the amount of sales. The firm size observations are classified into some groups and this question is evaluated: are the growth rates of firms distributed equally between different groups? The result of the analysis is that the Gibrat

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law is rejected; meaning that the size and growth are dependent statistically.

Johansson (Johansson 2004) analyzes the annual data of firms acting in the Sweden IT industry for the period 1993-1998 and the criterion for the firm size was employment. This paper performs the test related to availability or unavailability of fixed or random effects. The total result is the rejection of the Gibrat law and hence, the growth of the firms decline with the expansion of the size. This paper is repeated with other techniques and the result is the same.

Studying the 2640 factory firms in Greece in the period 1992-1997, using the employment as an index for firm size and estimating nonparametric density, Fotopoulos and Louri (Fotopouols 2004) discusses the relation between firm growth and foreign direct investment. The findings show that the logarithms of firm size data are deviated from their mean; the growth rates of firms are not stochastic completely; the firm size has negative relation with the firm growth and the Gibrat law is rejected. However, the negative effect of size on the growth of the firm is more meaningful for firms having faster growth.

Lensink et al.(Lensink 2005) evaluates uncertainty and the firm growth. In this paper, data related to 811 Dutch firms in the period 1995-1999 is studied and the criterion for firm size is employment (the Logit model is used also). Firms with less than five workers are considered small and those with more than five are regarded large. The question under study is whether firm growth has different forms for small and medium scale firms. The result is that there is no clear image of the firm growth and findings are in harmony with the Gibrat law; meaning that the growth of firms are independent of their size.

Using the ARD database in the period 1973-1998, Harris and Trainor (Harris 2005) used 26 British manufacturing industries to come up with firm analysis. These industries form one third of the UK GDP in the period under study. Different criteria (like employment, GDP and gross value added) are used to measure the firm size. To analyze the relation between the size of the firm and its growth, the unit root test for a panel of data is used. The results show that Gibrat law is rejected and this finding is verified using three different criteria.

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3. Theoretical Bases

One of the important laws in area of firm growth is the law of Proportionate Growth. In the simplest explanations, Gibrat law says that the expected rate of growth of a firm is independent of its initial size in the beginning of the period under study and it is considered as a law. The Gibrat relative effects law describes the industrial growth better than alternative theories. This law has a kind of information basis that shows the evolutionary behavior of a firm. There are three reasons for this claim:

1. The Gibrat law emphasizes the heterogeneity available between firms and shows the variance of growth shocks.
2. The stochastic nature of the Gibrat law shows the internal uncertainty of firms and economic systems.
3. Gibrat considers a dependency path for a firm; which means that the current size of the firm is affected by the growth shocks in the previous periods. This problem shows, in a way, the stochastic characteristic of the firm growth (Coad, 2009, p. 7).

According to the hypothesis of this research and the Gibrat law, the probability of any change in the firm size in a specified time period is independent of the initial size of the firm. Hence, if the firm size in time t is denoted by (S_t) then the growth rate of the firm (g_t), which is a stochastic variable, can be stated as:

$$\frac{S_t - S_{t-1}}{S_{t-1}} = g_t$$

This formula can be rearranged as:

$S_t = S_{t-1}(1+g_t)$

With iterated substitutions for the values of S_{t-1} and S_{t-2} in this formula, we come up with:

$$S_t = S_0(1+g_1)(1+g_2).....(1+g_t)$$

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Taking logarithms from the both sides of the formula, we can come up with:

$$Log(S_t) = Log(S_0) + \sum_{i=1}^{t} Log(1 + g_i)$$

Considering the fact that: $Log(1 + g_t) \approx g_t$ we can rewrite this formula in the following form:

$$Log(S_t) = Log(S_0) + \sum_{i=1}^{t} g_i$$

As it can be inferred from this formula, the size of a firm in the current period is dependent to the initial size of it plus a bunch of stochastic elements; which determine the growth rate of the firm. When t approaches infinity, then the logarithm of the initial size of the firm becomes less important in comparison with the current size of it but the importance of stochastic elements increases. Now if the growth rates have independent and normal distribution with mean μ and variance δ^2, then we can say that the logarithm of the current size of the firm has also mean μ and variance δ^2. Therefore, the distribution of the firm size in the industry is Lognormal and the initial size of the firm has nothing to do with its growth.

Another way used to test the Gibrat law is based on this idea that if a growth process is stochastic, then there should be no relation between the firm size, in a period of time, and its growth. The regression analysis of this idea is:

$$(\log(S_{i,t+n}) - \log(S_{i,t})) = a + b_1 \log(S_{i,t}) + b_2(\log(S_{i,t}) - \log(S_{i,t-n})) + u_i$$

In this equation, S_t stands for the firm size and u_i for the error term. In this model, the regression of the firm growth is performed (in the period t and t+n) on the logarithm of the firm size in period t and firm growth in period t-n and t. According to Gibrat law, b_1 and b_2 should be equal to zero; $b_1 = 0$ means that there is no relation between the firm size in period t and the growth of the firm in the period t and t+n. But, $b_2 = 0$ means that there is no relation between the firm growth

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in period t-n and t and the growth in period t+n and t. This model can be estimated using the cross-section data. However, if the results of the regression of model do not confirm the Gibrat law, two situations may happen:

- If $b_1 < 0$, it means that there is a negative relation between the firm size in period t and its growth in period t+n and t. under this condition, the smaller firms experience higher growth than the large firms. So, in the long-run, there will be a kind of convergence in the size of the firms in the industry. In such situations, the increase in the industrial concentration will be limited to a specified amount.
- If $b_2 > 0$, it means that there is a positive relation between the firm growth rates. It shows that the firm that has a fast growth in period t and t-n, will continue its fast growth in period t and t+n. In this condition, the trend of the industrial concentration will be strengthened as time elapses.

In this paper, following Pagoulatos and Sorensen (Sorensen 1981) and Uri and Coate (Uri 1989) in which the effect of research and development and the advertisement concentration variables on the performance of economic firms is evaluated, research and development and the advertisement concentration variables (as behavioral variables) are derived for the Iranian producing firms and their effects on the firm growth, which is the performance index (alongside with firm size), are evaluated. Before introducing and estimating the studied model, a definition of behavior and performance of firms are provided next.

4. Firms Behavior

Behavior is one of the three elements of the market and in fact is a model used by firms to harmonize them with the market condition. Any decision or policy that a firm uses to continue its work in the market lies in the area of behavior. Some of the behavior variables are: Pricing policies, Production policies, Sale enhancement policies,

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Reaction to rivals' behavior, Research and development, and advertisement.

5. Performance

Economic performance is a bunch of effects and consequences generated form economic activities. Because of the variety of the firm activities, the economic performance has different dimensions. The economic performance of firms can be understood in three areas: Firstly, each firm buys from the input and labor markets as buyer of resources and human capital. Secondly, the performance of the firms relate to organization of production, coordination of human forces, production tools and other inputs, choice of technology and production method and finally managing the financial issues. Thirdly, each firm inters in selling and buying of goods and services (Kahshi, 2009). In fact, the performance is the results of activities done by firms to reach their goals.

The results are measurable by different criteria. On this basis, some of the important performance indices are profitability, growth, the quality of outputs and services and the distributive and productive efficiency.

In recent years, the advertisement expenditure has been considered as one of the important behavioral elements which is supposed to be effective on firms sale, and hence their growth and size. However, there are some disagreements on the causality between advertisement and sale. On the other hand, investing in research and development helps knowledge production and technical improvement and consequently, the learning of the labor force would be affected. Considering all of what was stated and paying attention to Iranian firm data limitations, we evaluate the effects of advertisement, research and development and size on the firm growth.

6. The Panal Regression Model

The methodology of this paper is of a quantitative nature and a panel of data would be used (we should pay attention that generally statistical data can be classified into three groups which are cross

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section, time series and panel data). Considering the research conducted in recent years, we come to this conclusion that there is growing trend in usage of panel data. Considering the positive characteristics of the panel estimation and because of the nature of data used, in this paper the panel technique is used, which is a combination of cross section and time series. After model specification and introducing variables, the stationary test and those tests related to panel data will be conducted.

7. Model Specification

$$y_{it} - y_{it-1} = \alpha_i + \beta y_{it-1} + \lambda adv_{it} + \delta r \,\&\, d_{it} + v_{it}$$

where y_{it} is the logarithm of the firm size in time t;

$y_{it} - y_{it-1}$ is the growth index;

α_i is the intercept for showing the individual firm effect;

β shows the fact that whether or not there is any relation between the firm growth and its initial size;

λ shows the fact that whether or not there is any relation between the firm growth and advertisement cost;

δ shows the relation between research and development cost and the firm growth;

v_{it} is the error term of the growth equation.

8. The Results of Stationary Test

As the results of the growth equation stated in the table shows, the independent and dependent variables in the regression model are stationary in level and hence there is no need to first order difference (Table 1).

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9. The Breusch-Pagan Test

Breusch-Pagan (1980) uses the Lagrange Multiplier (LM) to perform panel data test via random effect test. For this purpose, these assumptions are considered:

$$H_O = \delta_U^2 = O \qquad H_1 = \delta_U^2 \neq O$$

Where the acceptance of the H_0 means that it is better to use panel data and the rejection of H_0 means that there is random effect in the model. The statistic used to this test is χ^2 which can be stated as:

$$LM = \frac{nT}{2(T-1)}\left[\frac{\sum_{i=1}^{n}\left[\sum_{t=1}^{T} e_{it}\right]^2}{\sum_{i=1}^{n}\sum_{t=1}^{T} e_{it}^2} - 1\right]^2 = \frac{nT}{2(t-1)}\left[\frac{\sum_{i=1}^{n}(Te_i)}{\sum_{i=1}^{n}\sum_{t=1}^{T} e_{it}^2} - 1\right]$$

According to the table5 H_0 is rejected which means that there is random effect in the model (Table 2).

10. The Hausman Test

To select between random and fixed effects, Hausman (1987) provide a kind of test. The assumptions of this test are:

- If H_0 is accepted, the random effect model is preferable.
- If H_1 is accepted, the fixed effect model is preferable.

According to results presented in the table, H_0 is rejected and hence the fixed effect model is preferable (Table 3). The estimation the model using panel ordinary least squares is presented in Table 4.

11. Analyzing the Results of the Regressions

The specified model is regressed considering the assumption of fixed effects. According to the results, the advertisement expenditure has a positive and meaningful effect on the firm growth. The research and

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development variable has a positive and meaningful effect on the firm growth too. But, there is no meaningful relation between the firm size and its growth which means that Gibrat law can be verified (Table7).

The advertisement is one of the signs which affect the behavior of the firm in the industry. Suppose that a firm has decided to have a wide-ranging advertisement. If the firm could increase its market share and become dominant in the market via expanding its advertisement, this behavior (advertisement) changes the structure and performance of the firm through changing the level of concentration.

Similarly, the expansion of the research and development activity of the firm, as a change in the behavior can change the structure and performance of firms. These changes can happen in this way that by introducing new kinds of goods, the variety of goods in the market increases. This will increase the level of output differentiation and also the barriers to entry.

The distribution of the firm size is not equal in most of the industries. In other words, the available firms in the industry have different sizes. In this regard the issue of the relation between the firm size and its growth has been highly paid attention to specially considering the consequences it has on the level of firms' market share dispersion and industrial concentration. If large firms, averagely, benefit more from faster growth in comparison with small firms, it is expected that we see a kind of increase in the industrial concentration in different industries. But this phenomenon does not happen in all industries. So, we can come to this conclusion that changeability of firm growth is an important factor in changing the level of industrial concentration of firms.

According to the results of this research, there is no meaningful relation between the firm size and its growth process; these results are in accordance with the Gibrat law. The important point here that should be paid attention to is that different factors affect the firm growth which can affect the relative change of the firm size. These factors include entrepreneurship ability, changing the demand for output and stochastic factors. Evaluation of these factors is very difficult and sometimes impossible. So, it is assumed that these different factors have no systematic relation with the firm size in a specific period of time. Therefore, the firm size is a stochastic process.

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In fact, the probability of change in the firm size in a specified time period is independent of the initial size of the firm. Some firm are benefited from an appropriate growth while some others have experienced a very limited one.

Table 1: The Results of Stationary Test on Firm Variables

	Null: Unit root	**Statistic**	**Probability**
Growth of firm $(y_{it} - y_{it-1})$	Levin, Lin & Chu t*	14.4286	0.0000
	PP - Fisher Chi-square	217.356	0.0000
	Levin, Lin & Chu t*	14.4286	0.0000
Firm size (y_{it-1})	Levin, Lin & Chu t*	4.42979	0.0000
	PP - Fisher Chi-square	234.026	0.0000
lnr&d	Levin, Lin & Chu t*	5.12800	0.0000
	PP - Fisher Chi-square	58.6558	0.0000
lnadv	10.5216	-10.5216	0.0000
	87.4567	87.4567	0.0001

Table 2: The Breusch-Pagan Test on firm variables

Null: Unit root	**Probability**	**Statistic**
Cross-section F	2.343592	0.0013
Cross-section Chi-square	49.515944	0.0004
Period F	1.950682	0.0467
Period Chi-square	17.912926	0.0362

Table 3: The Hausman Test on Firm Variables

Test summary	**Probability**	**Statistic**
Cross-section random	46.827267	0.0000
Period random	13.998743	0.0029

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Table 4: The Estimation the Model Using Panel Ordinary Least Squares

Variable	Coefficient	Standard deviation	Probability
Lnadv	0.994152	13.92621	0.0000
Lnr&d	0.709447	6.196207	0.0000
Yit-1	-0.118551	-0.359410	0.7197
α_i	-11.39686	-3.252546	0.0014

DW statistic	2.032798
statistic F	8.356778
P-value	0.000
R^2	0.509608
(adjusted) R^2	0.448628

12. Conclusion

As previously was said, research and development and advertisement expenditure factors have positive and significant effects on the firm growth. In contrast, there is not a significant effect between the initial size of a firm and its growth. Based on the findings of this study, the Gibrat law was confirmed. In addition, the direct relation between the behavioral elements and firm performance was verified.

On the base of these results, the traditional view about the firm size impact on the economic growth face with challenge. In fact policy of expanding small and medium firms especially in developing countries has been failed and this group of countries is better to pay attention more to the other factors such as competition, human capital, research and advertisement.

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