An Empirical Study on Factors of Concentration in Taiwan Manufacturing Industry

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ABSTRACT

According to the industrial economics, the more firms enter, the more competitive a market becomes. Thus, it fosters the remaining firms become much productive under the assumption of other things being equal. Studying on how the extent of competition in markets influences the entry of firms, therefore, is a critical issue. On the other hand, the industrial economics reveals that the extent of competition may also impact the entry of firm. That is, there is an interaction relationship between the entry of firms and the extent of competition. Preceding related articles, however, focus either on the influence of firm entry on the competition, or on the effect of competition on firm entry. Consequently, this paper will examine the interactions between firm entry and competition to comprehend the influence of firm entry on the competition, and to analyze the factors of firm entry.

By means of Taiwan manufacturing census data in 1986-1996, this paper examines the relation between firm entry and competition in 1986-1991 and in 1991-1996, respectively. The subjects of study are the number of firms that began operations, four-firm concentration ratio, and price-cost margins. The regressions of entry-determined equation and competitive variation equation are created, and 2SLS is employed to analyze the relation between firm entry and competition of Taiwan manufacturing industry. Keywords: Concentration, Entry, Competitive, Market Structure

INTRODUCTION

In accord with industrial economics, a perfectly competitive market is much efficient than the imperfect one. As a result, the extent of competition directs performance in industries. Furthermore, recent industrial theories indicate it is crucial for industrial performance whether firms may freely enter the industry. There is a certain relationship between entry of firms and the extent of competition impacting on performance in industries.

Theoretically, firm entry is a main factor that determines the extent of competition. In general, the more firms enter, the more competitive a market becomes. The level of competition, on the other hand, may also affect the entry of firms either in markets or in industries. The more competitive a market is, the easier a firm enter; namely, it is an obvious positive interaction between firm entry and extent of competition. In addition, the empirical results also showed that there is a negative effect between firm entry and market share of large-scaled firms. Since firm entry may decrease market control of large-scaled firms, it may make the industry become more competitive and profitable. Besides, some empirical studies on determinant of entry also indicate that the level of the extent of competition may significantly affect firm entry. We usually exert four-firm concentration ratio as an indicator while evaluating the extent of competition in an industry, whereas the data of net firm entry rate, the sizes of firm entry, and initial scale of firm entry were adopted to examine entry of firm.
Both the theory and empirical statistics state a positive relation between firm entry and the extent of competition. This relationship is not unidirectional, but bidirectional interaction. Though there are plenty of studies discussing on firm entry from abroad, they chiefly put emphasis either on how firm entry affect the extent of competition or how the extent of competition impact firm entry. In comparison with the related domestic articles, there are only a few. Accordingly, this paper, based on firm entry and the extent of competition, will compare theories with empirical results to unravel the relation between firm entry and competition in Taiwan’s four-digit manufacturing industry.

RELATED LITERATURE REVIEW

Plenty of studies discussing on firm entry abroad put emphasis either on how firm entry affects the extent of competition, or on how the extent of competition influences firm entry. However, there are only few studies in Taiwan. Apart from that, reviewing articles of firm concentration ratio and variation of determinant are widely studied both at home and abroad. As a major reference of this paper, this chapter will inspect each key study, and elaborate its core thesis from author’s perspectives. For the sake of creating an appealing theory, this paper will compare and categorize articles mentioned below.

Influence of firm entry on market structure

By means of U.S. manufacturing census data of 151 industries in 1947-1963, McGuckin (1972) collated top ranked firms’ market concentration rate of change and net entry rate of change, and suggested that there is a negative effect between firm entry and market share of large-scaled firms. Meanwhile, he also pointed out there are few drawbacks if net firm entry rate and concentration ratio are applied as indicators of market share. Generally speaking, using the number of firms may overestimate the significance of firm entry, because the entry of firms is relatively smaller than the remaining firms. Some scholars, therefore, don’t use net firm entry rate as an indicator, but initial market share of new firm entry instead. If the net firm entry rate is small, compared to the whole manufacturing industry, and the growth of new firm is greater than remaining firms’, the net firm entry will be a better measure than market share of new firm entry. Besides, if potential new firms pose a threat to remaining ones, it results in a considerable competition as though it is a small firm. As a result, net firm entry rate is the best candidate for examining market structure and variation of the extent of competition. Also, when concentration rate was applied to evaluate market structure, we encountered similar situations that had been spotted when firm entry is analyzed by net firm entry rate. Since concentration rate is just an indicator, it cannot simultaneously consider the distribution of the number and the size of firms in an industry. In other words, highly concentrated industries do not necessarily stand for uncompetitive. Since concentration rate can assess the market share of large-scaled firms, it can also examine the effect of firm entry on this ratio. As addressing market structure variation, concentration ratio is indeed the most plain and straightforward indicator.

Mueller (1991) advocates few methods which were used by remaining firms to keep new firms from entering. For example, price-cutting may prevent new firms from making profits; setting high yield may shrink market demand and stop new firms from earning; the sunk cost of advertisement may act as entry barrier; decision-making advantages may give rise to advanced technology and priority of production resources. Mueller also points out that economic models of firm entry and exit progress confirmed either the influence of the level of industrial profit on a firm’s entry and exit, or the effect of firm entry and exit on the level of industrial profit. Most of the studies, however, support the influence of
the level of industrial profit on a firm’s entry and exit, but hardly defend the latter thesis. He took the
history of cereal industry in the U.S. to demonstrate this phenomenon, and revealed that firm entry and
exit are not statistically significant to price cost margin and profit rate. He believed that if the industrial
development is robust, the new domestic firm may only cause slight damages to the profit of remaining
firms; it is, however, a different story when it comes to the international firms. If an international firm
enters a domestic industry (say international competition), it will cause a great transformation either in the
profit of remaining firms, or in industrial structure. This external competition is much greater than the
internal competition.

Kessides (1991) created a simple model of firm entry to explain the determinants that influence the
decision making of firm entry, and to make a proper definition of sunk cost, which plays an important
role when examining the barrier of entry. He regarded conventional experiment was conducted under a
loose-defined model whose hypothesis testing is improper; and, therefore, it will be lack of the
significance of testing in the entry model. The differences between his empirical model and others are his
model can provide valuable insight to the economy as well as enable meaningful hypothesis testing in
economy. Accordingly, an estimating equation is derived from this model. Net entry number is affect by
the profit level of initial remaining firms, minimum efficient scale of entry, growth rate of demand, price
elasticity of demand, and the size of sunk cost. He took four-digit industries in U.S. manufacturing as the
subjects of study, and created an equation to test some major hypothesis. Empirical results showed that
sunk cost effectively block the entry of firm; that is, sunk cost is the main barrier of the extent of
competition. Consequently, he suggested public policies should aim to boost market performance. For
example, providing the incentive on tax deduction of leasing, old factory buildings reuse, and using
accelerated depreciation method, are policies that can reduce sunk cost. Since advertisement is a barrier of
new competition, he, then, presented a direct test, and divided ads into two types: sunk cost of firm entry,
and the uncertainty of firm entry. Ads may increase (persuasion theory) or decrease (information
processing theory) the possibility of success of a firm to enter a market. Empirical results support sunk
cost effects of ads and information processing theory, whereas deny persuasion theory.

As for empirical results, Joachim Schwalbach (1991) bring different perspectives on the
relationship among firm entry, firm exit, concentration ratio and competitive market. 79 four-digit
industries of German manufacturing in 1983-1985 were used as subjects of study. Based on Weiss’ theory
(1965), he investigated in the influence of firm entry on concentration ratio by evaluating the effect of
firm entry on market share loss of top ranked remaining firms, whereas the opposite approach was applied
when we consider influences of firm exit. According to the empirical results, firm entry and exit have
more thorough explanation than other factors, such as merge, internal growth, and factory replacement.
The concentration ratio may also be affected significantly by the essential elements of industry, such as
market scales and capital demands. Setting the progress of firm entry and exit, he introduced Orr’s (1974)
model to evaluate firm entry by applying gross entry rate. Empirical results turned out that profits and
growth rate of demand draw firm entry, whereas economies of scale and research activities effectively act
as the barriers of entry. Contrary to the traditional results, product differentiation and capital requirements
barrier to entry appeal new firm to join. He, on the other hand, calculated the height of barrier of firm
entry, and discovered some industries, whose barrier of firm entry is low, carry out relatively low firm
entry and high concentration ratio. He viewed these industries as contestable market.

There is another study on the influence of firm entry on market structure. Focused on the interaction
among structures, behaviors, and performance, Masson (1990) took 62 Korea manufacturers in 1976-
1981 as his study subjects, and set down a simultaneous equation model, consisting of concentration ratio,
net entry rate, and profit rate. The results also showed the net firm entry has negative effect on the concentration ratio of top ranked firms. Since the firm entry steals market share from remaining firms and results in the negative interaction mentioned above, the industry become more competitive, resulting from decreased market control of large-scaled firm.

Based on these references listed above, the firm entry has a positive effect on the extent of competition; namely, the more firms enter, the more competitive the industry becomes.

**The impact of the extent of competition on firm entry**

As stated by industrial economics, the industrial structures, such as the level of concentration ratio, number of firms, and the barrier of firm entry are considered when a firm enters a market. The higher concentration ratio of an industry is, the less competitive the market becomes. By then, the remaining firms can hold greater market shares, and, therefore, avert undesirable competition, known as entry of new firms. Consequently, the level of concentration ratio, or the extent of competition, may block the firm entry. Apart from the concentration ratio, the level of price cost margin may also reflect the extent of competition. Accordingly, it may affect the threshold of firm entry. All of these confirm higher concentration ratio and price cost margin result in an uncompetitive market as well as an unpleasant environment toward new firms. On the contrary, the uncompetitive market may also represent the possibility of high earn profit, which draws firms to join. Thus, the effect of the level of concentration ratio and of price cost margin on firm entry is uncertain as gauging the extent of competition.

**DESCRIPTION STATISTICS AND ANALYSIS**

We conclude the few summary from Taiwan manufacturing industry census data below:

1. The average of net entry rate of four-digit manufactures in Taiwan manufacturing industry is 37%, and of net entry number is 149 in 1986-1991. Since the industrial structure underwent adjustments, some industries grew rapidly and yield high firm entry rate. For example, the net firm entry rate of powder metallurgy industry and of data processing equipment manufacturing is 265% and 264%, respectively. Besides, other 122 industries also present positive net firm entry rate. On the other hand, some industries’ net firm entry rate plunged. For example, rope, cable and net manufacturing, as well as bamboo and cane products manufacturing present net firm entry rate of -66% and -56%, respectively. In addition, other 39 industries also presented negative value on their net firm entry rate. Overall, the net firm entry rate varied, up to 60% standard deviation, in Taiwan manufacturing industry.

2. The average of net entry rate of four-digit manufactures in Taiwan manufacturing industry is 31%, and of net entry number is 63 in 1991-1996. Compared to the net firm entry rate in 1986-1991, 37%, it is lower, and suggests that the economic development by then is tardy and much mature whose firm entry rate is normally lower than the developing ones, 1986-1991 by this case. Still, the 31% firm entry rate was remarkable. 139 industries carried positive firm entry rate; 87 industries, negative. Then, the standard deviation is 180% implying that manufacturers frequently enter, or exit, an industries in Taiwan manufacturing industries, and that the differences in the degree of firm entry was greater than in 1986-1991. All these fluctuation differences were resulted from the internationalization, liberalization, and the transformation of domestic economic environment in 1991-1996.
3. According to the data in 1986-1991 and in 1991-1996, we conclude that higher firm entry lead to lower concentration ratio, that firm entry raises the extent of competition, and that the relationship between firm entry and price cost margins is insignificant. Clearly, different results are obtained when concentration ratio and price cost margins are used to evaluate the extent of competition.

4. In 1986-1991, both concentration ratio and firm entry rate is high, whereas this was not what we expected. Possible reason is that all the new-entering firms are small which cannot hurt the extent of competition of top four firms. Besides, it is unobvious between price cost margins and firm entry.

5. In 1991-1996, the relation between concentration ratio and entry firm is insignificant. Some industries, having high concentration ratio, have high firm entry rate, some industries, featuring low concentration ratio, possess low firm entry rate, and still some industries, which is monopolistic competition, present both high and low firm entry rate with inconsistent direction. As a result, firm entry rate may be affected by the properties of industries, and may give rise to inconsistent results. Furthermore, the price cost margins has a significantly negative effect on firm entry. In addition, high price cost margins (i.e. uncompetitive) pose a negative effect on firm entry. Since the large-scaled firms have greater price cost margins, it can not only provide a solid infrastructure but also engage any strategy to raise the threshold of firm entry, such as advertisement.

THE SETTING OF EMPIRICAL MODELS

In order to further the analysis of the relation of firm entry, the extent of competition, and the determinant of net firm entry, this section will accord with the basis of theories that were mentioned. First, we will introduce two simultaneous equation models. Then, we will explain evaluation of explanatory variables in the models and its hypothesis testing. The descriptions of two regression equations are written below.

\[
\Delta C_{t}/C_{t-1} = \alpha + \alpha \cdot ENTRY_t + \alpha \cdot \Delta VA_{t}/VA_{t-1} + \epsilon_1
\]

\[
ENTRY_t = \beta_1 + \beta_2 \cdot \pi_t + \beta_3 \cdot MESS_{t-1} + \beta_4 \cdot LPA_{t-1} + \beta_5 \cdot AD_{t-1} + \beta_6 \cdot RD_{t-1} + \beta_7 \cdot C_{t-1} + \beta_8 \cdot \text{GR}_t + \beta_9 \cdot LVA_{t-1} + \beta_10 \cdot EX_{t-1} + \epsilon_2
\]

\(\Delta C_{t}\): the change of concentration ratio between time t and time t-1

\(C_{t-1}\): the previous concentration ratio

\(ENTRY_t\): the net firm entry rate

\(\Delta VA_{t}\): the change of market size between time t and time t-1

\(VA_{t-1}\): the previous market size

\(\pi_{t-1}\): the previous profit rate

\(MESS_{t-1} / \text{total assets}\)

\(LPA_{t-1} / \log(PA_{t-1})\)

\(PA_{t-1}\): the capital demand of asset per person

\(AD_{t-1}\): the previous advertising expense ratio

\(RD_{t-1}\): the previous research and development expense ratio

\(\text{GR}_t\): the growth rate of demand

\(EX_{t-1}\): the previous export ratio
THE ANALYSIS OF EMPIRICAL RESULTS

Table 1 is the empirical results calculated by simultaneous equation of 1986-1991. Table 2 is the empirical results calculated by simultaneous equation of 1991-1996. These empirical results include three model settings. In the first equation: we place all the possibility that may influence the variables of firm entry into firm entry determined equation. However, its experimental results do not meet our expectation. Many barriers of firm entry, such as concentration ratio, minimum efficient scale, capital demands, commercial fees, and research and development expense are insignificant, whereas capital demands, growth rate of demand, market size, and export have significant influence on firm entry. Owing to the variables of entry barrier in the first equation, the results are unreasonable. Accordingly, we simply keep the most significant variable of entry barrier: minimum efficient scale and concentration ratio, and exclude other variables of entry barrier as the second model of estimation. As the results showed in the second model of estimation, the effect of minimum efficient scale still insignificant. Therefore, we merely keep the concentration ratio and eliminate other variables of entry barrier as the third model of estimation.

In the light of these three models’ empirical results, we conclude that net firm entry rate has negative effect on concentration ratio and presents statistically significant. Thus, when net firm entry rate becomes higher, we can infer that concentration ratio will decline, and that market structures become more competitive. However, it is not what we expected that the change rate of market scale have positive influence on the change rate of concentration ratio. This phenomenon might result from the limited resources of variables. As for the determinant of firm entry rate, we found that the value of and the influence of profit rate on firm entry rate is positive and insignificant, respectively. Regression coefficients of variables of barrier of firm entry, such as minimum efficient scale, capital per person, proportion of advertising expense and research, and concentration ratio, are positive. Though these variables are not statistically significant, the results appear to contradict their expectation, but suggest barrier of firm entry has negative, or no, effect on net entry rate instead. Probable explanation is that net firm entry is derived from subtracting firm exit from firm entry, and that barrier of firm entry has negative effect either on firm entry, or on firm exit. As a result, net firm entry, resulting from subtracting firm exit from firm entry, is influenced by positive and/or negative barrier of firm entry, which may offset the net firm entry, and yield either statistically insignificant, or opposite sign results. Another reasonable explanation is that it is a prospering period whose economic growth rate is remarkably high in 1986-1991 (as described in Table 1). Consequently, the barrier of firm entry has small influence on firm entry in this period. That is, these barriers of firm entry are not significant when it comes to economic prosperity.

Based on R2 (adjusted) criteria, the third model is the best among these three models. From the third model, we learned the primary factors are previous concentration ratio, industrial growth rate, and the characteristic of export. Previous concentration ratio, having positive and significant impact on firm entry rate, states that concentration ratio and firm entry rate increased in Taiwan manufacturing. A possible explanation is that the scale of new firms is quite small, compared to the market, that they cannot bring any adverse effect on remaining firms, and that they may share profits from monopolistic market of remaining firms. Accordingly, we inferred that high firm entry rate may results either from super-normal profit, which come along with high concentration ratio, or from same number of entry in high concentration ratio industries, whose manufacturers is less than other industries.
Table 1: The empirical results calculated by simultaneous equation of 1986-1991

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<th>ENTRY&lt;sub&gt;1&lt;/sub&gt;</th>
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<th>ENTRY&lt;sub&gt;3&lt;/sub&gt;</th>
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<th>ENTRY&lt;sub&gt;5&lt;/sub&gt;</th>
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Numbers in brackets under the parameter estimates are the standard errors. *, **, and *** indicate that the coefficient is significantly different from zero at the 10%, 5%, and 1% level, respectively.

Table 2: The empirical results calculated by simultaneous equation of 1991-1996

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<td>GR&lt;sub&gt;t&lt;/sub&gt;</td>
<td>0.289***</td>
<td>0.293***</td>
<td>0.300***</td>
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<td></td>
<td>(7.819)</td>
<td>(8.097)</td>
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CONCLUDING REMARKS

By means of Taiwan manufacturing census data in 1986-1996, this paper aims to study the relationship between the entry of firms and the extent of competition on four-digit manufacturing industry. In the paper, the simultaneous model consisted of entry-determined equation and competitive variation equation is created, and then 2SLS is employed to analyze the competitive variation affected by entry rate, and determine the factors for new plant entry.

The conclusion of this study shown as below is summarized eight points.

1. The average net firm entry rate is 37%, and the average firm entry number is 149 based on the data of Taiwan four-digit manufacturing industry during the period from 1986 to 1991. According to the adjustment of industry structure, some industries grow rapidly and boost the firm entry rate like powder metallurgy industry, 265%, and data processing equipment manufacturing, 264%, whereas some industries decline. For example, rope, cable and net manufacturing as well as bamboo and cane products manufacturing carry -66% and -56%, respectively. In sum, the net firm entry rate varied, up to 60% standard deviation, in Taiwan manufacturing industry.

2. The empirical results from 1986-1991 imply that increasing firm entry rate results in concentration ratio decline and competition in market structure. Moreover, the influence of empirical results of determinant of firm entry rate indicates that variables of barrier of firm entry, such as minimum efficient scale, capital demand of asset per person, and proportion of advertising expense and research have insignificant effect on firm entry rate. In other words, these variables of barrier of firm entry cannot block, or affect, firm entry in 1986-1991. The growth rate of demand and export of industry are two primary variables that influences on and have significantly positive effect on firm entry. Besides, concentration ratio also has significantly positive effect on firm entry. The results affirmed that high concentration ratio industries result in high firm entry rate, whereas this is not what we expected. The results, however, correspond to the Yamawaki’s (1991) study on Japan’s industries during 1979 and 1984. Also, he pointed out that growth rate of demand is the main cause to firm entry. As a result, high growth rate of demand in 1986-1991 in Taiwan, whose economic growth rate is also high, is the primary reason for firm entry. Since the market scale in Taiwan is small, the growth of industries depends on international market. Accordingly, the scale of exportation is another critical issue on firm entry. Jeong (1991) and Duetsch (1975) have the same empirical results with respect to the positive effect on firm entry. Their reason is that high concentration ratio is consistent with high expected profits. Thus, high concentration ratio results in the increase of firm entry, whereas it has no obvious effects on past profit rate.

3. The average of net entry rate of four-digit manufactures in Taiwan manufacturing industry is 31%, and of net entry number is 63 in 1991-1996. Compared to the net firm entry rate in 1986-1991, 37%, it was lower, and suggested that the economic development by then was tardy and much mature whose firm entry rate is normally lower than the developing one, 1986-1991 by this case. Still, the 31% firm
entry rate was remarkable. Hosiery manufacturing and textile gloves manufacturing, for example, carried net firm entry rate of 2321% and of 1020%, respectively. Pulp manufacturing and towel manufacturing, on the other hand, presented a negative growth of firm entry rate of -75% and -74%, respectively. The standard deviation of net firm entry rate is 180%, which is greater than last five years, and may be attributed to internationalization, liberalization, and transformation of domestic economic environment in 1991-1996.

4. The empirical results from 1991-1996 reveal that higher firm entry rate will lower concentration ratio and promote a stable market structure. Apart from concentration ratio, growth of demand also has positive effect when it comes to firm entry rate, whereas exportation is insignificant. Besides, the effect of entry barrier on firm entry rate is corresponding to the thesis, but it is not statistically significant. As Yamawaki concluded on his study, the signs of regression coefficients of variables of entry barrier varied from time to time, and most of variables are insignificant. On the whole, demand and different economic environment are two primary factors of firm entry rate.

5. Comparing the empirical results from 1986 to 1991 and from 1991 to 1996, we discovered that concentration decrease whenever firm entry rate increase, especially during 1986 and 1991. We also found that the main factor of firm entry is “demand”, which present greater cause in 1991-1996 than 1986-1991. The determinant of entry barrier are neither significant nor coherent with the theory of industrial economics. It is worth mentioning that the export does no effect on firm entry in 1991-1996. The reasonable explanation is that manufacturers raise their overseas investments and productions, but partial substituting productions in Taiwan to compromise with the economic environment shift in 1991-1996.

6. This study concluded that two market structure indicators, CR4 and PCM, barely share connections. Also, we learned that PCM and CR4 have different explanation on the extent of competition and firm entry rate. The chief reason may be the limited recourses of PCM.

7. To review barrier of firm entry in each industry during 1991 and 1996, we introduce the theory of competitive market to analyze the competition of market, compared to the firm entry rate and concentration ratio. We found that some industries have low barrier of firm entry, low firm entry rate, and high CR4, whereas some industries have low barrier of firm entry, high firm entry rate, and high CR4. These industries need further studies on their properties to analyze it competitive.

8. As stated by the study results, the more firm enter, the more competitive a market becomes. Demand is the main cause of firm entry in Taiwan manufacturing. Accordingly, market expansion can promote firms to surge in and increase competition. Since Taiwan is a foreign-oriented economy of small scale, the key to market expansion are internationalization, liberalization, and raising international competitiveness. In addition, all results and theories of this paper show that higher firm entry results in more competitive industries, and that barriers of firm entry indeed prohibit firm from entering. In order to achieve better economical benefit and economic welfare, the policies should aim to lower the barriers, and facilitate firms to enter, thereby raising the extent of competition.

Failing to acquire the number of firm entry and exit from four-digit manufacturing industry, this study simply use net entry number to examine the influence of firm entry on the extent of competition. Though net entry number can also be applied to assess firm entry, it may underestimate the importance of firm entry, especially in Taiwan whose firm entry (and exit) number are quite significant. In addition, this paper need further studies since it cannot thoroughly explain the influence of firm entry and exit on market structure and the extent of competition. If the firm entry and exit annual data from four-digit
manufacturing industry are given, we can analyze these data via panel data or related quantitative methods, and further this study. Or we can approach firm entry from market share of new firm.

REFERENCES


