IJMS 13 (SPECIAL ISSUE), 83-101 (2006)

INDUSTRIAL STRUCTURE AND CONCENTRATION IN MALAYSIAN MANUFACTURING INDUSTRY

MUHAMMAD RIDHUAN BOS
Faculty of Economics
Universiti Utara Malaysia

SUHAILA ABDUL JALIL
Faculty of Economics and Management
Universiti Putra Malaysia

ABSTRACT

The study uses econometric analysis; the least square method is used to determine factors that influence changes in the level of concentration of the 103 Malaysian manufacturing industries. The result shows that the concentration ratio of the Malaysian industries are rather high when compared with those in most other countries. At the same time our analysis reveals that competition in certain sectors of the Malaysian manufacturing industry have increased over time. Most importantly, the analysis supports the hypothesis that economies of scale are the major source of concentration. Other variables use in determining the industrial concentration is barriers to entry, the size of industry and foreign ownership.

JEL Classification: L10, L11.
Keywords**:** *Concentration; Competition; Market power; Economies of scale; Entry barrier.*

ABSTRAK

Kajian ini menggunakan analisis ekonometrik kaedah kuasa dua terkecil bagi menentukan faktor yang mempengaruhi perubahan dan tahap pemusatan industri dalam 103 sampel industri pembuatan di Malaysia. Keputusan analisis menunjukkan nisbah pemusatan industri di Malaysia agak tinggi berbanding dengan negara lain. Di samping itu, persaingan dalam industri pembuatan di Malaysia menunjukkan peningkatan. Paling penting, kajian ini menyokong hipotesis bahawa skel ekonomi adalah sumber utama penentu

pemusatan. Pemboleh ubah lain yang digunakan untuk menentukan pemusatan industri ialah halangan kemasukan, saiz industri dan pemilikan asing.

INTRODUCTION

Of late, much attention has been given to industry market structure and their relationship with market power. The effects of market integration, – due to globalization and advanced technology - policy intervention by government has changed the trend in industrial structure in many developing and industrialized countries.

Market structure refers to the number and the size of the distribution of firms in the economy with barriers to entry and product differentiation. It is defined mainly by the concentration of market share in the market. On the other hand, conduct refers to pricing behaviour, product strategy and advertising, as well as research and innovation by firms. It also includes the firm's behavior such as competitive or collusive. Performance is the production and allocative efficiency of firms, the economic equi-distribution of profits among firms and firms' progress. Hence, structure and conduct are related to how the market functions within the limits of its basic conditions, whereas performance relates to how well it functions.

Many studies have shown that there can be a strong relationship between structure-conduct-performance (SCP) of the firm and market power. Greer (1992), defined market power as the ability to influence market price and/or to subdue rivals. According to the basic theory of market structure, higher concentration will increase the firm's profit which will be followed by higher price thus increasing its market power. Empirical studies often reveal that the association of profit and market concentration is due to the 'ability' of firms to influence price levels. In other words, the more concentrated an industry is, the better, for it to become monopolistic with higher price-cost margin or profits, which can gradually enhanced market-power of the industry.

The level of industrial concentration can also characterize markets. When an industry becomes more concentrated, there are greater chances that it will become monopolistic. Apparently market concentration can be divided into three dimensions; namely; the number of firms in the industry, their relative shares in the market and the viability of collusion by leading firms which will eventually cause concentration to take place. Concentration can be a good indicator of

competitiveness for the manufacturing sector because it offers better prospect for the industry's export earnings and rapid productivity growth, as well as greater price stability.

COMPETITION VS. CONCENTRATION

A study on issues related to efficiency and productivity for the purpose of enhancing competitiveness of the Malaysian manufacturing industries would be useful. Such matters on whether the industrial market structure would encourage greater efficiency, productivity and competitiveness of the Malaysian industries have hardly been raised at all. These factors are important and it can have great influence on the nature of competition in the manufacturing sector.

The neoclassical analysis traditionally shows that monopoly leads to an inferior allocation of resources by restricting output below the competitive level. An optimal allocation of current resources requires output to be increased until the marginal benefit derived by consumers equals the marginal cost of production. However, it is argued that this level of output will not be attained because the monopolist maximizes profit by equating marginal cost with marginal revenue. As a result there is a reduction in consumer surplus and deadweight welfare loss to the society.

Competition is often seen as a spur to economic efficiency as firms pursue and adopt innovation in order to gain competitive advantage. Economists argued that competitive market structures will increase consumer choice and welfare. At the same time competition is also said to encourage efficiency by allowing most efficient firms to survive and grow at the expense of their inefficient counterparts. Under the Structure-Conduct-Performance (SCP) approach, a good structure is defined in terms of perfect competition. This approach focuses on the performance of industries and suggests aspects of structure and conduct that could be adjusted to bring about desirable performance outcome. In other words, competition defines good performance, and appropriate industry structure to ensure such performance.

In industrialized countries like the United Kingdom (UK) and United States (US), much attention has been given to the evolving market structure. In the US, for instance, globalization to a certain extent have some degree of influence on how imports can serve to change competition on domestic markets due to the constraints on the use of antitrust policies. This is especially true when imports come from

foreign firms but are controlled by domestic companies, therefore globalization may lead to less competition. On the other hand it will encourage the increase in the concentration of firms. Although government can influence the concentration of industries in a variety of ways but if permission for various horizontal and vertical mergers were granted market concentration may be fostered further (Pryor, 2001).

The trend towards market concentration in the US as Pryor concluded, has increased from 1982 to 1999, with due consideration on factors such as increased in globalization, recent changes in information technology and the rise of e-commerce. The merger wave in the U.S. was significant in determining the changes in industrial concentration pattern through government influence on industrial concentration by allowing various horizontal mergers.

Similar situation has also taken place in Malaysia where the government encourages mergers and acquisition, in the banking and insurance industries. Since then, research in this area has mushroomed. Besides that, the period of 1980 to 1998 saw 20 most dynamic products in the world being traded. Most of which fall into four categories, and they are electronic and electrical goods (SITC 75, 76, 77); textiles and labor-intensive products, particularly clothing (SITC 61, 65, 84); finished products from industries that require high research and development (R&D) expenditures which are characterized by high technological complexity and/or economies of scale (SITC 5, 87); and primary commodities including silk, food, non-alcoholic beverages and cereals (SITC 261, 111, 084). Motivated by the scenario of the Malaysian market, this paper focuses on the market structure and industrial concentration in the Malaysia's industrial sector. Perhaps, it may be useful to investigate whether competition or concentration in these industries has indeed increased overtime.

The intention of this paper is to carry out an investigation by looking at the changes in the determinants of industrial concentration, which is considered as the simplest measure of market power. Hence, the objective of this study is to empirically examine the significance of the determinants of industrial concentration within the Malaysian manufacturing sector by setting up a concentration model for industry, based on the hypothesis that entry of foreign firms will encourage merger and concentration of the local industries.

The paper is organized as follows. The following section reviews existing literature on the market structures and the determinants of

changes in the levels of industry concentration. The theoretical model on industry concentration plus the statistical method applied will be discussed in section four. Section five discusses on the results of the empirical analysis. Finally, summary, policy implications and recommendation plus suggestion on future research areas are presented in section six.

INDICES FOR THE MEASUREMENT OF CONCENTRATION AND THE DATA

Researchers and policy-makers use various concentration indices to capture industry structure. The extent to which industries are concentrated provides useful information on the extent and nature of competitive forces acting upon firms in a particular industry at any given time. For the purpose of our study concentration ratio and Herfindahl index have been used to measure concentration.

Among the most commonly used measure for concentration is the *K*-firm concentration ratio. It is defined as the cumulative share of the *Kth* firm measurement with *si* denoting the share of the *ith* firm as follows;

$$CRK = \sum_{i=1}^{K} si \qquad (1)$$

where CRK = the *Kith* firm concentration ratio
si = the percentage market share of the *ith* firm

It is the percentage of market sales (or some other measure of size, such as assets, employment, or value added) accounted for by an absolute number of the largest firms in the market - for example, the 4 or 8 or 20 largest firms. We use the 4-firm concentration ratio in our analysis on patterns and trends, as they are fairly easily understood indices of market power. These indices are also useful for international comparisons as they usually available in other countries.

Another popular index called *H index*, so named after its inventors Orris Herfindahl and Albert Hirschman. It is defined as the sum of the squared values of firm's shares. The 'paternity' of the index is somehow disputed because it is being regarded as a special case of the Hannah and Kay index for it satisfies all of Hannah and Kay's axioms. Thus, in mathematical notation Herfindahl-Hirschman's index is,

$$H\ index = \sum_{i=1}^{K} (Si)^2 \quad (i=1, 2, 3, ..., n) \qquad (2)$$

Where, *S* presented the percentage share of individual firm *i* and *n* is the number of firms in the market.

Although most of these measures have their limitations they normally tend to correlate highly with one another (Davies, 1979; Kwoka, 1981). Even in the complexity of business life it is unlikely that there is one concentration measure, which will clearly be superior in all circumstances (Curry & George, 1983). Nonetheless it is not our intention here to discuss the limitation of such measures.

For the purpose of analyzing the causes of industry concentration in Malaysia, we specify the following model introduced by Ratnayake (1999) which he used in his study to determine the industry concentration in New Zealand.

$$Cj = \alpha + \sum \beta i\, Xij + \sum \gamma i\, Yij + \sum \delta i\, Zij + \mu, \qquad (3)$$

where *Cj* is a measure of concentration in industry j,

Xij is a vector of technical causes and market condition affecting concentration

Yij is a vector of variables representing international influences

Zij is a vector of government policy related variables and

μ is an error term.

In this model the dependent variable *(Cj)* is industry concentration ratio for 103, 5-digit industries during 1986-1990. The data used to construct the value of concentration ratio is based on the industry output extracted from the data-base of the Department of Statistics.

Our hypothesis is that industrial concentration is partly determined by barriers to entry (*Xij*). Barrier to entry normally makes it difficult for new firms to enter the industry, and hence, encourage collusion and the growth of monopolistic or highly oligopolistic market structures. Factors that could cause entry barriers include economies of scale, absolute cost, degree of technical intensiveness of an industry, and high capital intensity and advertising expenses. Here, we use measures of economies of scale variable (ES), capital intensity (PCI), advertising intensity (A/S), foreign ownership (FOI) and firm's size (SIZE) to explain the industry entry barriers.

Several methods have been proposed to test for the existence of economies of scale. Ratnayake measured ES as the value added per person of the class containing the 50th percentile of industry value

added, divided by the total value added per person of the industry. We can expect a positive relationship between scale economies and market concentration. In this study, we employ minimum efficient scale (MES) as a proxy to economies of scale that was initially proposed by Comanor and Wilson (1967) and was later used in other studies including Rugayah (1992), Gan (1978), Yusof and Phang (1993a), and Nor Ghani *et al*. (2000). The proxy is calculated by using the average size of the largest plants that accounted for at least 50% of total industry output. This is equal to $\sum_{i=1}^{m} Xi/m$, where *X*i is total output of firm *i* and *m* is minimum number of firms, which accounts for at least 50% of total output of the industry.

Capital intensity (PCI) is computed as the book value of fixed capital divided by number of employees. High capital intensity may make entry difficult because not many firms can raise sufficient amount of capital in order to enter the industry at a sufficient scale to be able to compete effectively and earn profit, commensurate with the risk and cost involved. Hence, capital intensity is expected to have a positive relationship with market concentration.

Firms that can successfully differentiate their products, gain market share and raise barriers to entry will prevent new competition. This is likely to lead to high level of industry concentration. Mueller and Rodgers (1980) updated earlier work by examining the relationship between advertising and concentration in the US manufacturing industry over the period 1947 to 1972. They found a positive relationship between advertising expenditure and changes in concentration. The advertising intensity (A/S) is defined as the ratio of advertising expenditure to the value of sales. Therefore, it is expected that there should be an inverse relationship between advertising and concentration.

Foreign firms, especially Transnational Corporations (TNCs) do provide powerful stimulus to market concentration partly because they could change the parameters by virtue of the special advantages that they have over local firms in term of their size, technology ability, command of various resources and difference in organizational structure, and also partly because of their conduct. They are more aggressive in their approach in lobbying policy makers and in affecting takeovers and mergers, and challenging local norms in the industry (Lall, 1979). There are two competing hypotheses regarding the likely effect of FDIs on industry concentration. The first is that foreign firms are able to breakdown local oligopolies and widen the scope for

competition by increasing the number of firms in the industry. This is possible because foreign firms have intangible assets such as technology, product development skills, and research and marketing skills to overcome the difficulties that may deter domestic firms from entering (Caves & Porter, 1980). The second hypotheses which runs counter to the above states that foreign entry may result in mergers and bankruptcies among local firms and thus, raise seller concentration in local industries. Foreign ownership of industry (FOI) can be computed by taking the percentage share of sales owned or controlled by foreign firms.

Industry's size (SIZE), represented by the industry's domestic sales, is expected to be inversely related to concentration. Larger markets naturally support larger number of firms. As a result, concentration level will tend to be lower in large markets, especially if the minimum efficiency scale is small, relative to industry size. Recent research has emphasized the importance of the links between markets size and concentration. Sutton (1991) defined two main industry types, now commonly referred to as Type 1 and Type 2. In Type 1 industry, the size distribution of firms is determined by exogenous factors such as the state of technology, while Type 2 industry, endogenous factors embodied in the strategic behavior of firms determine the concentration levels observed. Here, industry size is represented in the model by the value of sales.

Based on the above explanations, we establish the following equation by using the following, that is the first difference and the level form respectively,

$$\Delta C_t = \alpha + \Delta ES + \Delta PCI + \Delta A/S + \Delta FOI + \Delta SIZE_t + \mu, \qquad (4)$$

$$C_t = \alpha + ES + PCI + A/S + FOI + SIZE_t + \mu, \qquad (5)$$

where, t denotes period of time, from 1986 to 1990. Equations (4) and (5) provide the basis or the empirical models that are established in this article.

For the purpose of our study, we obtain the annual data on industry for the period of 1986 to 1990 from the Department of Statistics. The industry consists of 137 industries at 5-digit level of MSIC. From these samples, 34 industries were eliminated due to unavailable information on CR4, Herfindahl index, sales or fixed assets. This leaves us with 103 industries to work on. The econometric analysis with Ordinary Least Square (OLS) method was carried out using cross-sectional data for 103 industries.

PATTERN AND TRENDS IN CONCENTRATION

Concentration ratio and Herfindahl index for the Malaysian manufacturing industries over two years (1986 and 1990) are presented in Table 1. Column three of the table summarizes 4-firm concentration ratio for the year 1990. One can observe that on the average the four largest firms account for about 61.73% share of the total output of industries. It shows that instances of very low concentration are relatively rare in the Malaysian manufacturing industries' scenario. There are only 4 main industries whose concentration ratio is below 15% namely; large rice mills (31162), sawmills (33111), furniture and fixtures (33200), (except for metal furniture and fixtures)

Table 1
Concentration Ratios and Frequency Distribution of Industries in 1986 and 1990

4 – Firm Concentration Ratio:	Number of 5 – Digit Industry:	
	1986	1990
0-15	4	3
16-30	12	10
31-45	11	16
46-60	24	21
61-75	8	17
76-90	19	15
91-100	25	21
Median	63.18	61.07
Mean	65.01	61.73
Standard deviation	26.64	25.38

Source: Department of Statistics.

and rubber re-milling and rubber latex processing (35591). On the opposite extreme, 21 out of 103 industries have 4-firm concentration ratio greater than 91%, while the rest of the 15 industries are between 76 to 90% concentration levels.

The highly concentrated industries for instances, are those lying in the range of 76 to 100% share of the total industry output. Its number however, decreases from 44 firms in 1986 to 36 firms in 1990.

The number of industries with less than 30% concentration ratio declined slightly from 16 in 1986 to 13 in 1990. The largest increase in term of 4-firm concentration ratio, has been for industries where 61% £ CR4 < 75%. The number of industries in this range has increased by

100%, that is, from 8 in 1986 to 17 industries in 1990. By international comparisons, the industry is considered as an oligopolistic if CR4 reaches 40% and more. Using this criterion, Table 1 shows that the number of industries, which can be considered as oligopolistic, has risen from 81 industries (i.e. 79% of sample size) in 1986 to 85 industries (83%) in 1990.

To see the trends in the level of concentration, Table 1 summarizes the 4-firm concentration ratios at the industry level for two years. There is a declining trend in the levels of concentration over the period under consideration. This is reflected in the measure of the central tendency (median, means and standard deviation). The number of industries with more than 76% concentration decreased from 44 to 36% over the same period.

The highly and less concentrated industries are shown in Table 2. The table shows that pineapple canning (100%) and handicrafts spinning and weaving has the highest concentration ratio, followed by sugar factories and refineries (99.54%), tobacco manufactures (96.85%), and manufacture of footwear - except moulded rubber or plastic (88.01%). During the time of the study there are 26 firms in tobacco industry, (when initially there were only 20 firms in 1986). However, the number of firms in the tyre and tube industries decreased from 62 in 1986 to 58 in 1990. This industry consists of a few larger firms with large number of small firms. As expected, a notable feature of these highly concentrated industries is that they are generally controlled by few large firms and have high entry barriers, like large amount of capital requirements for initial investment (such as in the pineapple canning industry) and established brand names (such as in the tobacco industry).

Industries with very low levels of concentration are those of furniture and fixtures (15%), bakery (17.67%), manufacturing of pulp, paper and paperboard articles (21.17%), rubber re-milling and rubber latex processing (14.1%), and sawmills (9.15%). These industries are made up of many small firms, and they are consistently low concentration level. For instance, there are about 289 firms in the bakery industry, 507 firms in furniture and fixtures, 104 firms in cement and concrete products, 166 firms in planning mills, window and door mills and joinery works, 486 firms in saw-milling and 119 firms in large rice milling industry.

Bain (1959) postulated that when 4 firms concentration, accounted for less than 20% of the total industries output, then it is considered

Table 2
Industry Concentration by Selected Industry group, 1990 -1991.

Concentration ratio (CR) ≥60				Concentration ratio (CR) £40			
5-digit level industry		4-firm CR-output	Number of firms	5-digit level industry		4-firm CR-output	Number of Firms
31131	Pineapple canning	100	4	31172	Bakeries	17.67	289
31180	Sugar factories and refineries	99.54	7	32130	Knitting mill	34.32	86
31400	Tobacco manufactures	96.85	29	31211	Ice factories	20.99	64
32190	Manufacture of textiles, n.e.c	98.32	6	31220	Manufacture of prepared animals	28.16	66
32400	Manufacture of footwear except or moulded rubber or plastic	88.01	26	33113	Planning mills, window and door mills and joinery works	24.84	166
35231	Manufacture of soap and cleaning preparation	79.15	20	33200	Manufacture of furniture and fixtures, except primarily of metal	15.82	507
35510	Tyre and tube industries	73.26	58	36991	Cement and concrete products	31.12	104
38410	Shipbuilding and boat-building and repairing	70.82	83	38192	Manufacture of wire and wire products	36.53	77
35210	Manufacture of paints, varnishes and lacquers	66.37	27	38439	Manufacture of motor vehicle parts and accessories	38.23	94
38310	Manufacture of electrical industrial machinery and apparatus	60.27	68	34120	Manufacture of pulp, paper and paperboard articles, n.e.c.	21.17	91

*4-firm concentration ratio by output

Source: Department of Statistics

competitive. In the case of Malaysia's manufacturing sector, the situation shows that the industries are highly oligopolistic and non-competitive. Only between 3 to 4 industries out of 103 industries in 1986 and 1990 respectively, had CR4 less than 20.0%. Industries that have low level of concentration and can be considered competitive are large rice mills, sawmills, rubber re-milling, and furniture and fixtures. Pryor (2000), in his industry concentration study of 12 nations found that concentration was the highest among the tobacco, transport equipment, machinery, coal products and petroleum industries, and the lowest are among the furniture, lumber products and clothing industries. His findings are almost similar to the result obtain in our study, especially where the tobacco industry is concerned. As shown in Table 2 the tobacco industry is among the highly concentrated, where almost 97% of the total output share is contributed by 4 firms out of the total 29 firms in the industry.

High concentration of the Malaysia's manufacturing sector may be attributed to many factors. According to Ratnayake (1999), the long-standing high protection must have enlarged the share of the domestic market held by domestic firms by reducing the intensity of international competition. In the case of Malaysia, it was only in the late 1990s that foreign trade has been rather "liberalized". Secondly, the relatively small size of the domestic market, and the need for firms to be large to gain the benefits of economies of scale could be another reason for high industry concentration. Finally, the absence of any affective antitrust legislation could also be one of the major contributions to the increase in concentration.

In order to examine the trends in competition Ratnayake (1999) classified the 4-firm concentration into three groups, namely: non-competitive industries, competitive industries, and semi-competitive industries. The non-competitive group of industries is defined as the industries that have concentration ratios greater than or equal to 60%. The competitive group consists of industries with less than 40% concentration ratios. Industries with a concentration ratio between 40 to 59% are classified as semi-competitive. Table 3 shows the classification of industries for the years 1986 and 1990 following the classification by Ratnayake base on the industries' output. The result of the industry classification shown above is comparable to the result of the study done by Ratnayake (1999), on the competition in the manufacturing industry in New Zealand. He found that competition has increased in most New Zealand's manufacturing industry over time. This is a similar case of the Malaysia's industrial.

Table 3
Trends in Competition

	Non-competitive Industries		Competitive Industries		Semi-competitive Industries	
Years	No. of firms	Percent of output	No. of firms	Percent of output	No. of firms	Percent of output
1986	56	54.37	20	19.42	27	26.21
1990	51	49.51	23	22.33	29	28.16

Source: Department of Statistics

sector. As shown in the table there has been a marginal decrease in the percentage of output accounted for the non-competitive firms between the period of 1986 to 1990. On the other hand, the share of output by both semi-competitive and competitive industries has dramatically increased by about 2 and 3% respectively, during this period. The increase is assumed to have taken place at the expense of the non-competitive firm. This implies that competition in the Malaysian manufacturing sector is on the rise. Besides the study done by Ratnayake, our result is quite consistent with the findings of the studies done by Shepherd (1982), Nor Ghani *et al*. (2000) and Pryor (2001).

REGRESSION RESULTS

The above analysis of patterns and changes in concentration has shown that competition in the Malaysian industry has increased over time. In order to see what are the factors that contribute towards such increase, we now examine the determinants of the changes in, and the levels of industry concentration. The results are shown in Tables 4 and Table 5.

The coefficients of all conventional variables (economies of scale, capital intensity and industry size) bear the expected signs and are consistent with the findings of many previous studies in Malaysia and other countries (Rugayah, 1992; Lall, 1979, and Yusof & Phang, 1993b). See Table 4. The economies of scale variable (ES) isstatistically significant at 1%, supporting the widely held view that the small size of the domestic market in Malaysia requires relatively large firms to exploit economies of scale. The coefficient of capital intensity (PCI) is statistically significance at 5%, supporting the hypothesis that capital requirements is an important variable that explains why barriers to entry exist. It suggests that high capital-intensity is not necessary for efficiency, but it appears to be important for market dominance by firms.

Table 4
OLS Results of the Determinants of Industry Concentration
(First Difference) (Dependent Variable $CR_{86\text{-}90}$)

Independent variable	Coefficient (t-ratio)
ES	1.071(17.58)[a]
PCI	0.026(2.364)[b]
FOI	0.0901(1.685)[c]
SIZE	-0.804(-1.007)[b]
A/S	-0.534(-2.387)[b]
Constant	0.337(14.02)[a]
F ratio	72.410[a]
Adjusted R^2	0.778
RESET[d]	196.55
H. test[e]	0.32905

Notes: t-ratio (two-tail) are given in parentheses.
Significance level: [a]1%, [b]5%, [c]10%.
[d] Ramsey's regression specification test
[e] Breusch-Pagan Godfrey test

As it is generally known that advertising is undertaken to promote brand-consciousness and to achieve market exclusivity. Apparently there are scale economies in advertising, as a result so that it is more worthwhile for large firms rather than small firms to undertake advertising in order to conserve its market, or to keep out new entrants, or to expand its market size by attracting new customers. Our findings show that A/S is inversely related to concentration and significant at the level of 5%.

The results for the industry size (SIZE) supports the hypothesis that the larger the size of the industry, the larger will be the number of efficient firms that are in the industry and the barrier to entry and firms concentration will be lower. The result of the estimated coefficient is -0.804 at CR4 concentration level (see Table 4), showing the negative relationship between the two variables.

The foreign ownership (FOI) variable has a positive sign, but significant at 10 per cent level. During the period of 1986 to1990, foreign investment in Malaysia was quite significant. This could have lead to mergers (acquisitions) and bankruptcies among some of the domestic firms that were unable to compete with the efficient foreign firms. This may have been the possible cause of the slight increase in concentration in the domestic industries. The correlation result for FOI is 0.09 for CR4. This interprets that in the early infant years of Malaysia's industrialization effort local industries are made up of small firms which are less

competitive as compared with foreign firms which are normally large and more efficient. The more important role in the economy are being undertaken by foreign direct investment. This has important repercussions on the industry structure because substantial share of industry is owned or controlled by foreign firms. For instance, 14 out of 103 industries at the 5-digit level of MSIC, foreign firms account for more than 60% share of the total industry. In some industries, like manufacturing and assembling of motorcycles and scooters, the share is even as high as 91%. Other examples are the manufacture of photographic and optical goods, foreign firms cover about 90% of the share of the total output, and 72% share in the production of tobacco industry. This suggests that penetration of foreign firms into the local market has helped promote competitive market structure, and thus, confirms the hypothesis that foreign entry might result in mergers and bankruptcies among local firms and that raise seller concentration in local industries.

To examine the determinants of inter-industry variation in the levels of industrial concentration, we now use the 4-firm concentration ratio discussed previously, to analyze the variation in the changes of the industry concentration. Both, 4-firm concentration ratio and Herfindahl index are used here as the dependent variables. In order to explore the sensitivity of the results in the choice of measure for concentration we retained all the explanatory variables.

To run the regression on the levels of concentration, we first log the model into functional form in order to solve the problem of heteroscedasticity. The regression results is as shown in Table 5. The results are almost similar to those obtained in the earlier analysis and it shows the same level of statistical significance (see Table 4).

The economies of scale (ES) have the expected sign and are statistically significant at the level of 1%, indicating that the small domestic market requires large firms to exploit economies of scale. The coefficient for capital intensity (PCI) valued at 0.014, is positively related to the dependent variable CR4. This suggests similar reasons that the leading producers in the industry could possibly influence market concentration through the impact of higher capital intensity or may be due to the presence of foreign firms. It also supports the hypothesis that concentration can be partly determined by barriers to entry. The advertising intensity (A/S) is statistically significant and is inversely related to CR4. It reflects that advertising can be a useful way of breaking a monopoly based on imperfect information and expanding the market.

Table 5
OLS Results of the Determinants of Industry Concentration – (Level form)

	Independent variable	Dependent variable
	Concentration ratio	Herfindahl index
	Concentration t-ratio	Concentration t-ratio
ES	0.482(32.63)[a]	4.011(18.78)[a]
PCI	0.014(0.926)	0.026(0.824)
A/S	-0.021(-2.184)[b]	-0.021(-2.658)[a]
SIZE	-0.011(-1.243)[b]	-0.079(-2.907)[a]
FOI	0.013(1.413)[c]	0.205(1.092)[c]
Constant	0.637(3.743)[a]	-3.0306 (-35.45)[a]
F ratio	314.669[a]	90.793[a]
Adjusted R^2	0.9389	0.8149
RESET[d]	52.251	90.738
H.test[e]	0.06841	0.2624

Notes: t-ratio (two-tail) are given in parentheses.
Significance levels: [a]1%, [b]5%, [c]10%.
[d]Ramsey's regression specification test.
[e]B-P-G heteroscedasticity test.

Using Herfindahl index as the dependent variable (shown in the third column of Table 5) gives us almost the similar results. The Foreign ownership (FOI) variable is positively related to the Herfindahl index and significant with an estimated coefficient of 0.2057. Advertising intensity has a negative sign with estimated coefficient of –0.2103.

In conclusion, the result confirms the hypotheses that concentration is partly determined by barriers to entry. Barriers to entry include economies of scale (ES), capital intensity (PCI) and advertising intensity (A/S). The coefficients of all the conventional variables (economies of scale, capital intensity and industry size) bears expected signs and are consistent with the findings of other studies for other countries (e.g., Caves *et al*., 1980; Henley, 1994; Ratnayake, 1999). The major difference here is the role played by the economies of scale (ES) and the foreign ownership (FOI) variables in determining the inter-industry differences in changes in, and level of concentration in the Malaysian manufacturing industries.

CONCLUSION

Examining the determinants of concentration, it has shown that both the level and rate of change in market concentration can be explained

by a variety of features such as, the existence of economies of scale, factors that contribute toward barriers to entry, strategic behavior of firms and the presence of foreign firms in the local market. The econometric results support the hypothesis that economies of scale is the cause for market dominance for large firms in Malaysia, in order to promote greater efficiency in industries.

The presence of foreign firms is also a significant factor which promotes concentration through the use of high capital-technology-based, with large-scale production and advertising strategies through product differentiation and innovation. Foreign domestic investment might result in mergers and bankruptcies in local firms, which could foster concentration in local industries. Although merger can reduce the number of firms in the industry and could increase concentration, incidence of mergers is not included as the determinant of the inter-industry variation of level of concentration because of the unavailability of the data concern. Besides, Hart and Clark (1980) considered it as the means towards increase in concentration rather than as the fundamental cause of concentration.

Base on the empirical findings, we are able to gauge the extent to which certain economic variables determine the change in as well as the level of concentration in Malaysia, which is consistent to those of other countries. These findings can provide some basis for the imposition of policy measures in order to ensure that the market structure is not excessively concentrated and to eradicate monopolistic practices. Our analysis also provide some policy implications aimed at creating a competitive industrial environment and maximizing consumer welfare. To date Malaysia does not have any antitrust policy that could properly coordinate a correct trade off between competition and efficiency among firms in the industry, and to stop anti-competitive mergers. Malaysia needs a competition policy, which is necessary to ensure that efficiency is rewarded and consumer welfare is maximized.

An important factor, which may be taken into account when decisions regarding competition policies are made, is the nature of foreign ownership. Our analysis shows that foreign firms controlled and owned substantial share of the local industry. They have intangible assets like technology, research and product development skills, and marketing skills to overcome their operational difficulties. They can act as tough competitors to the local firms, which might also deter domestic firms from entry into industries, which are mainly dominated by them.

There is still a lot of empirical work that could be done in the area of industrial concentration. Additional explanatory variables such as

export intensity and import penetration for international trade, nominal rate of protection by governments, and merger activity could be included in order to get better insight of the level of concentration and competition of the manufacturing sector of the industry. Such variables are not included here due to the confidentiality and limitation of the data available. Another potential area to look at is the economic integration through globalization and technological change. Globalization influences the degree to which imports serves to change the degree of competition on domestic market, even though such factors are not easily quantifiable.

REFERENCES

Bain, J. S. (1951) *Industrial Organisation*. New York: John Wiley.

Caves, R. E. & Porter, M. E. (1980) The dynamics of changing seller concentration. *Jurnal of Industrial Economics, 29*, 1-15.

Comanor, W. S. & Wilson, T. (1967) Advertising and competition: a survey. *Jurnal of Economic Literature*, *17*, 453-476.

Curry, B. & George, K. (1983). Industrial concentration: A survey. *Journal of Industrial Economics, 31*, 205-256.

Davies, S. W. (1979) Choosing between concentration indices: the iso-concentration curve. *Economica*, 46, 67-75.

Greer, Douglas, F. (1992). *Industrial Organization and Public Policy*. Macmillan Publishing Company, New York.

Gan, W. B. (1978). The Relationship between Market Concentration and Profitability in Malaysian Manufacturing Industries. *The Malaysian Economic Review, 23*, 1-13.

Hart, P. E. & Clarke, R. (1980) *Concentration in British Industry*: 1935-1975. Cambridge: Cambridge University Press.

Kwoka, J. E. (1981) Does the choice of concentration measure really matter? *Jurnal of Industrial Economics, 29,* 445- 453.

Lall, S. (1979) Multinationals and markets structure in an open developing economy: The case of Malaysia. *Weltwirtschaftliches Archv. 115(2)*, 325-350.

Mueller, W. F. & Rodgers, R. T. (1980) The Role of advertising in changing concentration of manufacturing industries. *Review of Economics and Statistics, 62*, 89-96.

Nor Ghani Md. Nor, Zulkifli Osman, Ahmad Zainuddin Abdullah & Chin Yit Jun (2000). Trends in the Malaysian industrial Market Structures. *Jurnal Ekonomi Malaysia, 34*, 3-20.

Pryor, F. L. (2001). New Trends in U.S. Industrial Concentration. *Review of Industrial Organization, 18*, 301-326.

Ratnayake, R. (1999). Industry Concentration and Competition: New Zealand Experience. *International Journal of Industrial Organization, 17*, 1041 - 1057.

Sutton, C. J. (1991). *Sunks Costs and Market Structure*. London: MIT Press.

Shepherd, W. G. (1982). Caused of Increased Competition in the U.S. Economy, 1939-1980. *The Review of Economic and Statistics, 64*,613-626.

Yusof Z. A. & Phang H. E. (1993a). *Industrial Structure in Malaysia, 1979-1990: A Profile.* Working paper for Bank Negara Malaysia, 21.

Yusof, Z. A. & Phang, H. E. (1993b). *Determinants of Industrial Market Structure in Malaysia: 1979-1990*, Bank Negara Malaysia Discussion Paper.