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Competition and Market Power in the Manufacturing Industries: A Comparative Study

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Abstract

This paper examines the gap between marginal cost and the price of 22 manufacturing industries in Iran at ISIC 2-digit level and 32 industries at a 3-digit level during 1995-2015 compared to selected countries. It examines the gap by using the Hall-Roeger model. We found that in garments, basic chemicals, non-metallic mining, and refined petroleum products, the price and marginal cost difference are high and in tobacco industries are low. In 3 out of 22 industries at ISIC 2- digit level and in 11 out of 32 industries at 3-digit level, Iranian industries have higher markups and a significant gap between price and marginal cost than Japan, Germany, France, and the United Kingdom. Also from 32 industries in ISIC 3-digit level and 22 industries in 2-digit level, Iran has the lowest mark-up in the tobacco industry with 1.03 and in chemical products with 2,33, has the highest markup.

Keywords: Markup, Manufacturing Industries, Market Power, Marginal Cost, Iranian Economy.
JEL Classification: L_1 , F_1, L_6

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1. Introduction

One way to evaluate market structure is to determine market power. Market structure and industry environment and conditions for operating firms are key issues for economic policymakers. Basically, market power means the firm's ability to set commodity prices above its competitive price, provided that it does not lead to sales reduction.

The difference between the price setting, the marginal cost of production, and the firm's ability to control price are called market power. The literature includes models for Perloff and Shen (2012), Twomey and Green (2005), Bresnahan (1982) and Lau's (1982) static and dynamic model, Azzam (1997), Collins and Preston (1969), and Boone (2008).

The methodology of Perloff (1991), Bresnahan (1982) and Lau (1982), Appelbaum (1979), Azzam (1997), and Iwata (1974) models are the same.

In the aforementioned models, supply and demand equations and profit maximization are used to measure market power. In industrial economics, this is called the structural method. In efficiency methods, by optimizing profit function subject to cost, we first need to estimate the Boone model (2008). The non-structural method in which its empirical model is based on the relationship between CR, $\frac{p_{k\,k}}{pq}$ and $\frac{p-AVC}{p}$, we have to estimate Collins and Preston functions (1969).

Another method, which is called the reduced form model, measures the Lerner index by combining the features of the cost and production function. In this method, using cost and production function and modeling in an imperfect competition structure, the Lerner index and mark-up are derived. This method is preferred to the direct method for estimating the Lerner index. Another method is known as the income method put forward by Panzar and Rosse (1987). In this method, the sum of elasticities of income relative to inputs is known as a measure of market power. We are looking for a method that can be used to evaluate the intensity of monopoly and competition in industries based on ISIC 2 and 3-digit industries.

We do not apply Bresnahan (1982), Appelbaum (1979), and Iwata (1974) models because information on industrial demand is not available. Panzar and Rosse model (1987), as well as the Lyonson model, are market power assessment methods at the firm level, therefore they could not be used at the industrial level to measure monopoly power. Collins and Preston's model (1969) is based on the structure, behavior, and performance of industries that have been criticized. For example, critics argued that it is an approximate monopoly power that has no theoretical basis. We did not use the Boone model (2008) in this study either, because it assumes efficiency that leads to higher profitability for firms, and thus the monopoly power coefficient in efficiency situation is estimated, while the reality of many industries does not support the assumption. Accordingly, the Hall-Roeger model was applied as the market power measurement model in this study. This model has significant advantages:

1. The model applies use cost and production function and builds in an imperfect competition structure,
2. By this method, we can calculate $\frac{p-mc}{p}$ for industries as markup,
3. The model is designed for industry-level data and can well represent the industrial structure, and
4. Its method has a strong theoretical basis.

There are, in fact, different methods to measure market power. We used the Hall-Roeger method to calculate marginal cost and price gap, which is called also a reduced form model to measure the Lerner index with respect to properties of cost and production functions. In this method, using cost and production function and modeling in an imperfect competition structure, we calculated the Lerner index and mark-up for industries. In fact, the competitive structure of industrial products requires reducing market power for domestic firms.

In this paper, we examined the determinants of mark-ups for firms operating in different industries, comparing US A, Japan, Germany, France, Italy, United Kingdom, Iran, Canada, Australia, Belgium, Denmark, Finland, the Netherlands, Norway, and Sweden. To this end, we examined the mark-up index for industries in the above-mentioned countries. The organization of the paper is as follows. In section 2, the literature review is presented. Next, the model estimation and the results are discussed, and finally, conclusions and policy recommendations conclude the paper.

2- Review of the Literature

Roeger's (1995) work is basically a continuation of

Hall's (1988) work. Hall applied a new test to evaluate the market power in the US industries. He criticized the Bresnahan-Lau model (1982) for testing market power based on the assumptions of a particular functional form rather than on a reduced form of the non-structural method.

His basic understanding was that while there is market power, traditional Solow residual should be independent of the logarithm of product changes.

Roeger (1995) indicated that in order to drive an unbiased estimation of market power, it is better to derive it from the difference between Solow residuals of production-based and cost-based to remove unobserved productivity shock.

A probable deficiency of the model is the one based on the assumption of constant return to scale. However, it should be noted that constant return to scale does not make a biased estimation when compared to a similar industry in a different period and that the nature of the economies of scale will not change over the period (Rezitis, 2010).

Raper, Love, and Shumway (2007) examined the level of competition in the United States tobacco industry. They used parametric and non-parametric tests to identify market power exercised by the US tobacco and tobacco producers from 1997 to 1993 and provide alternatives to the structural method. The results indicated that tobacco producers have monopoly power. The results of the estimation have shown that the cigarette industry has market power. It has also been shown that the oligopsony for tobacco purchases has been exerted on market power. Overall, the test results indicated a more oligopsony ratio than monopoly power in the US tobacco industry.

Shahiki Tash (2013) examined competition in the Iranian economy and explored competition according to neoclassical, Schumpeterian, Chamberlain, Bailey, and Porterian perspectives. The results indicated that the competition in the Iranian industries was low and that there was not enough room to develop the competition, and that the role of the Competition Council in the implementation of Chapter 9 of Article 44 of the Constitution constituted a suitable model for the expansion of competitive activities in the Iranian economy.

Khodadad Kashi and Shahiki Tash (2005) measured the level of competition in the World Market for Traditional and Agricultural products and examined the level of competition in international markets for Iran's major agricultural export commodities (pistachio, date, grape, apple, saffron, caviar, and raisin). They used the N country concentration ratio and Herfindal index to measure the concentration of the aforementioned markets.

Allender and Richards (2010), examined market power in the California Egg Industry. They used the following equation to calculate market power:

$$P = C - S_p^{-1}S - ((G^{-1}S_p)\,S_p * I_N)^{-1}\,S$$

In this equation, C is the marginal cost. The second phrase represents the retail margin and the third part on the right side of the equation shows the producer margin.

The results indicated that the profit margin of the producer depends on egg export. But this effect is decreasing over time. There is also a deviation from the competitive market in the industry.

Rezitis and Kalantzi (2013) examined the level of competition and market structure in 9 Greek food and beverage industries. They calculated mark-ups using the Hall-Roeger model for three-digit industries. The results indicated that for the entire Greek food and beverage industries, during the period 1984-2007, the level of market power was 24% and mark-up was around 2.44, which indicates non-competitive industries. The reasons for the non-competitive situation pertain to the number of joint ventures during the period 1991-1999 as well as a wave of mergers and acquisitions during the period 1999-1998, which led Greek food and beverage industries to move towards a non-competitive situation during 1984-2007. In addition, these findings indicate that there is welfare loss and, in particular, net welfare loss was 11% and total welfare loss was 0.97%.

4. The Hall-Roeger Model

In the Hall-Roeger model, the firm is assumed to have a first-order homogeneous production function and Hicks-neutral technology is as in equation (1).

$$Y(X_1, X_2, ..., X_n, K, E) = F(X_1, X_2, ..., X_n, K)E \quad (1)$$

With logarithmic differential, if a firm operates in a perfect competition structure of the input market and in the imperfect competition structure in the product market, then $P \neq MC$ or $P = \mu MC$.

Based on the differential function (4) and in the market structure of perfect competition, we derive equation (7), which is called Solow residual:

$$SR = \frac{dE}{E} = \frac{dY}{Y} - \sum_i \theta_i . \frac{dX_i}{X_i} = (1 - \sum_i \theta_i) \frac{dK}{K} \quad (2)$$

which represents the Solow residual in the imperfect competition. B= (1- $\frac{1}{\mu}$) is the same as the Lerner index. That is:

$$\underbrace{\frac{dY}{Y} - \sum_i \theta_i \frac{dX_i}{X_i} - (1 - \sum \theta_i) \frac{dK}{K}}_{SR} = \beta \left(\frac{dY}{Y} - \frac{dK}{K} \right) + (1 - \beta) \frac{dE}{E} \quad (3)$$

Equation (3), which is derived by Hall (1988), faces the endogeneity problem. Roeger (1995) solved this problem by considering the features of the cost function and deriving the Solow residual. Roeger defined the cost function derived from equation (1) as follows:

$$C(W_1, W_2, ..., W_K, Y, E) = \frac{G(W_1, W_2, ..., W_K) Y}{E}$$

$$MC = \frac{\partial C(W_1, W_2, ..., W_K, Y, E)}{\partial Y} = \frac{G(W_1, W_2, ..., W_K)}{E} \quad (4)$$

$$C(W_1, W_2, ..., W_K, Y, E) = \frac{G(W_1, W_2, ..., W_K) Y}{E}$$

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Given the logarithmic differential of two sides marginal cost equation in (3-4) and applying lem Shepherd's, then:

$$\frac{dMC}{MC} = \sum_i \alpha_i \frac{dW_i}{W_i} + \alpha_K \frac{dW_K}{W_K} - \frac{dE}{E} \quad (5)$$

If mark-up (μ) is constant, then price increase will be equal to the growth rate of the marginal cost:

$$\frac{dMC}{MC} = \frac{dP}{P} \quad (6)$$

Given the assumption that the average mark-up is constant, after deriving a differential of generalized H-R model, it can be rewritten as equation (7):

$$\frac{dP}{P} + \frac{dY}{Y} = \frac{\mu}{\lambda} \left\{ \sum_i \theta_i \left(\frac{dX_i}{X_i} + \frac{dW_i}{W_i} \right) + \theta_k \left(\frac{dK}{K} + \frac{dW_K}{W_K} \right) \right\}$$

$$\frac{dP}{P} + \frac{dY}{Y} = \left\{ \sum_i \theta_i \frac{\mu}{\lambda} \left(\frac{dX_i}{X_i} + \frac{dW_i}{W_i} \right) + (1 - \sum \theta_i) \frac{\mu}{\lambda} \left(\frac{dK}{K} + \frac{dW_K}{W_K} \right) \right\} \quad (7)$$

Now we can derive the generalized Roeger model (1995) as shown in:

$$\frac{dY}{Y} + \frac{dP}{P} - \sum_i \theta_i \left(\frac{dX_i}{X_i} + \frac{dW_i}{W_i} \right) - (1 - \sum \theta_i) \left(\frac{dK}{K} + \frac{dW_K}{W_K} \right) = [\lambda(\beta - 1) + 1] \left\{ \left(\frac{dY}{Y} + \frac{dP}{P} \right) - \left(\frac{dK}{K} + \frac{dW_K}{W_K} \right) \right\} \quad (8)$$

4. Model Estimation Results

We estimated mark-ups for 2 and 3-digit ISIC codes using the Hall-Roeger Markup Model over the period 1995-2015.

According to the mark-up calculated for the ISIC 2-digit code in the industries, it can be stated that during this period, the most competitive behavior was in the tobacco industry and the wood and cork products except industry making straw and rattan products and the tools, optics, instrumentation, watches, and other types of clocks. Firms do not have a high bargaining power to set prices and markups. Other industries have shown uncompetitive behavior. The results indicated that non-metallic mineral products have the highest markups. Basic metal industries, rubber and plastic products, publishing, garment, and the fur coating industry have the highest market power respectively.

This means that these industries will be able to set a higher price than their marginal cost for their products. By estimating this model, it was indicated that P> MC in all industries of Iran. In some industries, high mark-ups are obvious, as shown in Table 1, and in others, the rate is low as shown in Table 2. If we compare Iranian industries at a 3-digit level with other developed and developing countries, it reveals that some industries in Iran have had the most or the least monopoly or equivalent to them as shown in Table 3.

Table 1. Markup in Iranian Industries 3- digit ISIC Code (Higher Market Power)

ISIC Code	industry	Markup
181	Garments product except Furry Clothing	1.28
221	Publishing	1.76
232	Production of refined petroleum products	1.78
241	Production of Basic Chemicals	2.33
269	Non-Metallic Mining Industries	1.82
272	Precious stones products and nonferrous basic metals	1.46

Source: Authors

As indicated in Table 1, markup values for Iranian industries 3-digit ISIC codes are higher than those of the US, Japan, Germany, France,

Italy, Britain, Canada, Australia, Belgium, Denmark, Finland, the Netherlands, and Norway. Mark-ups start at the range of 1.28 for garment products (with the exception of furry clothing) and end at the mark-up value of 2.33 for chemicals industries.

Table 2. Markups for Iranian Industries in the 3-digit ISIC Code (Lower Market Power)

ISIC Code	industry	Markup
160	Tobacco Industries	1.03

Source: Authors

Table 2 indicates that market power in 11 Iranian industries is on par with Denmark, Canada, America, Australia, Norway, Germany, Japan, and the Netherlands.

Table 3. Markup in Iranian Industries 3-digit ISIC Code (Equivalent Market Power)

ISIC Code	industry	Markup	equivalent country
151	Food Industry	1.12	Denmark
171	Textiles	1.23	Canada
191	Tannery and Leather and Luggage Manufacturing	1.10	USA
202	Wood , Cotton and straw Products	1.74	Australia
231	Coke Furnace Production	1.12	US
243	Synthetic Fiber Production	1.08	Norway
261	Glass Production and Glass Products	1.30	Canada
281	Manufacture of Construction Metal Products, Tanks and Steam Generators	1.20	Germany
300	Office Machinery and Computer Manufacturing	1.32	Japan
331	Manufacture of medical equipment and instruments for measuring, controlling, testing and navigating and other purposes	1.13	the Netherlands
351	Manufacture and Repair of Water Vehicles	1.29	Japan

Source: Authors

In many studies, the Hall-Roeger method is preferred to the direct method of estimating the Lerner index. In general, the Hall-Roeger model has significant advantages, including the use of cost and production functions and modeling in an imperfect competition structure. We can measure the Lerner index and markup for industries. This model is designed for industry-scale data and can well indicate industry structure. It also has strong theoretical foundations.

The results help identify market power for Iranian industries. We compare the market power of Iranian industries to other countries. Some Iranian industries have high mark-ups, as indicated in Table 4. In some industries, the mark-up value is low (Table 5).

When we compare Iranian industries at the double-digit ISIC code to industries of developed and developing countries, it reveals that the Iranian industries have the most or the least market power (Table 6).

Table 4. Markups for the Iranian industries with Double-Digit ISIC Code (Higher Market Power)

ISIC Code	industry	Markup
22	Publishing, Printing and Duplicating Recorded media	1.25
26	Other Nonmetallic Mineral Products	1.55
27	Manufacture of basic metals	1.35

Source: Authors

As it is illustrated in Table 4, the double-digit ISIC codes, markup values for Iranian industries are higher than those of the US, Japan, Germany, France, Italy, Britain, Canada, Australia, Belgium, Finland, Denmark, the Netherlands, Norway, and Sweden.

The estimated mark-ups start from 1.25 for print and publishing industries and end with the mark-up of 1.35 for the basic metals industry. Table 5 shows the industries whose mark-ups are lower than those of the aforementioned countries.

Table 5. Markups for Iranian Industries in Double-Digit ISIC Code (Lower Market Power)

ISIC Code	industry	Markup
16	Tobacco Products	1.03
20	Wood & Cotton Products Manufacturing - Manufacture of straw and rattan products	1.07
33	Medical Tools, Optics, Instruments, Watches and Other Types of Clock	1.06

Source: Authors

According to Table 5, the tobacco industry has the lowest markup value, indicating that the difference between price and marginal cost is at its

minimum value, and wood and professional goods industries in Iran have less monopoly than other countries.

Table 6. Markup in Iranian Industries for 2-Digit ISIC Code (Equivalent Market Power with Other Countries)

ISIC Code	industry	Markup	Country on Par
1	Food and Beverage Industry	1.14	Belgium
17	Textile Manufacturing	1.12	Belgium
21	paper and paper products	1.20	Australia
28	Fabricated metal products except for machinery and equipment	1.17	Australia
29	Manufacture of Unclassified Machinery and Equipment	1.18	Italy
30	Office & Accounting Machines	1.32	Japan
32	Radio, Television and Communication Equipment	1.32	Japan
34	Motor vehicles and trailers and semitrailers	1.13	France

Source: Authors

As Table 6 indicates, in the manufacturing of non-classified machinery and equipment, Iranian industries' mark-up is on par with Italy. In the manufacturing of radio and television, the communication industry, office machinery, and the accounting industry, Iranian industries are on par With Japan. In the motor vehicle and trailer and semi-trailer industries, Iranian Industries are on par with France. In the food, beverage, and textile, Iranian industries are on par with Belgium. In paper products and metal fabrication industries, Iranian industries are on par with Australia.

5. Conclusion

In this paper, we compared the level of competition and market power in the Iranian manufacturing industries and the selected developing as well as developed countries. The generalized Roeger markup model (1995) was estimated for active industries in ISIC 2 and 3 digit codes. According to the calculated mark-ups, it can be concluded that the most competitive behavior is observed in the Iranian tobacco industry and the firms do not have the high bargaining power to determine price and mark-ups. Other Iranian industries have shown uncompetitive behavior. The results indicated that the Iranian chemical industry has the highest markups. Non-metallic mining, refined petroleum products, and publishing industries have the highest mark-ups, respectively. This means that these industries have been able to set a higher price than their marginal cost for their products.

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