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Evaluation of Social Cost of Monopoly in Iranian Industries: Leibenstein Approach

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Abstract

The main objective of this research is to evaluate the social costs of monopoly in Iranian concentrated industries during 1996-2006. Leibenstein approach has been employed to evaluate the social costs. Leibenstein believed that most monopolistic industries operate inefficiently because of being in the safe margin. Hence, he proposed that the costs of inefficiency be added to the welfare triangle. Results show that "manufacture of tobacco products, recycling, mnufacture of medical, precision and optical instruments, watches and clocks, manufacture of coke, refined petroleum products and nuclear fuel, manufacture of fabricated metal products, except machinery and equipment " have imposed the most social cost on the society due to their inefficiency and deadweight loss of the welfare triangle. The social cost that these industries imposed on the society is equal to 100.47, 54.701, 41.039, 39.509 and 31.241 percent of the sales, respectively. In other words, a social cost of 24.01 percent of the sales is imposed on consumers in Iran by the concentrated industries**.**

Keywords: Social Cost, Monopoly, Concentration, Leibenstein, Welfare Triangle, Inefficiency,Iran.
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1. Introduction

Based on the microeconomics and industrial economics theories, it is expected that the monopoly leads to disruption in optimal allocation of resource and welfare costs for the consumers. In other words, there is a direct relationship between effective monopoly and welfare cost in the society and the social costs are imposed on society proportional to the deviation of the competitive situation. By looking at the studies conducted in the country it is observed that one of the prominent features of the industrial sector is the lack of competition in most activities of this sector. These studies confirm that in 2005, about 74% of the country's industrial firms have been at the disposal of the industries with $CR_4 < 40$ and they have accounted for 35% of sales of industrial sector. More accurately, 11941 firms have been at the disposal of industries with $CR_4 < 40$. The industries with $CR_4 \geq 40$ have covered about 4077 firms and the industries with $CR_4 \geq 60$ have covered about 1910 firms. The industries with $CR_4 \geq 60$ have accounted for 55% of sales of industrial sector. If we consider the industrial markets with a concentration ratio over 40% as the non-competitive industries (effective monopoly),we may accept that among 132four-digit industries, the monopolistic forces are more effective than competitive forces in 84 industries and the effective competition exists only in 51 four-digit industries. Basically, the non-competitive industries have accounted for over 65% of industry's sale in 2005, while this percent has been 35% for competitive industries (Khodadad Kashi, 2000).

Also, according to Khodadad Kashi (2000), about 74.4% of the firms operating in the industrial sector in 2007 have been at the disposal of industries with $CR_4 < 40$ which have accounted for 30% of industry's sales, while the concentrated industries ($CR_4 \geq 40$) have had possession of about 25.6 percent of country's firms and have accounted for over 70 percent of industry's sales. In 2007, from 140 four-digit industries of ISIC[1] codes, 92 industries have had concentration intensity of over 40percent. Also, based on the Herfindahl-Hirschman Index (HHI) in 2005, it is seen that 46 percent of the nation's industries accounting for 40 percent of industry's sales have a concentration ratio less than 1000, and 54 percent of the industries accounting for over 60 percent of industry's sale have the concentration intensity over 1000. This confirms that the concentrated industries possess the most volume of industry's sale. The

Herfindahl-Hirschman index for 2007 also confirms the results of CR_4 index, such that 47 percent of industries have $H-H<1000$ possessing 40 percent of sales and the remaining 53 percent possess 60 percent of sales having a concentration ratio of over 1000. These conditions indicate that the effective monopoly structure is dominant on most of the Iranian industrial activities.

Now, the aim of this study is to investigate how much welfare cost has been imposed on society due to the governance of effective monopoly structure in Iranian industrial sector. The paper continues with the review of literature; then the theoretical bases of Leibenstein will be reviewed and the manner of measuring this index according to information of ISIC 2-digit code of industry sector will be checked. Finally, after measuring Leibenstein index, we will identify the industries which have imposed the highest welfare costs on society.

2. Literature Review

With a quick look at the studies conducted within and outside the country, we find out that there are various methods for calculating the (deadweight) welfare loss, and every researcher has introduced a different indicator for calculating the welfare loss. In this section, we will review some important studies in this field and measure the welfare loss using different approaches. It is notable that most previous studies on measuring the deadweight loss resulting from monopoly power were carried out outside the nation some the most important of which are reviewed below.

Harberger (1954) attempted, for the first time, to provide a measure for evaluating the welfare cost of monopoly. In his article entitled "Monopoly and resource allocation," Harberger attempted to measure the social burden of monopolistic activities. He concluded that the conditions of deviation from Pareto optimal point and the amount of disruption in resources allocation that leads to cost loss and reduction of consumers' welfare can be expressed in terms of welfare triangle. He considered the price elasticity of demand equal to unit for all industries and calculated the welfare loss for 37 USA industries during 1924-1928 equal to about 0.08 of its national income.

Posner (1974) believes that the welfare cost of monopoly is not limited to welfare triangle, but that the opportunity cost of resources which is spent to obtain and maintain the monopoly power should also be considered as the negative welfare effects of monopoly. He believes that acquisition of monopoly power is a competitive activity, and this activity takes place to the extent where the cost of monopoly acquisition is equal to the profit and rent the firm expected to get from being monopolist. So, the competition for acquisition of monopoly position will continue between old firms and new entrants until the expected profit is more than the cost of monopoly acquisition, and inevitably these firms must attempt more and employ more inputs and resources. As a result, the competition continues as far as the cost of acquisition of a monopoly is equal to its expected value (Khodadad Kashi, 2001).

Comanor and Leibenstein (1969) believed that due to being in a safe margin, the monopoly industries operate inefficiently. Hence, they believed that in addition to the welfare triangle, the costs of inefficiency of monopoly industries must be considered as welfare cost. Leibenstein also believed that there is a positive relationship between the firm's size and the deadweight loss and whenever the firm is larger, it is possible that it has more monopoly power and consequently the firm would be more inefficient.

In their article entitled "The social costs of monopoly power", Cowling and Mueller (1978) attempted to compute the social cost of monopoly so that mistakes of previous studies do not take place. They believed that the previous studies suffered from bias in different aspects and thus, the social costs of monopoly and monopoly power have been underestimated. From their view, the social cost of monopoly is composed of two components: the first is reduction of consumers' surplus and the second is the costs of acquisition and maintaining of monopoly power. In order to calculate the social costs of monopoly, they compared the situation of real markets with situations where there is no monopoly power. They took the firm as the basis of calculations, while Harberger's base of calculations was industry.

Masson and Shaanan (1984) tried to calculate the social costs of monopoly with the application of the limit pricing theory in dynamic conditions. Their methodology was based on an empirical model of oligopoly and limit pricing behavior. They considered two different situations: 1) The market’s real situation; and 2) Hypothetical situation based on which industrial firms make coalition to maximize their joint profits and at the same time be safe from the others entry. As such, they were able to estimate the size of competition by measuring the deviation of the actual price from the coalition price. For this, they used the dynamic limit pricing theory and judged about the size of barriers considering the amount to which the actual price is higher than the limit price. Masson and Shaanan employed a different method from Harberger's and their results indicated that the social cost of monopoly in the USA is in average equal to 2.9 percent of its national income during (1950- 1966). The old microeconomic theories predict that increased profit acts as a signal for the entry of new firms. The history of the limit pricing shows that stabilized firms use this signal to delay the entry of other firms. The limit pricing model was firstly introduced by Kamien and Schwartz (1971) and Baron (1973) based on dynamic maximization and random entry. In this model, there is a synchronicity between the percentage of entry to industry and percentage of profit and thus they used the simultaneous equations method to test the hypothesis of the limit pricing. As such, they could estimate the profit level creating stable entry barriers, the profit level of the limit pricing, the profit level of optimal limit pricing and the profit level of monopoly so that it be as a function of structure and growth of the industry.

Khodadad Kashai(2001) in an article titled "estimation of social cost of monopoly in Iranian industry sector" showed that the amount of social cost of monopoly is largely depended to researcher's used method. In addition to point to various indexes, he estimated the social-welfare cost of monopoly using two approaches of Harberger, and Cowling and Mueller as expected these approaches have had different estimation results, such that the Harberger approach estimated the monopoly costs equal to 2.03% of industry sector's sales, while in the Cowling and Mueller approach this amount was equal to 10.25%.

Shahiki Tash and Ekhtiari (2009) in their article titled "Estimating the welfare cost of effective monopoly in Iranian insurance industry," investigated the effective degree of monopoly in insurance market and estimated the welfare cost of this structure on insurance services recipients using the indexes of Harberger, Posner and Mueller. The results of estimating these indexes in (2004) showed that the estimation of welfare cost in the three indexes is different given the different assumptions, but totally, it has been imposing a high social cost on insurance services recipients due to the structure of effective monopoly.

Table 1: The Most Important Basic Studies Aimed at Measuring the Social Costs of Monopoly

Researcher	The central purpose	Scale of market and country	The estimated welfare cost
Harberger (1954)	Monopoly and resources allocation	(37) USA industries based on 4-digit codes	Welfare triangle
Leibenstein (1966,1973)	x-efficiency and measuring welfare loss	-	welfare triangle + inefficiency of monopoly industries
Posner (1975)	The welfare cost of monopoly and regulations	The USA industries	welfare triangle+economic rent
Cowling and Mueller (1978)	The welfare cost of monopoly power	(734) firms	welfare triangle+ costs of acquisition and maintenance of monopoly power
Masson and Shaanan (1984)	The welfare cost of oligopoly and competition value	(37) USA industries based on 4-digit codes for (1950-1966)	Measuring the deviation of actual price from coalition price
Gisser (1986)	Price leader ship and welfare loss in the food industry	445 industries based on 4-digit codes	The half of products obtained from two section of Korno and leader collusion
Willner (1989)	Price leadership and welfare loss	Food and tobacco industries based on four-digit codes	welfare triangle+ costs of acquisition and maintenance of monopoly power
ShahikiTash&Nasiri (2009)	The welfare cost of effective monopoly	Iranian water cooler industry	The competition level is low among the industry's firms, but the intensity of barrier to entry is very high.
Memarnejad (2013)	The welfare cost of monopoly	Iranian telecommunication industry	The calculated welfare loss is 45-65 percent of sale value.

Source: research findings

3. Theoretical Bases of Leibenstein's Social Cost

There are two major views in the investigation of the welfare effects of the performance in an industry. The first view measures the difference between competitive and non-competitive production as well as price pressures of this difference (allocative inefficiency) assuming the efficient allocation of inputs in production units (existence of the x-efficiency).According to this view, the welfare loss resulting from the non-competitive conditions is equal to the "welfare triangle "or "welfare triangle plus the economic rent". In the second view which was first introduced by Leibenstein (1966),the cost of non-competitive performance is considered beyond the welfare triangle by addressing the concept of x-inefficiency. According to this view, in calculating the welfare cost of an industry performance, it is necessary that the inefficiency and allocative social cost of x-inefficiency be calculated simultaneously. In other words, Leibenstein believed that the monopolistic industries operate inefficiently in many cases due to being in a safe margin. Hence, he believed that in addition to the welfare triangle, the costs of inefficiency of monopolistic industries should be considered as welfare cost. Also he believes that there is a positive relationship between firm’s size and the deadweight loss and whatever the firm is larger it is possible that it has more monopoly power and consequently the firm would be more inefficient.

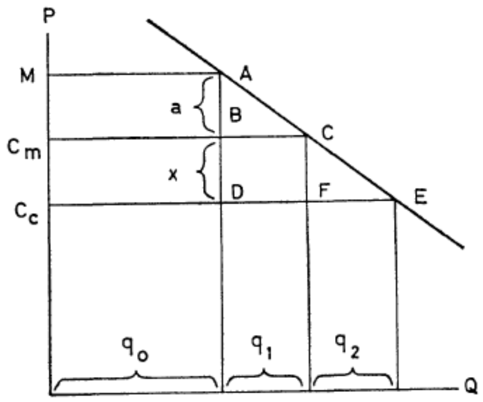

Figure 1: Welfare (Deadweight) Loss in the Index Leibenstein

We follow the estimation of welfare loss using Leibenstein method. Moving from monopoly to competition has two possible effects: Removing the monopoly rent and reducing the cost per unit.

Moving from monopoly to competition will reduce the rent of monopoly of per unit product by *a*, and will reduce the cost of unit by *x*. On this basis, w_a is the partial welfare loss created from the allocative inefficiency of monopoly and has been shown by the area of ABC triangle. On the other hand, W_{ax} stands for the full size of allocative in efficiency due to monopoly shown by the area of ADE triangle. Similarly, W_x is the welfare loss of x-inefficiency resulting from monopoly and indicates the higher costs for producing at limited product level. Given that this loss has been calculated regardless of change in product levels it does not contain the allocative element and is equal to the area of rectangle C_mC_cDB. Hence a is the margin of price-cost that arises under monopoly; x is the difference between cost of monopoly and competition; $q_1$is the difference in amount that has arisen due to the move from monopoly to competition solely by the cost effect; q_2 is the difference in amount that directly corresponds to decline in cost. Now, assuming that X is the cost difference in units of a, that is, X is equal to $\frac{x}{a}$ indicates the ratio of cost difference to margin of price-cost under monopoly. So

$$W_a = \frac{aq_1}{2} \tag{1}$$

$$W_{ax} = \frac{(a + Xa)(q_1 + q_2)}{2} \tag{2}$$

Total welfare loss that has arisen from allocative inefficiency due to monopoly is given by:

$$\frac{W_{ax}}{W_x} = \frac{aq_1 + aq_2 + Xaq_1 + Xaq_2}{aq_1} \tag{3}$$

$$\frac{W_{ax}}{W_x} = (1 + X)^2 \tag{4}$$

This relationship implies that the cost difference due to monopoly is greater than price-cost margin and subsequently the loss in allocative inefficiency is far greater than the allocative loss which is normally measured. In the previous figure xq_0 indicates the unemployed resources in a monopoly situation which would have been employed for producing more units of $\frac{xq_0}{C_c}$ product. Similarly, the percentage of increased product due to the transition from monopoly to competition is equal to $q_1 + \frac{q_2}{q_0}$ that may be shown as follows:

$$\frac{(a+x)e}{M} \tag{5}$$

Where the elasticity of demand is constant. Therefore, the increase in output level due to resources reallocation as a ratio of original output is as follow:

$$\frac{(a+x)e}{M} - \frac{x}{C_c} \tag{6}$$

$$\frac{x}{C_c} = \frac{xM}{MC_c} = \frac{x\left(C_c + a + x\right)}{MC_c} = \frac{x}{M} + \frac{x\left(a+x\right)}{MC_c} \tag{7}$$

We can write:

$$\frac{ae + x(e-1)}{M} - \frac{x(a+x)}{MC_c} \tag{8}$$

By dividing both terms of the last equation by $\frac{(a+x)e}{M}$, we get the following equation:

$$1 - \frac{x}{(a+x)e} - \frac{x}{C_c e} \tag{9}$$

Leibenstein (1996) and Comanor and Leibenstein (1969) suggested that the welfare cost of the performance of an industry is beyond the welfare triangle. From their view, in many studies assessing the social costs of an industry's noncompetitive performance, it is assumed that the first optimal equilibrium condition is satisfied. At this point, the deadweight loss due to monopoly, resulting in non-optimal allocation of resources occurs and its amount will be equal to the triangle ABC. In contrast, if the assumption of equality of inputs efficiencies is set aside in competitive and monopoly performance conditions, then the welfare loss due to monopoly units' performance which can even artificially (state license) be formed, will include x-inefficiency as well as expanding the allocative inefficiency. In this situation, the deadweight loss resulting from monopoly is much greater than the previous approach and will be equal to the area of $ADE + C_m C_c BD$. Quantitatively, one can calculate the amount of welfare loss resulting from allocative inefficiency and x-inefficiency as follows:

$$S_j(ADE) + S_j(C_m C_c BD) = W_{ax} + W_x = \frac{1}{2}(a + x)(q_1 + q_2) + xq_0 \qquad (10)$$

In the above relationship, W_{ax} is the comprehensive measure of allocative inefficiency which Leibenstain (1969) considers equal to the area of triangle ADE. Also W_x is Welfare costs resulting from x-inefficiency without any allocative inefficiency. In order to calculate W_{ax} the following relationship is used:

$$W_{ax} = \frac{(dp \times dq)}{2} = \frac{(a + Xa)(q_1 + q_2)}{2} \qquad (11)$$

Then, like Harberger's relationship, by defining the price elasticity of demand of good j as η_j and assuming $\sigma_j = \frac{dp_j}{p_j}$, we get:

$$(x + a) = dp_j = \sigma_j p_j \qquad (12)$$

$$dp_j = q_j \eta_j \sigma_j \qquad (13)$$

$$W_{ax} = \frac{1}{2} p_j q_j \eta_j \sigma_j^2 \qquad (14)$$

$$S_j(ADE) = \frac{1}{2} qp\eta \left(\frac{a + x}{p}\right)^2 \qquad (15)$$

$$= \frac{1}{2} p_m q\eta \left(\frac{(p - c_m) + x}{p}\right)^2, a = p - c_m \qquad (16)$$

Also, in order to calculate W_x the following relationship is used:

$$W_x = q_0 \times x \qquad (17)$$

Then, by calculating $Ln(\hat{u})$ as the technical inefficiency term in the above relationship, the amount of x- inefficiency is calculated as follow:

$$x = 1 - \frac{C^{\min}}{C^{b}} = 1 - \exp\{-u_{it}\} \tag{18}$$

So:

$$W_{total} = W_{ax} + W_{X} \tag{19}$$

$$= \frac{1}{2} q p_m \eta \left[\frac{p - mc}{p} + \frac{1 - \exp\{-u_{it}\}}{p} \right]^2 + \left[q_0 \times \left(1 - \exp\{u_{it}\}\right) \right] \tag{20}$$

Where, p, q, η, $(1 - \exp\{-u_{it}\})$ and $(p - mc/p)$ indicate the price, amount of sale, elasticity, inefficient term and price disturbance component, respectively. For calculating the above index, it is required first to calculate the amount of inefficiency of every concentrated firm in industry. Also, the price elasticity of demand can be calculated based on a scientific criterion and we should calculate the amount of disturbance term considering various points of view. Hence, in continue, we assess the manner of calculating each variable of Leibenstain index.

4. Variables in Measuring the Leibenstain Index

As it mentioned in the previous section, in order to measure the Leibenstain index it is required that the three main component (i.e., price elasticity, the amount of inefficiency, and price disturbance component) be calculated. So, in continue, we assess the manner of measuring each of these components.

4.1. How to Measure the Price Elasticity in Leibenstain Index?

The main objective of this research is to evaluate the social costs of the monopoly in Iranian concentrated industries during 1996-2006. One of the key differences between this paper and previous studies is related to the manner of measuring the demand elasticity. In most conducted studies, the elasticity of demand is considered as the same or equal to unit for all industries, whereas once the elasticity is considered equal to unit, it means that the marginal revenue is zero which this in turn leads the welfare cost estimation to be biased and usually its estimation will have a downward bias. Hence, to increase the accuracy of the calculations, in continue, we'll explain how to calculate the elasticity in the Leibenstein index.

If we consider the firm's profit function as follow and the firm uses the Cournot pattern in profit maximization, we will have:

$$\pi_i = P_G\left(q_i + Q_{-i}\right)q_i - TC_i \tag{21}$$

Where, π_i is the profit of firm i, P_G is the price of per unit of good produced by firm i, q_i is the amount of output produced by firm i, Q_{-i} is the amount of output produced by all firms in market (except firmi), Q is total amount of output produced in market and TC_i is total cost of firm i. Since, it is assumed that all firms have same cost structure, we can remove the subscript i and obtain the following equation by maximizing the profit function for n firms (Shahiki and Nasiri, 2011):

$$P_G(Q) + Q P'_G(Q)\frac{q}{Q} = MC_G \tag{22}$$

Given the above relationship, we can achieve the Lerner index:

$$L_H = \frac{P_G - MC_G}{P_G} = \frac{S}{\eta} \tag{23}$$

Where, L_H is the Lerner index, MC_G is marginal cost of production, S stands for market share of firm and η is the price elasticity of demand which is equal to $\eta = -\frac{\partial Q}{\partial P_F}.\frac{P_F}{Q}$. Since, the cost structure and market share structure of all firms is assumed to be the same, $\left(S_i = \frac{1}{n}\right)$, it can be shown that the Herfindahl index (H) will be equal to S. because:

$$H = \sum_{i=1}^{n} S_i^2 = \frac{n}{n^2} = \frac{1}{n} = S \tag{24}$$

$$L_H = \frac{H}{\eta} = \frac{P_G - MC_G}{P_G} \tag{25}$$

Also, we can adjust the Lerner index according to Cabral (2000) with regard to the conjectural variation coefficient (θ) as follows:

$$L_H^{\theta} = \frac{\theta H}{\mu} = \frac{\theta}{n\eta} \tag{26}$$

Where $0 \le \theta \le \frac{1}{H}$. If $\theta = 0$, the actors play according to the Bertrand pattern, and if $\theta = 1$, the play's pattern will be Kernot and if $\theta = \frac{1}{H}$, the actors' pattern will be collusion or cartel. In other words:

Table 2: The Lerner Index in Terms of Different θ

Conjectural variation coefficient	**Lerner index**	**Play pattern**
$\theta = 0$	$L_H^{\theta} = 0$	Bertrand pattern
$\theta = 1$	$L_H^{\theta} = \frac{H}{\eta}$	Cournot - Nash pattern
$\theta = \frac{1}{H}$	$L_H^{\theta} = \frac{1}{\eta}$	collusion or cartel pattern

Source: Shahiki and Nasiri (2011)

And as a result:

$$\frac{P - MC}{P} = \frac{H}{\eta} \tag{27}$$

$$\eta = \frac{1}{\left\{\frac{P - MC}{P}\right\}} H = \frac{1}{\left\{\frac{P - MC}{P}\right\}} \left(\Sigma S_i^2\right) \tag{28}$$

The feature of adjusted Lerner index provided by Cabral is that: first, it shows the monopoly power in supply side; second, it is located between zero and one. In conditions where the market is perfect competition the value of this index is zero, and in the perfect monopoly condition it is equal to unit. Now, for calculating the elasticity, the amount of $\left\{\frac{P - MC}{P}\right\}$ should be calculated. In this research, the Roeger approach has been used to calculate $\left\{\frac{P - MC}{P}\right\}$. Roeger (1995) provided an alternative method based on Solow residual for calculating the Lerner index and based on the technical progress he provided the following approximation for calculating MC_t:

$$\mu - 1 = \frac{\Delta(\tilde{p}_{it} + \tilde{q}_{it}) - \tilde{\alpha}\Delta(l_{it} + w_{it}) - \tilde{\beta}\Delta(m_{it} + p^m_{it}) - (1 - \tilde{\alpha} - \tilde{\beta})\Delta(k_{it} + r_{it})}{\left(\tilde{\alpha}\Delta(l_{it} + w_{it}) + \tilde{\beta}\Delta(m_{it} + p^m_{it}) - (\tilde{\alpha} + \tilde{\beta})\Delta(k_{it} + r_{it})\right)} \quad (29)$$

Where, θ_{it} indicates the rate of technological progress for the period t and section i. Based on the constant returns to scale assumption and Mark-up constancy, the above relationship can be stated as follow:

$$\underbrace{\Delta q_{it} - \alpha\Delta l_{it} - (1-\alpha)\Delta k_{it}}_{\text{Solow Residual } (SR_t)} = (\mu - 1)\alpha\left(\Delta l_{it} - \Delta k_{it}\right) + \theta_{it} \quad (30)$$

Where, the Mark-up price relative to marginal cost is equal to $\mu = P / MC$ and $\theta \equiv \dot{A} / A$ stands for exogenous technical progress. In perfect competition conditions we have $\mu = 1$, and in monopolistic competition conditions $\mu > 1$. Due to the problem of correlation between $(\Delta l - \Delta k)$ and θ of productivity shocks, Roeger provided the following relationship:

$$DSR_{it} \equiv \alpha\Delta w_{it} + (1-\alpha)\Delta r_{it} - \Delta p_{it} = (\mu - 1)\alpha(\Delta w_{it} - \Delta r_{it}) + \theta_{it} \quad (31)$$

In this condition the problem of endogeneity bias is overcome and dual of Solow residual can be calculated and based on it, we can obtain a relationship between productivity-based price and Mark-up pricing which in this relationship, w and r stand for logarithm of wage rate and rental rate of capital, respectively. Using the above relationship, Roeger tried to obtain the nominal Solow residual (NSR_{it}):

$$NSR_{it} \equiv \Delta(p_{it} + q_{it}) - \alpha\Delta(l_{it} + w_{it}) - (1-\alpha)\Delta(k_{it} + r_{it}) = (\mu - 1)\alpha(\Delta(l_{it} + w_{it}) - \Delta(k_{it} + r_{it})) \quad (32)$$

In this relationship, the effect of productivity shocks has been removed and the problem of endogeneity has been solved and there is no need to instrumental variable. We can calculate the Mark-up ratio using last relationship as follows:

$$\mu - 1 = \frac{\Delta(p_{it} + q_{it}) - \alpha\Delta(l_{it} + w_{it}) - (1-\alpha)\Delta(k_{it} + r_{it})}{\alpha\left(\Delta(l_{it} + w_{it}) - \Delta(k_{it} + r_{it})\right)} \quad (33)$$

On this basis, the elasticity is calculated as follows:

$$\eta = \frac{1}{\frac{P - MC}{P}} \{H\} \tag{34}$$

$$\eta = \frac{1}{1 - \frac{\Delta(p_{it} + q_{it}) - \alpha\Delta(l_{it} + w_{it}) - (1-\alpha)\Delta(k_{it} + r)_{it}}{\alpha\left(\Delta(l_{it} + w_{it}) - \Delta(k_{it} + r_{it})\right)}} \{H\} \tag{35}$$

Table 3: The Estimation of Elastisity in Iranian Industries

Elasticity	**Industry**	FK
0.835504	Manufacture of food products and beverages	**15**
6.167865	Manufacture of tobacco products	**16**
1.386031	Manufacture of textiles	**17**
1.21554	Manufacture of wearing apparel; dressing and dyeing of fur	**18**
2.189024	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	**19**
1.635818	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	**20**
1.100021	Manufacture of paper and paper products	**21**
0.702136	Publishing, printing and reproduction of recorded media	**22**
0.593242	Manufacture of coke, refined petroleum products and nuclear fuel	**23**
0.624761	Manufacture of chemicals and chemical products	**24**
0.790493	Manufacture of rubber and plastics products	**25**
0.45184	Manufacture of other non-metallic mineral products	**26**
0.601317	Manufacture of basic metals	**27**
1.143449	Manufacture of fabricated metal products, except machinery and equipment	**28**
1.160811	Manufacture of machinery and equipment n.e.c.	**29**

0.776217	Manufacture of office, accounting and computing machinery	**30**
1.357125	Manufacture of electrical machinery and apparatus n.e.c.	**31**
1.302975	Manufacture of radio, television and communication equipment and apparatus	**32**
2.075181	Manufacture of medical, precision and optical instruments, watches and clocks	**33**
1.46638	Manufacture of motor vehicles, trailers and semi-trailers	**34**
1.152053	Manufacture of other transport equipment	**35**
1.073173	Manufacture of furniture; manufacturing n.e.c.	**36**
1.40215	Recycling	**37**

4.2.How to Measure the Inefficiency

As we know, the best method for analyzing the performance of a monopolistic firm is measuring its efficiency and productivity. Determination of efficiency is related to definition and comparing it with an optimal and standard frontier, this standard frontier indicates maximum potential or actual power of the firm. This standard frontier is so called frontier production function which shows the frontier of minimum inputs in order to produce specific level of output at given technology level or maximum output which can be produced by given amount of inputs. The producers which act on production frontier are considered technically efficient and those located in below the frontier production function are inefficient. One method for obtaining frontier functions is the statistical parametric method known as Stochastic Frontier Analysis (SFA). In this method the difference between actual output and frontier output is obtained; in addition to technical inefficiency, the stochastic factor is also considered and is estimated using Maximum Likelihood Estimation (MLE).

One of the best measures of assessing the performance of an industry is evolution of frontier efficiency in industry presented by Battese and Coelli (1995). Battese and Coelli assume that the relation between inputs (X_{it}) and outputs (Q_{it}) can be approximated using production function where i stands for firms and t stands for years. So, the production frontier corresponded to the best empirical function is defined as follow:

$$Q_{it}^{F} = f(X_{it}, t) \tag{36}$$

Where Q_{it}^{F} is Potential output level on production frontier in period t for firm i which is a continuous, strictly increasing and quasi-concave function and X_{it} is a k order vector of inputs. In order to estimate the stochastic frontier, one can define the stochastic component, $v_{it} - u_{it}$, in production function and restate the production function as follows:

$$Q_{it} = f(X_{it}, t)\exp\{v_{it} - u_{it}\} \tag{37}$$

$v_{it} - u_{it}$ is the combined error component where v_{it} is an stochastic variable indicates exogenous factors and random shocks and u_{it} is an stochastic variable shows endogenous factors and technical inefficiency of production which so called technical efficiency error. Generally, u_{it} is greater or equal to zero and it is assumed that is independent from stochastic error. Hence, in this research the technical efficiency of country's industry is measured using stochastic frontier function model which is based on Battese and Coelli model(1995).

$$\begin{aligned} Q_{it} &= f(x_{it,}\beta)\exp(\varepsilon_{it}) = f(x_{it,}\beta)\exp(v_{it} - u_{it}) \\ \varepsilon_{it} &= v_{it} - u_{it} \\ v_{it} &\cong iid\ N(o, \sigma_v^2) \\ u_{it} &\cong iid \left| N(m_{it}, \sigma_u^2) \right| \\ u_{it} &\geq 0 \end{aligned} \tag{38}$$

In above model, $f(0)$ is suitable function form, y_{it} is the ith unit's output in the period t and x_{it} is the vector of production factors for ith unit in the period t. the variables u_{it} and v_{it} indicate the amount of inefficiency and other statistical disturbances, respectively. u_{it} has normal distribution Interrupted in zero with a mean equal to m_{it}. In this model instead of variances σ_u^2 and σ_v^2, the two parameters of σ^2 and γ which are equal to $\sigma^2 = \sigma_v^2 + \sigma_u^2$ and $\gamma = \sigma_u^2 / (\sigma_v^2 + \sigma_u^2)$, respectively, are replaced and estimated. The parameter γ, in fact, evaluate if inefficiency component is significant and its effect in model. This parameter is estimated in the iterative maximization process and takes a value between zero and one. In order to assess the performance, in this research we use the information of Shahiki and Nasiri (2011) which has applied the following Translog function for $Q_{it}^F = f(X_{it}, t)$:

$$\begin{aligned} LnQ_{it} &= \alpha_0 + \alpha_L LnL_{it} + \alpha_K LnK_{it} + \tfrac{1}{2}\beta_{LL}(LnL_{it})^2 + \tfrac{1}{2}\beta_{KK}(LnK_{it})^2 + \beta_{LK}(LnL_{it})(LnK_{it}) \\ &+ \beta_{tL}(LnL_{it})t + \beta_{tK}(LnK_{it})t + \alpha_t t + \tfrac{1}{2}\beta_{tt}t^2 + (v_{it} - u_{it}) \end{aligned} \quad (39)$$

$$v_{it} \cong iid\ N(o, \sigma_v^2)$$

$$u_{it} \cong iid \left| N(m_{it,} \sigma_u^2) \right|$$

$$u_{it} \geq 0$$

It is notable that to quantify the technology index, in this research using the information related to Research and Development (R&D) costs, the number of expert labor forces (LL), and applying fuzzy approach, a combined index is considered to assess the technology which Q_{it} is corresponded to industry's value added. Also distribution related to "technical inefficiency effects" is a non-negative truncated normal distribution function with components of N (m_{it}, σ_u^2). Level of technical efficiency of i-th firm in time t is obtained as the ratio of average output to potential average output as follows:

$$TE_{it} = \frac{E(Q_{it} / u_{it}, L_{it}, K_{it})}{E(Q_{it}^F / L_{it}, K_{it})} = \exp\{-u_{it}\} \quad (40)$$

According to TE relationship the assessment of industries' technical efficiency located at ISIC 2-digit code has been presented. As it mentioned before, the technical efficiency indicates a firm's ability in product maximization given specific production factors or, in other words, indicates the use of minimum inputs for producing a specific level of product.

Table4: Estimating the Efficiency in Iranian Industries

Efficiency	Industry	FK
0.554273	Manufacture of food products and beverages	**15**
0.5375	Manufacture of tobacco products	**16**
0.44944	Manufacture of textiles	**17**
0.43605	Manufacture of wearing apparel; dressing and dyeing of fur	**18**
0.5165	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	**19**
0.47496	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	**20**
0.5647	Manufacture of paper and paper products	**21**
0.40346	Publishing, printing and reproduction of recorded media	**22**
0.5921	Manufacture of coke, refined petroleum products and nuclear fuel	**23**
0.619011	Manufacture of chemicals and chemical products	**24**
0.5104	Manufacture of rubber and plastics products	**25**
0.47174	Manufacture of other non-metallic mineral products	**26**
0.60845	Manufacture of basic metals	**27**
0.496667	Manufacture of fabricated metal products, except machinery and equipment	**28**
0.515971	Manufacture of machinery and equipment n.e.c.	**29**
0.6016	Manufacture of office, accounting and computing machinery	**30**
0.545233	Manufacture of electrical machinery and apparatus n.e.c.	**31**
0.6121	Manufacture of radio, television and communication equipment and apparatus	**32**
0.51536	Manufacture of medical, precision and optical instruments, watches and clocks	**33**
0.590867	Manufacture of motor vehicles, trailers and semi-trailers	**34**
0.519167	Manufacture of other transport equipment	**35**
0.47268	Manufacture of furniture; manufacturing n.e.c.	**36**
0.4682	Recycling	**37**

4.3 How to Measure the Price Disturbance Component

One of the most important variables in this index is the price disturbance component. To measure the price disturbance component, in this paper the ratio of profit to sales has been used. This approach is like the approach of Harberger, Posner and Khodadad Kashi.

$$\frac{P - MC}{P} \cong \frac{\pi}{R} \qquad (41)$$

5. Measuring the Social Cost of Iranian Concentrated Industries

In this research in order to identify the monopoly industries in Iran, the concentration Index of Herfindahl-Hirschman (HHI) has been used. This index is the one of the important and applicable indexes for representing the concentration. The advantage of this index over the other indexes is that it considered the all points on the concentration curve, that is, this index uses the information of all firms of industry. In order to obtain this index the sum of squares of (output, sales, labor force, etc) share of all firms in industry or market is used. In other words, this index is obtained using the sum of squares of market share of firms or using the ratio of firm outputs to total output of the market's desired product. The above index can be measured as $H = \sum_{i=1}^{N} S_i^2$, where, S_i is the market share of the ith firm and N is the number of firms in the industry. If the value of HHI be greater than (1800), the market will be concentrated.

Table5: Introducing Iranian Concentrated Industries Based on Herfindahl-Hirschman Index

HHI	Industry	FK
0.135238	Manufacture of food products and beverages	
0.20354	Manufacture of tobacco products	**15**
0.197232	Manufacture of textiles	**16**
0.194486	Manufacture of wearing apparel; dressing and dyeing of fur	**17**
0.182419	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	**18**
0.220835	Manufacture of wood and of products of wood and	**19**

HHI	Industry	FK
	cork, except furniture; manufacture of articles of straw and plaiting materials	
0.19727	Manufacture of paper and paper products	**20**
0.20053	Publishing, printing and reproduction of recorded media	**21**
0.164625	Manufacture of coke, refined petroleum products and nuclear fuel	**22**
0.170907	Manufacture of chemicals and chemical products	**23**
0.168375	Manufacture of rubber and plastics products	**24**
0.17075	Manufacture of other non-metallic mineral products	**25**
0.162255	Manufacture of basic metals	**26**
0.167706	Manufacture of fabricated metal products, except machinery and equipment	**27**
0.19825	Manufacture of machinery and equipment n.e.c.	**28**
0.192502	Manufacture of office, accounting and computing machinery	**29**
0.189771	Manufacture of electrical machinery and apparatus n.e.c.	**30**
0.176336	Manufacture of radio, television and communication equipment and apparatus	**31**
0.214159	Manufacture of medical, precision and optical instruments, watches and clocks	**32**
0.191118	Manufacture of motor vehicles, trailers and semi-trailers	**33**
0.194505	Manufacture of other transport equipment	**34**
0.160761	Manufacture of furniture; manufacturing n.e.c.	**35**
0.166856	Recycling	**36**

Source: Current research

Because of using Leibenstain index for welfare cost evaluation, and due to the fact that in this index the oligopoly market is considered, we should select the industries which have a concentration index of higher (1800).Now, the central aim of discussion is to see how much welfare cost has been imposed on consumers in society due to concentrated structure in Iranian industrial sectors. Hence, considering the mentioned information and using Leibenstain index, we evaluate W_L in Iranian concentrated industries.

Table6: Evaluating Leibenstain Welfare Cost in Iranian Concentrated Industries

Sale to social cost	**Industry**	FK
0.019496	Manufacture of food products and beverages	**15**
0.104775	Manufacture of tobacco products	**16**
0.018155	Manufacture of textiles	**17**
0.009804	Manufacture of wearing apparel; dressing and dyeing of fur	**18**
0.001768	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	**19**
0.022836	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	**20**
0.022669	Manufacture of paper and paper products	**21**
0.027468	Publishing, printing and reproduction of recorded media	**22**
0.039509	Manufacture of coke, refined petroleum products and nuclear fuel	**23**
0.023196	Manufacture of chemicals and chemical products	**24**
0.022174	Manufacture of rubber and plastics products	**25**
0.024609	Manufacture of other non-metallic mineral products	**26**
0.022619	Manufacture of basic metals	**27**
0.031241	Manufacture of fabricated metal products, except machinery and equipment	**28**
0.021179	Manufacture of machinery and equipment n.e.c.	**29**
0.014921	Manufacture of office, accounting and computing machinery	**30**
0.027518	Manufacture of electrical machinery and apparatus n.e.c.	**31**
0.021124	Manufacture of radio, television and communication equipment and apparatus	**32**
0.041039	Manufacture of medical, precision and optical instruments, watches and clocks	**33**

0.028869	Manufacture of motor vehicles, trailers and semi-trailers	**34**
0.023792	Manufacture of other transport equipment	**35**
0.023069	Manufacture of furniture; manufacturing n.e.c.	**36**
0.054701	Recycling	**37**

Resource: Research findings

As table(6) shows, the welfare cost has been shown as a percentage of sale and the highest welfare cost is related to Manufacture of tobacco products, Recycling, Manufacture of medical, precision and optical instruments, watches and clocks, Manufacture of coke, refined petroleum products and nuclear fuel, Manufacture of fabricated metal products, except machinery and equipment, which have created a welfare cost equal to 100/47, 54.701, 41.039, 39.509 and31.241 percent of sales, respectively. In other words, as can be seen in the table (6) a welfare cost of about 24.01 percent of sales has been imposed on consumers in society by concentrated industries.

Table 7:Average Leibenstein Welfare Cost in Iranian Concentrated Industries

Index	**Average welfare cost in industries**
The ratio of welfare cost to sales (percent)	0.24

Source: Research findings

6. Summary and Conclusion

In order to organize government’s decisions and policies in the direction of increasing society welfare, awareness about the level of welfare loss due to non-optimal allocation of resources for consumers and other economic agents is essential. Hence, the main goal of this paper was to evaluate the social costs of effective monopoly in Iranian concentrated industries. There are two major views in investigating welfare effects of the performance in an industry. The first view assuming the efficient allocation of inputs in the production units (the existence of the x-efficiency) measures the difference between competitive and non-competitive production as well as price pressures of this difference (allocative inefficiency). According to this view, the welfare loss resulting from non-competitive conditions is equal to the "welfare triangle "or "welfare triangle plus the economic rent."In the second view which was firstly introduced by Leibenstein (1966),the cost of non-competitive performance is considered over welfare triangle by addressing the concept of x-inefficiency. According to this view, in calculating the welfare cost of an industry's performance, it is necessary that the inefficiency cost and allocative social cost of x-inefficiency be calculated simultaneously. It is believed that the monopoly industries operate inefficiently in many cases due to being in a safe margin. Hence, he believed that in addition to the welfare triangle, the costs of inefficiency of monopoly industries should be considered as the welfare cost. So, in order to measure social cost of welfare triangle and inefficiency in Iranian concentrated industries, in this study, the Leibenstein approach was used. Findings showed that the industries of " Recycling, Manufacture of medical, precision and optical instruments, watches and clocks, Manufacture of coke, refined petroleum products and nuclear fuel, Manufacture of fabricated metal products, except machinery and equipment, have imposed highest welfare cost on society due to inefficiency and deadweight loss of welfare triangle; that is, they have created a welfare cost equal to 100.47 54.701, 41.039, 39.509 and 31.241 percent of sales, respectively. Hence, in order to determine that the factors such as the severity of barrier to entry, concentration intensity, non-competitive behaviors and abuse dominant position to what extent have contributed in creating this welfare cost, the structural components of these industries should be identified by the competition council. Also, some policies should be adopted by this institution to increase competition in mentioned industries.

Endnote

1- International Standard of Industrial Classification.

References

Baron, D. (1973). Limit Pricing, Potential Entry, and Barriers to Entry. *American Economic Review*, 63, 666-674.

Battese, G., & Coelli, T.(1995). A Model for Technical Inefficiency Effects in a Stochastic Frontier Production Function and Panel Data. *Empirical Economics*, 20, 325-332.

Cabral, Luis, M. B. (2000). Stretching Firm and Brand Reputation. *Real Journal of Economics*, 31, 658-673.

Comanor, W.S., & Leibenstein, H. (1969). Allocative Efficiency, X-efficiency and the Measurement of Welfare Losses. *Economica*, 36(3), 304-309.

Cowling, K., & Muller, D. (1978). The Social Cost of Monopoly Power. *Economic Journal*, 88, 727-748.

Gisser, M. (1986). Price Leadership and Welfare Losses in U.S. Manufacturing. *The American Economic Review*, 76(4), 756-767.

Harberger, A. (1954). Monopoly and Resource Allocation. *The American Economic Review*, 44(2), 77-87.

Kamien, M., & Schwartz, N. (1971). Limit Pricing and Uncertain entry. *Econometrica*, 39, 441-454.

Khodadad Kashi, F.(2000). Monopoly, Competition and Concentration in Iran's Industrial Markets (1988-1994).*Iranian Journal of Trade Studies*,15(4), 83-116.

Khodadad Kashi, F. (2001). Assessment of Power and Volume of Monopolistic Activities in Iran's Economy. *Institute for Trade Studies and Research.IR.454.*

Leibenstein, H. (1966). Allocation efficiency Vs X-efficiency. *The American Economic Review*, 56(3), 392-415.

Leibenstein, H. (1973). Competiton and X-efficiency: Reply. *Journal of political Economy*, 81(3), 765-77.

Masson, R. T., & Shaanan, J.(1984). Social Cost of Oligopoly and the Value of Competition. *The Economic Journal*, 94, 520-535.

Memarnejad, A. (2013). The Welfare Cost of Monopoly in Iranian Telecommunication Industry. *Iranian Journal of Applied Economics*, 4(3), 83-107.

Posner, R .(1975).The Social Cost of Monopoly &Regulation. *Journal of Political Economy*, 83(4).

Roeger, W. (1995). Can Imperfect Competition Explain the Difference Between Primal and Dual Productivity Measures? Estimates for US Manufacturing. *Journal of Political Economy*, 103(2), 316-330.

Shahiki Tash M. N., &Fiuzi Ekhtiari, N. (2009). Estimation of Welfare Cost in Iran's Insurance Industry. *Iranian Journal of Economic Research*, 32.

Shahiki, T, M. N., & Nasiri, A. (2011). Concentration Barrier to Entry and Economics of Scale in the Water Air conditioner Industry in Iran and Evaluation of Social Welfare Costs. *Quarterly Journal of Quantitative Economics*, 8(1), 73-98.

Willner, J. (1989). Price Leadership and Welfare Losses in U.S. Manufacturing: Comment. *The American Economic Review*, 79(3), 604-609.