# Analyzing the Aspects of Cross Sharing Ownership

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## Abstract

*With the growth of capital market, the shareholding structure of companies has become more complex. Direct ownership is easily recognizable through companies' shareholders information, however with the formation of cross shareholding among companies, a kind of indirect and complex shareholding has emerged which is not observable. The primary owners (original owners) can take over other companies through intermediate owners. In this research a model is presented to identify and investigate the structure of indirect ownership. Identifying the hidden ownership relations together with determining the level of complexity of network and the degree of ownership concentration are among the capabilities of this model. To this end, the ownership network of Tehran Stock Exchange in June 2014 was analyzed. The results indicate that over 86 percent of all observed ownership relations have been formed by indirect ownership and at least with the presence of one intermediate owner. Moreover, 15.35 percent of the market's total value (equals with 547 thousands billion Rials) was calculated twice and also studying the degree of concentration of ownership indicates that over 60 percent of the market's total value belongs to only 10 percent of the shareholders.*

***Keywords:** Cross shareholding, indirect shareholding, Ownership concentration*
***JEL Classifications:** L16, G32*

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## 1. Introduction

Nowadays, the ownership structure of companies has become more complex. Ownership structures such as pyramiding structure, one-sided shareholding, reciprocal shareholding and circular shareholding which are known as cross shareholding have emerged with the expansion of *limited liability partnerships* and capital market. In such structures the owners do not necessarily own other companies directly which means a kind of hidden ownership which intermediate companies have provided for them.

Direct ownership refers to simply owning something while indirect ownership refer to the ownership thru some other entity.

As an instance, consider the person A who holds a portion of the B Company's shares. B Company is also the partial owner of the company C. Although the person A is not the direct share holder of the C company, he is its indirect owner and benefits from its income due to the B company. This was solely a simple example of complex ownership structure. Such structures are of great importance and are necessary to be studied due to several reasons.

Cross shareholding can be effective in the cooperation of companies in an industry and also in guaranteeing a minimal stability, however, it has been criticized due to some reasons including reducing the speed of economic growth, preventing investment in productive activities and strengthening economic recession by hindering optimal allocation of capital. In case of overlooking the indirect ownership structure which is hidden by appearance, the regulatory bodies would make a wrong evaluation of the value of companies controlled by shareholders. Additionally, governments' tax benefits from companies' indirect incomes can be investigated only through the study of direct ownership.

Cross shareholding leads to the additional calculation of a part of firm market value which is controlled by other companies. In such conditions calculating market's total value based on the firms' total value brings about misleading information. In addition, the indices derived from the market value are influenced by indirect ownerships and parts of the volatility are artificially intensified as a result of disregarding the cross shareholding. Therefore, those valuation models which use the market index as a factor commit an error and will provide incorrect results. A clear image of the ownership structure is needed to modify and adjust the total market value and indices subsequently.

Firm cross shareholding can lead to a complex network of inter-dependent relations among economic factors. In this research a model is presented based on the portion of indirect ownership from the total ownership in Tehran Stock Exchange for each firm and generally for the whole market. By using the primary and intermediate owners' ownership matrix, this model can precisely determine the amount which was considered twice in calculating the total market value and also can present an accurate rating of the major shareholders based on the total ownership (direct and indirect). On the other hand by using this model, it is possible to identify and draw the ownership structure and determine the path through which each shareholder is the owner of a company.

In the presented model, the "weighted average distance" criterion is defined to quantify the complexity of the relations between primary and intermediate owners. With this criterion it can be shown that through what number of intermediate owners and with what weight each shareholder has owned a part of the studied company.

## 2. Literature Review

Numerous studies have been carried out on the ownership structure (Bresnahan and Salop 1986, Reynolds and Snapp 1986, Flath 1989, 1991), however a few number of studies have focused on the indirect ownership or cross shareholding topics. In the literature this type of ownership is known as the "Insider System" which is observed in industrial groups of countries such as Japan, Germany and Switzerland.

Franks and Mayer (1995) have identified the two ownership structures of insider and outsider systems. An insider system contains a few number of small firms accepted in stock exchange with less interactions in them and representing a complex ownership network among companies. In contrast, an outsider system is known with a large number of big firms accepted in stock exchange and with higher interactions and a lower ownership among companies. The results of the research indicated that European and Japanese companies mainly follow the ownership structure of insider system and American companies follow the ownership structure of outsider system.

Ellerman (1991) has studied the cross shareholding and has suggested the primary and dual ownership. He has mainly focused on control issue and voting system in his model.

Flath (1992, 1993) has studied the indirect ownership for six industrial groups in Japan. He showed that indirect ownership in such groups has a large portion and since shareholders receive huge benefits through this type of ownership, it should be noted in studies. Such benefits have been investigated by Dietzenbacher et al. (2000) in an empirical study concerning the Dutch financial services industry. Moreover, cross shareholding among companies of an industrial group and its effect on the competition among these companies have been analyzed by Rietman (1994), Alley (1997) and Gilo et al. (2006).

The evolution of cross shareholding structure in Japan during 1990s has raised numerous fundamental questions regarding the reasons, effects and the results of this change which received great attention for various studies. By studying this phenomenon, Hideaki (2005) showed that profitable firms are more likely to leave cross shareholding ownership than other firms due to easier access to capital and foreign investments. While firms with less productivity prefer cross shareholding ownership due to limitation in providing the capital.

Studying the effect of cross shareholding ownership on performance indices has been the purpose of many researches. The empirical results of this group of researchers have not been the same and mainly have contradicted each other (Prowse 1990, Flath 1993, Lichtenberg and Pushner 1994, Morck et al, 2000, Yafeh and Yosha 2003).

Haowei and Yong (2014) have studied the ownership network and cross shareholding in Shanghai and Shenzen stock exchange in years 2004 to 2010 using social networks' analytical methods. They have studied the effect of these factors on companies' performance indices based on the characteristics of each company according to its position in network and regression analysis.

Vitali et al. (2011) have studied the architecture of international ownership network for the first time. In this research it is attempted to collect and process all the observable ownership structures around the world. The ownership structure was studied by using the concepts of complex networks and it was determined that the main part of the existing ownership and value in world markets is monopolized by a small group of shareholders and also control concentration has resulted in formation of several "super-entities" (who control the main part of the world companies) in the world.

It should be mentioned that there are no related previous literature on the internal studies.

# 3. Research Psychology

The firms' owners can be generally categorized in two groups: Primary owners and intermediate owners. Primary or main owners are those who are not controlled by others and therefore, they will be individuals or government representatives. The intermediate owners are the ones who do not belong to the primary owners' category. Companies, banks and other institutional investors are considered as intermediate owners. Although, primary owners can hold a portion of the intermediate owners' shares, primary owner cannot own a portion of the other primary owners' shares. In contrast, the intermediate owner can own a portion of the intermediate owners' share.

It is possible to trace out the ownership structure to the level of primary owners and attribute each portion of firm's value to a primary owner, on the condition that the shareholders' information of all kinds of companies are accessible. Since such precise information is not accessible, inevitably only the accepted firms in Tehran Stock Exchange published a clear list of shareholders who are considered as the intermediate owners and the rest of the owners such as individuals, private companies and institutional investors out of the stock exchange are known as primary owners.

Here, firstly a model will be presented to separate the direct and indirect ownership and subsequently based on the introduced concepts in this model, a criterion for measuring the degree of complexity of the ownership structure will be suggested.

## 3.1. The direct and indirect ownership separating model

If $m$ is considered as primary owner and $n$ as the intermediate owner, the primary ownership matrix $P$ can be defined with the dimensions of $n*m$. In this matrix the $P_{ik}$ shows the portion of the $i$ company ($i=1,…, n$) which is held by the primary owner $k$ ($k=1,…,m$). Moreover, the intermediate ownership matrix, $S$, is defined in this way that $S_{ij}$ represents the portion of $i$ company which is held by intermediate owner ($j=1,…, n$). The total sum of ownership percentages in row matrixes for each company equals 1 and $\sum_j s_{ij} + \sum_k p_{ik} = 1$ applies for each $i$ (in fact this assumption can be true when all of the companies (intermediate owners) are controlled by other intermediate and primary owners).

Matrixes $S$ and $P$ indicate the distribution of direct ownership which is observable through the present data. In order to obtain the appropriate distribution of ownership, the indirect ownership should be identified and separated. Consider the state in which the primary owner $k$ directly owns the amount of $P_{ik}$ shares of $i$ company and also he owns the amount of $P_{hk}$ shares of the $h$ company and this company directly owns the amount of $S_{ih}$ shares from the company $i$. Therefore, in this case the primary owner $k$ is both directly and indirectly in double steps $(k{\rightarrow}h{\rightarrow}i)$ the owner of company $i$. This is called the indirect ownership with the length of 2. If all the paths through which the primary owner $k$, indirectly and in double-step, owns the company $i$, then the $\sum_h s_{ih} p_{hk}$ will be the total amount of the indirect ownership of the primary owner $k$, in the company $i$ with the length of 2. The product of $SP$ is the matrix form of this sum. Similarly, the indirect ownership with the length of 3 $(k{\rightarrow}h{\rightarrow}l{\rightarrow}i)$ can be studied. In such conditions the total indirect ownership of the primary owner $k$ in the company $i$ with the length of 3 can be achieved through the $\sum_l \sum_h s_{il} s_{lh} p_{hk}$ relation which is in fact the element of $i$ row and the $k$ column of the $S^2P$ matrix.

Considering the indirect ownership with the length of 2 and more than 2, it can be said that the total indirect ownership matrix, Y, can be calculated through relation (1).

$$Y = SP + S^2P + S^3P + \cdots = (S + S^2 + S^3 + \cdots)P \qquad (1)$$

By adding the direct ownership, the total ownership matrix, $T$, can be calculated through relation (2) in which the $i$ is the matrix unit and the equality of the $(I + S + S^2 + S^3 + \cdots) = (I - S)^{-1}$ can be proved through the exponent series expansion.

$$T = P + SP + S^2P + S^3P + \cdots = (I + S + S^2 + S^3 + \cdots)P \qquad (2)$$
$$= (I - S)^{-1}P$$

Using the simplified form of the relation number (2), the Y matrix can be calculated:

$$Y = (S + S^2 + S^3 + \cdots)P = [(I - S)^{-1} - I]P = T - P \qquad (3)$$

It is noteworthy to say that the two matrixes $T$ and $Y$ have the same and equal dimensions with $P$ matrix and also $T$ matrix are obtained with elimination of intermediate owners' ownership in $S$ matrix and its allocation to each of the primary owners in Matrix P.

It is possible to determine the distribution of value controlled by primary owners on the condition that the intermediate owners' market value information (the *limited liability partnerships* accepted in Stock Exchange) were accessible. If $v$ (a vector with the dimensions of $1*n$) indicated the value of companies' market (intermediate owners), then the $k$ element in the product of $vT$ shows the total value controlled by primary owner $k$.

## 3.2. Measuring the complexity of the ownership network

With a larger amount of indirect ownership in an ownership market, there is a higher complexity and stronger hidden relations among owners. Moreover indirect ownership results in separation between ownership and control ability that the evaluation of the intensity of this separation is possible through having a clear criterion of the amount of the indirect ownership. Additionally, such criterion can be used in the comparative study of the markets from the viewpoint of the degree of complexity in indirect relations.

The degree of complexity of the indirect ownership relation among primary and intermediate owners can be measured with the weighted average distance. The distance is defined as the number of the existing intermediate owners between the primary owner and the company plus one. For instance, the distance between the primary owner $k$ who is the shareholder of a portion of the intermediate owner (company) $i$ through the intermediate owner $h$ equals with 2 (i.e. $k{\rightarrow}h{\rightarrow}i$).

In order to calculate the weighted average distance, the indirect ownership, matrix Y and relation (1) should be considered. If the element of the $i$ row and $k$ column are shown as $[S^r P]_{ik}$ in the $S^r P$ *matrix,* the share of the indirect ownership with the length of 2 equals *[SP]$_{ik}$/y$_{ik}$* from the total indirect ownership between the primary owner $k$ and $i$ company which is $y_{ik}$. Similarly *[SP]$_{ik}$/y$_{ik}$* is the determinant of the indirect ownership share with the length of 3 from the total indirect ownership. Totally *[SP]$_{ik}$/y$_{ik}$* indicates the share of indirect ownership with the length of *r+1*.

The average weighted distance, can be calculated with the averaging of the distance with the length of *r+1* by using *[SP]ik/yik* weights for *r=1,2,3,…* according to the relation(4):

(4)

$$\frac{2 * [SP]_{ik} + 3 * [S^2 P]_{ik} + 4 * [S^3 P]_{ik} + \cdots + (r-1) * [S^r P]_{ik} + \cdots}{y_{ik}}$$

$$= \left\{ \frac{1 * [SP]_{ik} + 2 * [S^2 P]_{ik} + 3 * [S^3 P]_{ik} + \cdots + r * [S^r P]_{ik} + \cdots}{y_{ik}} \right\} + 1$$

In the second line of the relation (4), the numerator can be re-written as: $\sum_{r=1}^{\infty} r S^r P$ . According to relation (5) it can be proved that (I-S) Q=Y:

(5)

$$(I - S) \left( \sum_{r=1}^{\infty} r S^r P \right) = \sum_{r=1}^{\infty} r S^r P - S \sum_{r=1}^{\infty} r S^r P$$

$$= \sum_{r=1}^{\infty} r S^r P - \sum_{r=1}^{\infty} r S^{r+1} P = \sum_{r=1}^{\infty} S^r P = Y$$

Thus the relation *Q=(I-S)⁻¹Y* is true and for the average weighted distance between the primary shareholder *k* and the *i* company is shown as the *WADILik* and can be calculated with the $\left( \frac{q_{ik}}{y_{ik}} \right) + 1$ relation. With a larger number of intermediate shareholders and higher level of complexity, a higher amount of *WADILik* will be obtained.

If *Yik* equals zero, which means that there is no indirect ownership, *WADILik* will not be measureable. Therefore, for the correction of these items the overall relation of this matrix can be redefined as relation number (6):

$$WADIL_{ik} = \begin{cases} \left( \frac{q_{ik}}{y_{ik}} \right) + 1, & y_{ik} > 0 \\ 0, & y_{ik} = 0 \end{cases} \qquad (6)$$

It is noteworthy that if there is an indirect ownership relation (which means *Yik>0*) there is at least one intermediate owner on the ownership path and therefore $\left( \frac{q_{ik}}{y_{ik}} \right)$ is bigger than one and the amount of *WADILik* will be bigger than 2.

It is possible to determine the level of complexity of the ownership network based on the total ownership (the sum of direct and indirect ownership). If $r$ is the number of the intermediate owners who are put on the $k$ primary shareholder's ownership path from company $i$, then this amount will be zero for the direct ownership. Regarding this point, the weighted average distance based on the total ownership can be defined like relation (4):

(7)

$$\frac{p_{ik} + 2 * [SP]_{ik} + 3 * [S^2 P]_{ik} + 4 * [S^3 P]_{ik} + \cdots + (r-1) * [S^r P]_{ik} + \cdots}{t_{ik}}$$
$$= \left\{ \frac{1 * [SP]_{ik} + 2 * [S^2 P]_{ik} + 3 * [S^3 P]_{ik} + \cdots + r * [S^r P]_{ik} + \cdots}{t_{ik}} \right\} + 1$$
$$= \left( \frac{q_{ik}}{t_{ik}} \right) + 1$$

In the relation above $t_{ik}$ is the element of the $T$ matrix and indicates the total ownership relation. If this amount equals zero, it means the non-existence of the ownership relation and thus the total weighted average distance is defined with the relation (8).

$$WADTL_{ik} = \begin{cases} \left( \frac{q_{ik}}{t_{ik}} \right) + 1, & t_{ik} > 0 \\ 0, & t_{ik} = 0 \end{cases} \qquad (8)$$

If $p_{ik} > 0$ and $Y_{ik} = 0$, meaning when there is only direct ownership relation, then $WADTL_{ik} = 1$. The more the amount of $WADTL_{ik}$ is closer to one, then the ownership relation is mostly direct. It is expected that the empirical amounts of this variable to be closer to one, since the direct ownership contains the main portion of the total ownership in the market. In addition it can be shown that $WADTL_{ik}$ is always the same as or smaller than $WADIL_{ik}$.

## 4. Research Findings, Data and Samples

The ownership data of all listed companies in Tehran Stock Exchange were used to examine the performance of the introduced model in identifying and studying the structure of the cross shareholding. In this market the information

of the listed companies' shareholders are made available to the public every day and after the end of the dealings. Tehran Stock Exchange uses a special classification in shareholders' list report based on which shareholders are separated into three categories. The first category is the major and institutional shareholders with their ownership percentages being reported separately. The second category contains a group of real shareholders who own a considerable portion of the companies' sharesi Such people are unnamed and are introduced as "individuals" and it is impossible to verify that this individual is the same as the real person introduced as the shareholder of the company. The third category is the minor shareholders each of whom own a small portion of the companies' shares and all are known as "other shareholders" and their total ownership percentage is reported at the same time.

The information of the shareholders of all the companies listed in Tehran Stock Exchange were extracted according to the considerations above at the end of the trading day of June 15th 2014 by Rahavard Novin software. In this step firstly the member companies in Tehran Stock Exchange which are in the list of other companies' shareholders, were identified and were implemented as the intermediate owners. Therefore, the rest of the shareholders are considered as primary shareholders. In information processing it is assumed that all the shareholders who are named as "individuals" are distinct from each other. In the case that two individuals who were considered distinct were in fact one individual, then it can be concluded that the ownership concentration is higher. Moreover, since the shareholders' list of private companies and other institutional investors are not made public or accessible, then the results obtained concerning ownership concentration only show a lower margin and it is expected to present more accurate results and with higher concentration.

According to the explanations above, 1565 shareholders were identified in total which contained 375 Limited Liability Partnerships (intermediate owners), 180 individuals, 374 minor shareholders (the rest of shareholders), and 637 institutional shareholders. With the shareholders' ownership percentages given, the direct ownership matrix P with dimensions of 375*1190 and intermediate ownership matrix S with dimensions of 375*375 were determined according to the definition.

## 4.1. Ownership concentration and major shareholders

By processing the information of companies listed in Tehran stock exchange and identifying the shareholders, the major institutional shareholders were determined according to table 1. This list is only created based on the direct

ownership (P matrix). The total market value on this date is 3566 thousand billion Rials. The total value of all companies (intermediate owners) which were controlled by primary owners is obtained through calculating the product of $vP$.

## Table 1: The Major Shareholders According to Direct Ownership

| Row No. | Major shareholders according to direct ownership | The value owned (million Rls) | The share of total market value (%) |
|---|---|---|---|
| 1 | The Social Security Investment Company | 155631389 | 4.36 |
| 2 | National Petrochemical Industries Company | 75164225 | 2.11 |
| 3 | The Staff Funds of the National Oil Company | 68018323 | 1.91 |
| 4 | Parsian Oil and Gas Development Company | 67261691 | 1.89 |
| 5 | The Social Security Organization | 63908403 | 1.79 |
| 6 | Taban Farda Petrochemical Group Company | 62633360 | 1.76 |
| 7 | Etemad Mobin Development Company | 60738045 | 1.70 |
| 8 | Sepah Bank | 55260465 | 1.55 |
| 9 | The Government of Islamic Republic of Iran | 53913553 | 1.51 |
| 10 | National Pension Fund | 45281247 | 1.27 |

*Source:* Authors' calculations

With the calculation of *T* matrix based on relation (2) and considering the total ownership (direct and indirect) a new rating of the major shareholders is gained the results of which are presented in table 2. The *vT* product is used to calculate the total value of all companies which was owned directly or indirectly by primary owners.

**Table 2: The Major Shareholders According to Total Ownership**

| Row No. | The major shareholders according to total ownership (direct and indirect) | The value owned (million Rls) | The portion of total market value |
|---|---|---|---|
| 1 | The Social Security Investment Company | 217697707 | 6.10 |
| 2 | Sepah Bank | 107390670 | 3.01 |
| 3 | Etemad Mobin Development Company | 87234047 | 2.45 |
| 4 | National Petrochemical industries company | 78599922 | 2.20 |
| 5 | The National Oil company Staff Funds | 71850786 | 2.01 |
| 6 | The Government of Islamic Republic of Iran | 69024164 | 1.94 |
| 7 | Parsian Oil and Gas Development company | 67261691 | 1.89 |
| 8 | Social Security Organization | 64920520 | 1.82 |
| 9 | Taban Farda Petrochemical Group company | 64174317 | 1.80 |
| 10 | The national Pension Fund | 55660688 | 1.56 |

*Source:* Authors' calculations

As observed above, the great portion of the value owned by 10 major shareholders are achieved through indirect ownership. For instance, Sepah Bank which is the 8th major institutional shareholder from view point of direct ownership, reaches the second rank considering indirect ownership. More than 48 percent of the value owned by Sepah Bank (equals to 52 thousand billion Rls) was achieved through indirect ownership, this amount is not observable apparently and only through relying on annual reports. The other institutional major shareholders have a similar condition and a huge portion of their ownership is through indirect ownership.

Table 3 presents a ranking based on indirect ownership. In order to achieve the amount of indirect ownership for each primary owner, the variance of two vectors $vP$ and $vT$ is calculated.

### Table 3: The Major Shareholders According to Indirect Ownership

| Row No. | Major shareholders according to total ownership (direct and indirect) | The value owned (Milion rls) | The portion of total market value (%) |
|---|---|---|---|
| 1 | The Social security investment company | 62066326 | 1.74 |
| 2 | Sepah Bank | 52130205 | 1.46 |
| 3 | Etemad Mobin Development Company | 26496002 | 0.74 |
| 4 | Pension, Duty and Disablement Fund of Bank Staff | 18247292 | 0.51 |
| 5 | The Government of Islamic Republic of Iran | 15110610 | 0.42 |
| 6 | The Steel Staff Pension Support fund | 12501396 | 0.35 |
| 7 | Iran National Bank | 10704449 | 0.30 |
| 8 | The national Pension Fund | 10379441 | 0.29 |
| 9 | The Armed Forces Social Security Investment | 7493194 | 0.21 |
| 10 | Armed Forces Pension Fund | 7384950 | 0.21 |

*Source:* Authors' calculations

The total value owned by primary shareholders through indirect ownership equals 547 thousand billion Rls which is as much as the 15.35 percent of the total market value. In other words, at least 15.35 percent of the total market value was calculated twice and the real total value of the market, was reported as 3018 thousand billion Rls meaning 84.65 percent.

To examine the amount of ownership concentration in the market, the diagram of collective ownership of institutional and individual shareholders was illustrated according to figure 1. In this diagram the horizontal axis indicates the percentage of shareholders from total and vertical axis indicates the percentage of collective ownership. It is possible to determine the percentage of total value of the market which is owned by a corresponding percentage of all shareholders from each point on the diagram.

## Figure 1: The Collective Ownership Diagram

### Institutional and individual shareholders
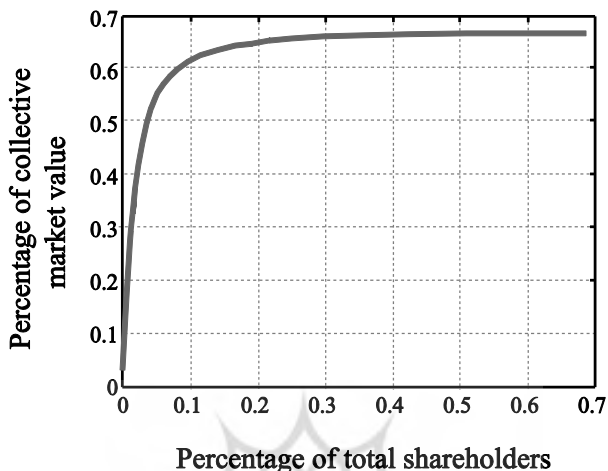


As observed in figure 1, the ownership concentration is in this way that less than 10 percent of all shareholders own more than 60 percent of the total market value. This amount is optimistic and if the ownership information among this group of shareholders is made accessible, then the amount of ownership concentration will be calculated higher.

## 4.2. Evaluating the complexity of the ownership network

In order to evaluate the level of complexity in the ownership network the two criteria of Indirect Weighted Average Distance (WADIL) and the total Weighted Average Distance (WADTL) were calculated for all the ownership paths between primary and intermediate owners. Distance distribution of WADIL is illustrated in figure 2 and its frequency in table 4.

**Figure 2: The Distribution of Indirect Weighted Average Distance**

Distribution of indirect weighted average distance
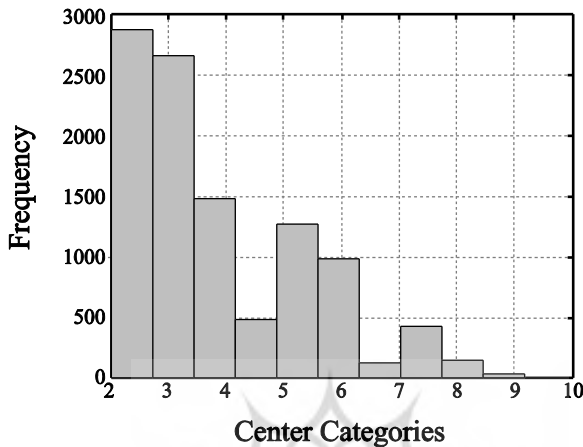


**Table 4: The Table of Indirect Weighted Average Distance Frequency**

| Center Category | 8.82 | 8.10 | 7.38 | 6.67 | 5.95 | 5.23 | 4.51 | 3.79 | 3.07 | 2.36 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Frequency** | 2 | 146 | 429 | 121 | 979 | 1270 | 474 | 1479 | 2662 | 2870 |
| **Percentage** | 0.28 | 1.40 | 4.10 | 1.16 | 9.36 | 12.14 | 4.53 | 14.14 | 25.45 | 27.44 |

*Source:* Authors' calculations

Such results suggest that the majority of the ownership relations, respectively have the WADIL distance with the average of 2,36 and indirect ownership is often created only through a company. Nonetheless on average more than 29 companies have made an indirect ownership relation through at least 7 other companies. In general, among 10,549 identified indirect ownership relations which are more than 86 percent of the total ownership relations in Tehran Stock Exchange, the highest total weighted average distance observed equals 9,18 and is related with " Mahidasht Agroindustrial Complex of vegetable oil" ownership in "Daru Amin" company. This ownership relation is the most complex indirect ownership observed.

Similar with the indirect ownership, the distribution of WADTL is presented in Figure3 and Table 5.

**Figure 3: The Total Weighted A verage Distance**
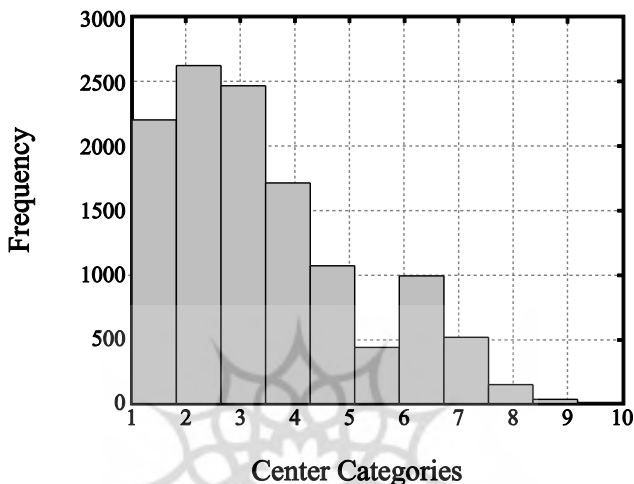


**Table 5: The Total Weighted Average Distance Frequency**

| Center Category | 8.77 | 7.95 | 7.13 | 6.32 | 5.50 | 4.68 | 3.86 | 3.04 | 2.23 | 1.41 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Frequency** | 29 | 146 | 514 | 990 | 430 | 1066 | 1705 | 2458 | 2620 | 2199 |
| **Percentage** | 0.24 | 1.2 | 4.23 | 8.14 | 3.54 | 8.77 | 14.02 | 20.22 | 21.56 | 18.09 |

*Source:* Authors' calculations

12,157 ownership relations including direct and indirect relations have been identified which according to prediction the highest number of observations is related with the second group of frequency table with the distance of more than 2. This means that most of the shareholders in Tehran Stock Exchange are benefiting the indirect ownership along with direct ownership.

According to the results above, it can be concluded that despite the fact that most of the ownerships in Tehran Stock Exchange are direct ownerships or similar ones, a huge number of indirect ownership has been observed. In fact based on the observed frequency it can be concluded that although the monetary value owned by shareholders through direct ownership is less than

indirect ownership, the number of completely direct ownership relations is lower than the indirect ownership relations. With the increase of weighted average distance, the number of ownership relations decreases, however the presence of indirect ownership with distances more than 8 is an indicator of complex ownership networks which should be taken into account.

## 4.3. Cross shareholding in Cement Industry

The presented model and studying the non-zero elements of associated row with each company in $S, S^2P, …$ and $S^rP$ matrixes (until all the elements equal zero) enable us to draw the ownership network related with each company. For instance, a simple ownership network formed in cement industry is studied according to figure 4. This network is recognized through examination of direct and indirect owners of Mazandaran Cement Company (SEMAZAN), in fact it is a part of a more complex ownership network in this industry. Firstly for simplicity only the intermediate owners' relations are considered.

On the first level, Semazan Company has five main owners with direct ownership while all the shareholders excluding "Kerman Cement" each have a cross shareholding relation with other companies. "Shomal Cement Company" in addition to direct ownership, is the shareholder of Semazan indirectly and through "Ghaen Cement Company". "Fars and Khouzestan Cement Company" have similarly direct and indirect owners.

"Behbahan Cement" and "Fars Cement" companies are on the second level. These two companies are the indirect shareholders of the Samazan Company. Nonetheless, the shareholding of "Fars and Khouzestan Cement Company" in these two companies have resulted in a complex ownership relation. This company has an indirect ownership with the distance of 3 in Samazan with the shareholding of the second level companies, as well as, the direct and indirect ownership with the distance of 2 in Samazan Company. This ownership relation causes the controlling and ownership power of "Fars and Khouzestan Cement Company" to stay hidden or to be under-evaluated in Samazan.

Moreover, the other point worth mentioning is the cross shareholding of "Ghaen Cement Company" in "Behbahan Cement 7 Company" in the second level of ownership structure. This company which was the direct owner of Samazan only in appearance, is also the owner of this company indirectly and with the distance of 4AOn the third level, "Sepahan Cement Company" has

provided the possibility of two other indirect ownerships with the lengths of 3 and 4 for "Fars and Khouzestan Cement Company". Eventually, the local ownership network in financial services industry through the indirect ownership of "Ghadir Investment Company" shape the fourth and fifth levels of this network.

**Figure 4: The Cross Shareholding Structure in Cement Industry**
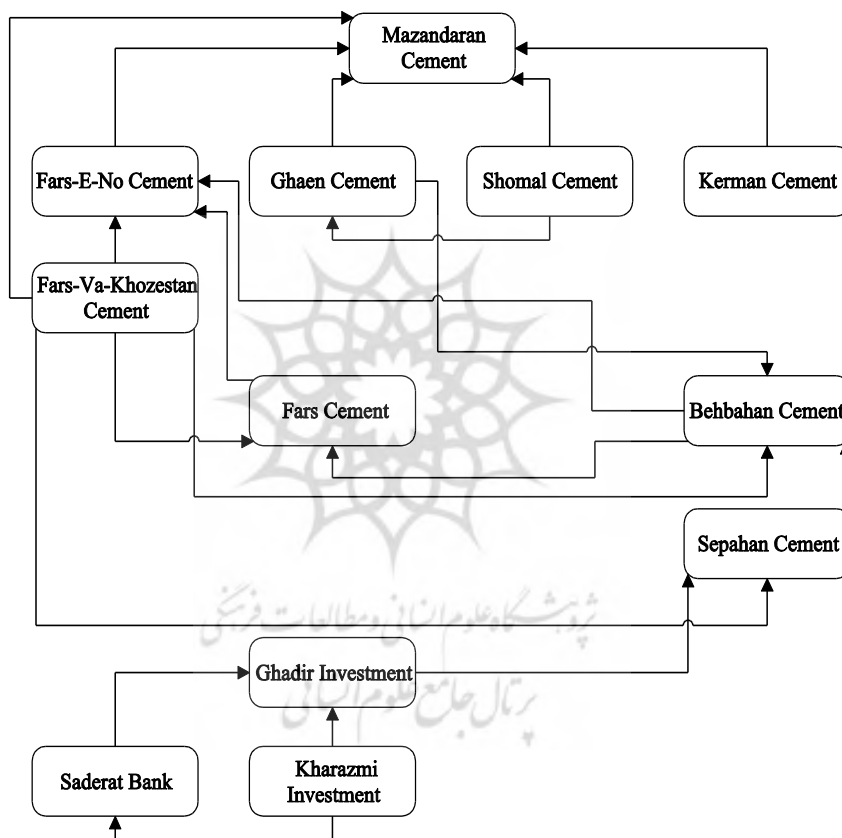


As observed above, the cross shareholding leads to further intertwinedness of companies and their interconnectedness. The study of complex networks enables the recognition of the most important companies in each industry or market. Overlooking the role of indirect ownership can be deceptive in the studies related with ownership concentration and in studying the relationship between companies' performance with ownership structure and the

competition among companies in an industry. In this example "Fars and Khouzestan Cement Company" indirectly controls a considerable portion of other companies' shares and is considered as the most significant company in this network.

The portion of each company's value which is indirectly related with primary owners, is considered twice in the calculation of market's total value and therefore, results in error. In this example the first level companies in total own 55.04 percent of Samazan's total value. Thus, less than 45 percent of this company's value is owned directly by Samazan's primary owners. In calculating Cement Industry market value in which the total value of Samazan and first level companies (Kerman Cement, Shomal Cement, Ghaen Cement, Farse No Cement and Fars and Khouzestan Cement) are added together, at least as much as 55.04 percent of Samazan's value error occurs.

According to the associated row with Samazan in *T* and *P* matrixes, it can be concluded that while only 5 primary owners are the direct shareholders of this company, 62 other primary owners indirectly own a portion of shares in this company. Among these, 13 primary owners hold more than 1 percent of shares. The shareholding amount of 7 major institutional shareholders are presented in table 6.

As observed "Cement Industry Investment and Development" has achieved more than half of its ownership in Semazan indirectly. Moreover, the four institutional investors own shares more than other direct shareholders and only through the intermediate shareholders in this company. The amount of WADTL shows the total weighted average distance, "Mining and Industry Bank" and also "Boursiran Joint Investment" are only direct shareholders and "Social Security Investment" holds the most complex form of ownership in Semazan.

## 5. Conclusions and Suggestions

A model was presented for identification and studying the aspects of ownership structure in this research. The capability of this model in identifying indirect ownership in Tehran Stock Exchange was evaluated and it was shown that a great portion of the value owned by shareholders in this market is indirect; in a way that 86 percent of the observed ownership relations are indirect ownerships. Determining the ranking of the major owners shows that combining them with regard to indirect ownership considerably changes.

**Table 6: The Primary Owners of Mazandaran Cement Company
(With the Shareholding of More than 1 Percent)**

| Primary Owners | Total ownership (Percentage) | Direct ownership (Percentage) | WADTL |
|---|---|---|---|
| Investment and Development Cement Industry Company | 45.44 | 20.78 | 1.54 |
| Mining and Industry Bank | 15.10 | 15.10 | 1 |
| Social Security Investment | 6.15 | - | 2.07 |
| Ta'amin Cement Investment | 4.00 | - | 1.77 |
| Maskan Bank Investment Group | 2.25 | - | 2.00 |
| Oil Pension Fund Investment | 2.10 | - | 1.54 |
| Boursiran Joint Investment | 1.73 | 1.73 | 1 |

*Source:* Authors' calculations

Studying the degree of ownership concentration reveals that more than 60 percent of the market's total value is owned by only 10 percent of the shareholders. Moreover, 15.35 percent of the market's total value is obtained through indirect ownership and is considered twice in calculating market's total value. Additionally by determining the criterion of weighted average distance to specify the level of ownership network complexity for all the ownership relations in Tehran Stock Exchange and calculating the distribution of this distance, it was shown that most of the ownership relations between primary and intermediate owners have a length of more than 2 and contain a type of indirect ownership with the presence of at least one intermediate owner.

Finding a method for identifying the ownership circles is one of the suggested issues for further study. In ownership circles, a company indirectly owns a portion of its shares. Those ownership circles which are hidden in appearance and are not extractable for financial reports can lead to false valuation and market inefficiency including speculative bubbles. The presented model in this research is able to identify ownership circles in

indirect ownership network by a software algorithm. It is possible to evaluate the effect of such ownership structures on performance and pricing of companies through case study of the companies in such circles. On the other hand, in case that more transparent information of real shareholders and owners of the institutional investors were accessible, the results of empirical examination of this research in Tehran Stock Exchange would be more accurate and more reliable. For this aim, it is necessary to provide a more distinct separation of individuals and the real owners of Limited Liability Partnerships.

As noted in the example of Cement Industry ownership network, there is a considerable amount of indirect ownership in markets and this has a direct effect on the controlling method and the value owned by primary owners. Therefore, there is an obvious need for designing and presenting a model which is able to recognize and study the dimensions of such ownership networks. On the condition that such ownership is overlooked, then the level of ownership concentration, market value and the related analysis to these amounts will be deceptive and the cost for neglecting cross shareholding structure is the vast occurrence of error in the results of numerous financial researches.

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