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The examination of effective factors on the efficiency of vehicle industry manpower (manufacture) in long-time and privatization role of this industry on manpower efficiency in Iran

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ABSTRACT

During the recent years, the efficiency factor has been focused by many institutions, organizations and companies as one of the key factors affecting on the manufacture; and therefore, manpower efficiency has been taken into much consideration as one of the components of whole efficiency. The improvement of efficiency, as a principle for developing the industry and consequently for increasing the employment level and the effect on many enormous variables, has found the special position in the economic literature and the improvement of efficiency as one of the best and the most suitable ways is considered for improving the situation of that unit and establishing and guaranteeing the profitability continuation of the company. This Article follows the examination of effective factors on manpower efficiency of vehicle-manufacturing companies and the rate of their effectiveness. Based on the arisen results, the manufacture variables, the rate of capital, salary, wages, bonuses and exports have the direct meaningful effect on manpower efficiency and the performed investment for development, researches and management changes arisen from the privatization have the negative relationship in proportion to the manpower efficiency.

Introduction

This study mainly aims to evaluate the factors and conditions affecting on automotive productivity (using data of two big automotive factories) and the effect of various factors calculate in such a way that it is beneficial in policy making and an applicable stations be determined in industry decision-making. Hence not only is productivity calculated by indicators, but the role of factors affecting the productivity of human resources in this industry are also being studied through estimating productivity functions (especially variables such as wages, salaries and rewards paid to employees, reducing government ownership, the costs consecrated to research and development and capital severity. For this reason, using financial information and automotive manufacturers functions are studied during the period (between 1981 to 2007) and the assessment model affecting productivity of human resources of the country's automotive industry are also estimated and the impact of these factors is discussed using economic measuring tools and related software (Eviews).

Test hypothesis in assessing the productivity functions are as follows:

1. Wages and salaries and also rewards paid to employees has a direct impact in increasing labor productivity.
2. There is a direct relationship between reduced government ownership in this industry and labor force productivity.
3. The costs on research and development is effective in increasing labor force productivity.
4. There is a direct relationship between capital intensity and labor force productivity.

Principles of Economic Efficiency and Productivity

Explicating Productivity and Efficiency Through Production Function

Economically speaking, there is a complete relationship between productivity and efficiency and the notion of boundary production functions. In (1) diagram, OF axis indicates boundary production functions which shows the relationship between output and production factors. The maximum achievable production from the production factor in various dimensions are shown by this boundary function, hereby showing the status of current technology in that industry. In diagram (1), axis X indicates production factor and axis V indicates the amount of production.

The enterprises located over this boundary production function are efficient, that is maximum output are achieved using current institute, yet the enterprises below this function are faced with lack of efficiency. In this diagram, A indicates a non-efficient point, but points B and C indicates efficient ones.

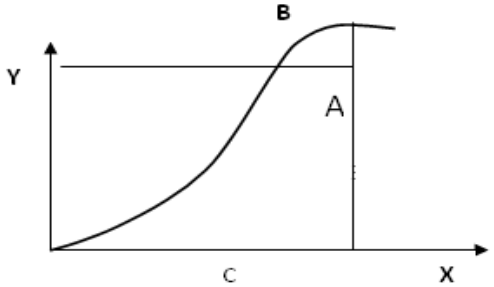

Diagram (1): boundary production function and technical efficiency

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The enterprise which operates in point A is faced with lack of efficiency, because it is able to increase its production to level B with the current technology without being needed to increase production factor.

In addition, if the production factor and production rates are not restricted, the set of available production comprises all the points over and below axis OF onto horizontal axis.

The points on the boundary function represents a set of efficient points. To measure the efficiency in the regarded pints in this diagram, lines from the starting point of coordinate with the slope $\frac{Y}{X}$ to those points are plotted. The slope of this line is a criterion to measure productivity. That is, the slope of line OB in diagram (1) is as follows:

B $= \frac{BX_1}{OX_1} = \frac{Y_1}{X_1} = \frac{p\ r\ o\ d\ u\ c}{p\ r\ o\ df\ u\ a\ cc\ tt\ i\ o}=$

production efficiency in the line OB.

If the enterprise operating in point A is moved the efficient point B, the slope of the point OA will be clearly increased which indicates higher productivity in line B. in addition, by moving towards point C, the plotted line from the starting point of the coordinates will be tangent on axis OF, that is to say this slope is increased to the point B and the maximum point is reached. This point represents the possible maximum efficiency. Point C is an instance of the economies resulted from economic scale of the enterprise and technical efficiency scale in that enterprise. The activity at any other point on the boundary production function will decrease productivity. It is therefore concluded that an enterprise may be technically efficient (production in point B), but it may able to be improved using the economies resulted from efficiency scale (that is point C).

The Impact of Efficiency on Economical Variables

A: Efficiency and Inflation

In the situation of a full competition, the real wage of ω is equal to final labor force productivity $\frac{\delta Q}{\delta L}$ and therefore it can be said that :

$$\omega = \frac{W}{P} = \frac{\delta Q}{\delta L}$$ Equation (2-1)

$$Ln\omega = LnW - LnP = Ln\frac{\delta Q}{\delta L}$$ Equation (2-2)

$$W^{o} - P^{o} = \left[\frac{\delta Q}{\delta L}\right]^{o} \quad P^{o} = W^{o} - \left[\frac{\delta Q}{\delta L}\right]^{o}$$ Equation (2-3)

Variables with signs means growth rate of that variable.

Therefore, in a simple and abstract full competition environment, the growth rate of price level P is reduced by increasing final growth rate of labor force productivity. Enterprises usually recourses to increase production prices during increasing data prices to maintain the benefit margins. For the are faced with the minimum internal resistance by taking such a method. Thus, increased data costs are transferred to consumer, while the increased productivity can be chosen as the appropriate strategy rather than choosing the strategy of increasing prices for their production costs to be decreased or it causes compensating increased used data prices. In other words, " in coping with inflation, productivity can be as a powerful weapon".

B: Productivity and Employment

The relationship between employment and labor force productivity is not often correctly explained and most people believe that improved productivity should be led to the dismissal of workers, while employment's job security can be provided by adopting correct methods and the employment rate can also be enhanced due to the higher demand rate for the products and their products diversity resulted from improved productivity in the long term.

In 1979, McKey showed that if, for example, the labor force was 2% and unemployment rate 7.5% due to productivity growth, the process of productivity rate being doubled to 4% is led to the unemployment rate will be reduced to 1% in America.

The Role of Productivity in Economical and Industrial Development

The relationship between productivity and economical development has been taken into account by many economists. " Gunnar Mirdal" was one of them. He maintains that reduced productivity is led to reduced income and reduced level of prosperity which is the main cause of underdevelopment. Reduced life level is by itself led to reduced productivity and this is what Mirdal calls " the cause of growing distance", which can be broken down by high growth of productivity.

The Ways to Measure Productivity

Indicator Method

In this method, average labor productivity can be directly obtained by production or added value divided on the total labor force and to calculate the final productivity, the equation $\frac{\Delta Q}{\Delta L}$ can be used which is the changes in production or added value divided to the changes in labor force.

To calculate productivity value, both products value and added value can be used. Therefore, the productivity value criteria is the production or the production enterprise added valued divided to the institute which current values must be converted to fixed price to a possible comparative study. In this case, the ratio of production or added value of the fixed price to the labor force indicates productivity criterion of labor force, or in other words, indicates average labor force productivity.

Production Function Method (Productivity Function)

Production functions indicates a mathematical relation between the maximum production in an enterprise in one hand and the utilized inputs to produced a specific output on the other. In other words, production function indicates the maximum output that a particular set of inputs and production factors can be attained assuming that other conditions are stable.

If it is assumed that industry or enterprise production function is as follows:

$$Q = \alpha + \beta K + \delta L$$

Then, to calculate the average and final productivity of labor force factor, production function should be firstly estimated and then the equation $\frac{Q}{L}$ indicating average productivity of labor

$\frac{\Delta Q}{\Delta L}$ force and indicating final productivity of labor force can be calculated.

Due to the fact that the article aims to study the factors affecting the productivity of human resources from this perspective, hence a review on previous conducted studies with this perspective seems necessary.

Review of Literature

The research performed on productivity has been mostly a single-equation estimation of the productivity and in some cases it has been estimated as a system of simultaneous equation in the framework of a simultaneous equation system. In most conducted estimations, the factors comprises added value (wages and salaries paid to labor force, initial materials, …) along with production variable has been considered as exogenous and independent variables in which productivity is a function resulted from them.

The effect of a variable has also been analyzed on productivity in external studies.

In recent years, various studies have been performed in the country in this field as follows:

Mr. Kordbache had an study concerning productivity in some petrochemical enterprises in the country and analyzed CES production functions and Kab- Douglass to regarded enterprises using econometrics and also analyzed productivity based on the above-mentioned estimations and using these functions' coefficient and finally studied the factors affecting productivity in the aforementioned industry as a model below:

$TFP=\alpha_0 + \alpha_1 Y+\alpha_2 SL + \alpha_3 SW + \alpha_4 KCL + \alpha_5 HCL$

Which HCL,KCL,SW,SL,Y, TFP are productivity of the petrochemical complex, the value of the complex products, the proportion of production workers from the total production, the proportion of wages and salaries in added value, the used capital intensity in production and human resources coefficient , respectively.

Mr. Bigdely has also been calculated and studied labor force productivity in his MA thesis in textile in Isfahan province industry and estimated the production function in simultaneous equations as well as studying the factors affecting productivity in textile industry in the mentioned province. In his estimated model, human resources productivity is a function of production, wages and salaries proportion. The worker's proportion in the production part and capital intensity and the salaries and wages proportions in added value and production is also a function of labor force productivity, capital intensity and the proportion of production workers out of the total production. The result of this study is in the part of production function estimation, increasing efficiency compared to the scale in industry and also more labor force being attracted to capital.

Mr. Homaie Abyane has also studied in his research the labor force productivity on Arak Machine Manufacturing Company assessed the factors affecting company productivity using the following single-equation pattern:

$TFP=\alpha_0 + \alpha_1 KCL+\alpha_2 Y + \alpha_3 SW + \alpha_4 M$

Which KCL, SW and M indicate capital intensity, productions value, the proportions of wages and salaries in added value and initial materials, respectively.

Mr. Mohsen Dashti in his research entitled " the study of current productivity in agriculture", assessed the capital stock using the " Perpetual Investment Method) (PIM) which is a recommended method by the United Nation, and also the method of gross fixed capital formation and then attempted to estimate the agricultural production function and finally analyze the estimated model coefficient based on productivity.

Mr. Mirkarimi also conducted an study entitled " study of the factors affecting oil and chemical industries productivity in Tehran province" and has taken into account their efficiency and productivity using mentioned boundary production functions in this industry. The results of this study indicate that the operation of investment in production are reduced during the time and the operation of raw and intermediary materials is increased. It has been also indicated that the obtained technical efficiency indicates the long distance of the activities of the country's industrial enterprises from their boundary production functions and no positive trend has been observed in the mentioned industries' productivity during the first 5 years of the program.

The studies performed by Mr. Ali Askari entitled " study of the changes made in production and employment structure in Iran's big industrial factories" can also be named (1991) in which the industrial evolutions during the years 1971 to 1986 are taken into consideration and labor force productivity has been considered in various fields of the industry and then the relationship between wages, salaries and productivity has also been studied.

The research performed by Ms. Kamyar entitled " study of productivity in chemical industries group (through production function) can also be mentioned.

Extensive overseas studies has also been carried out in this regard. The studies made by Z.Griliches and Jorjehnson (1967) is considered as the first integrated study regarding efficiency which are focused on separation of inputs growth proportion and their productivity in production. Setur Aman (1974) evaluated the process of productivity in different parts of India and deduced different sector's productivity in this country. He maintains that the changes made in productivity was affected by the relation of capital to each section. M.Chroger and A. Tenser (1982) evaluated the field of productivity in Turkey's manufacturing industries according to being public or private.

Z.Griliches and Frank Lichtenberg studied the effect of research and development and performed investments in this regard on total productivity through production function method.

John Halti Wanger, Joulialin and James Spiltezer (2000) assessed the mitigation in human resources and its impact on productivity.

Oren Levine and Waldman (1997) studied the relationship between minimum of wages and the productivity level and the impacts of labor unions in productivity. David Kastellani studied the impact of exports by survey instruments on efficiency considered variable effective through impacting on increased learning resulted from exports on productivity.

Other researchers are also involved in productivity in the last three decades including :

Mark J.Roberts, Bradfard Jensen-Andrew B. Bernard, Erick Baltezamn, Martin Nick Baily, Robert Heart, Muhammad Sasnou, Jack Maris, Emanuel Marko, Marian Boxter and Doursi Far.

Input-Output Method

Input-output analysis (I-O) is an analysis formed based on the studies performed by Leon and generally it is used for measuring macro-models and also calculating productivity in national and industry level, but it has not yet been used in the level of enterprise and company. Using this analysis, the effect of interfering a unit of production factor in various parts of

economy (or industry) including production, etc. can be observed.

Types of Productivity

Given the different perspectives, two types of productivity can be defined in general which will be briefly mentioned:

Partial Productivity

Partial productivity is the of ratio output to a set of inputs. For example, labor force productivity is the ration of output or added value to input of the labor force, and it can be written as follows:

$$Ilp = \frac{Lpt}{Lp} \times 100$$ Equation (4-1)

$$Lpt = \frac{Vf}{L}$$ Equation (4-2) which

the variables applied are :

Ilp: index of labor productivity

Lp: labor productivity in the basic time

Lpt: labor productivity in the time of t

Vf: added value to the constant price

L: number of labor force

Similarly, the productivity of other inputs can be defined.

Total-Factor Productivity

Total-factor productivity includes the ratio of output or the net product to the set of input factors both labor and capital.

The Relationship Between Partial and Total Productivity some indicators of partial productivity such as labor force productivity are paid attention by researchers and financial, management and economical analysts. Therefore, it is necessary that the mathematical relationship between total and partial productivity be investigated. The divisions between these two productivities can be as below:

A product's total productivity based on its partial productivity

In this case, the total productivity of the product I can be defined as the ratio of the input value of the total product to used total output cost to produce this input.

These indicators (partial) are not used in most cases without their effects on other partial indicators and also on total productivity being understood and analyzed. Therefore:

$$TPi = \frac{Q_i}{\sum_j I_{ij}}$$ equation (4-3)

In addition, the partial productivity of the product I to the input factor J can be defined as the ratio of the product I to the cost of input value J:

$$PP_{ij} = \frac{Q_i}{I_{ij}}$$

$$TP_i \sum_i I_{ij} = PP_{ij} I_{ij}$$

$$TP_i = PP_{ij} \frac{I_{ij}}{\sum_i I_{ij}}$$ (4-4)

If $W_{ij} = \frac{I_{ij}}{\sum_j I_{ij}}$ W_{ij} is the significance coefficient then (weight) related to the input factor J. in other words, W_{ij} indicates the ratio of input factors J to the set of all used inputs to produce the product I. therefore, Tp_i can be defined based on W_{ij} and pp_{ij} as follows:

$$TPi = WijPPij$$ (4-5)

in other words, the total productivity of a product is a function of that product's partial productivity based on the used input coefficients to produce the product.

The company's total productivity as a function of each product's productivity

By definition, a company's total productivity is the ratio of total input of a company to the overall used resources (total inputs). In other words, we have:

$$TPF = \frac{\sum Q_i}{\sum_i I_i}$$

On the other hand,

$$\sum_i I_i = \sum_i \left[\sum_i I_{ij}\right] = \sum_i \sum_j I_{ij}$$

Therefore,

$$TPF = \frac{\sum Q_i}{\sum_i \sum_j I_{ij}}$$.

Considering the equation (4-3), we have:

$$TP_i = \frac{Q_i}{\sum_j I_{ij}} \quad \Rightarrow \quad Q_i = TP_i \left[\sum_j I_{ij}\right]$$

By inserting the amount of Qi, we have:

$$TPF = \frac{\sum_i \left[TP_i \left(\sum_j I_{ij}\right)\right]}{\sum_i \sum_j I_{ij}}$$

$$TPF = \sum (TP_i).\frac{I_i}{I_f} = \sum (TP_i).W_j \quad , \quad W_i = \frac{I_i}{I_f}$$

$$TPF = \sum_i W_i TP_i$$ (4-7)

It has been obtained from the last relation that a company's total productivity is the weighted sum of total productivity related to each product.

A company's total productivity as a function of partial productivities

$$TP_i = W_{ij} PP_{ij} \quad , \quad TPF = \sum_{i=1}^{N} W_i TP_i$$

By inserting the amount of relation one in relation two, we will have:

$$TPF = \sum_{i=1}^{N} W_i . W_{ij} PP_{ij}$$ (4-8)

The above relation can be written s follows:

$$W_i = \frac{I_i}{I_f} \quad , \quad W_{ij} = \frac{I_{ij}}{I_i}$$

$$W_i W_{ij} = \frac{I_{ij}}{I_f} \quad , \quad W'_{ij} = \frac{I_{ij}}{I_f}$$

$$TPF = \sum_{i=1}^{N} W'_{ij} PP_{ij}$$ (4-9)

It can be figured out by the relation (4-9) that a company's total productivity is the weighted sum of partial productivities of that company. For example, if we have four input factors (such as human resources, materials, energy and capital), therefore the total productivity relation of the company can be written as follows:

$$TPF = \sum_{i=1}^{4} W`_{ij} PP_{ij}$$

According to the explanations mentioned above, it seems that in order to the total productivity in a company become more faster, the attention can be focused on the products that have a greater weight.

Revised Model

Economical phenomena are sufficiently complex and the study of the factors affecting them and also their affected and affecting intensity is a difficult process. For this reason, it is mostly attempted to an empirical model is devised and the relationships between regarded phenomenon and other factor affecting to them are identified and expressed using econometrics methods.

Naturally, the pattern devised for this reason both maintains the main and significant features in order to all unnecessary and insignificant features be overlooked for simplification as much as possible.

The analysis of quantitative factors affecting labor force productivity

The quantitative analysis of the impact of each effective factors on productivity is so important. However, due to statistical limitations and also the non-quantitative nature of some effective factors, the quantitative analysis of all these factors is not possible.

It is worth mentioning that all applied variables other than quantitative ones used statistically, the data are homogenized and deduced using the Central Bank indicators based on the base year 2007 due to the fact that the data are not homogenized and also because of the impact of inflation during the regarded period.

Hence, a multivariable regression model is presented using the precedent performed studies to measure and analyze the factors affecting labor force productivity of machine industry as follows:

FP=f (Q, KCL, M, Rd, X, S, Dum1, Dum2)

Which the variables in the above-mentioned model are as follows:

FP: the labor force productivity in the Saipa Company.

Y: indicates the value of company's products. Productivity and production are two variables that directly affect each other. Some economists maintain that product growth and productivity mutually enhance each other automatically. In fact, high rates of production is led to high rates of productivity growth and vice versa. On the other hand, developing growth and making possible using the economies resulted from the scale is led to increased productivity.

Kpl : indicates capital intensity which is the ratio of capital to labor force. Due to the fact that this ratio determine the amount of capital needed to a new job be created in the industry, it can indicate the capital-oriented or user-oriented of technology in industry from another point of view. It is required to be mentioned that to calculate this indicator, the mentioned ration has been calculated for all concerned period and the obtained ratio has been used in the model.

RD : it indicates the costs related to development, researches and training which is considered as the indicator for development and technology, for without depending on the development of the capacity and human resources training, increased and continuous production in such a way that it meets the needs of market demand is unexpected. For this reason, R&D has a main role and proportion in modern management.

X: it indicates the monetary value of the conducted exports during the regarded period. Due to the fact that the exporting motives is effective on people's productivity and also the overall company's productivity, hence it is regarded as one of the model's variable. Furthermore, due to the studies conducted by different people including *Andrew B. Bernard., Bee Yan Aw, Sukkyun Chung, Mark J.Roberts. etc,* it has been indicated that there is a positive relationship between improved productivity and enhancing the enterprise's motives through exports and getting involved to exporting markets.

W: the proportion of wages, salaries and rewards in added value which this variable can be as the reflection of the type of applied technology. That is, the more the ratio of wages and salaries to total added value, the more applicable the type of applied technology and vice versa.

Estimating the Econometrics Model of Quantitative factors

The added value model is as follows and the estimated results are shown in table 5-1 below:

$LFP = \alpha_0 + \alpha_1 LKpl + \alpha_2 LY + \alpha_3 LW + \alpha_4 LRD + \alpha_5 LX + \alpha_6 DUM1 + \alpha_7 DUM2$

As is observed, the relatively high effects of the estimated constant amount in the equation and also its significance indicate that there are other effective variables. In addition, these variables comprise qualitative factors which are not involved in the equation due to the aforementioned limitations. According to the conducted test, the model lacks variance incompatibility and auto-correlation and other statistics indicate its suitable process.

Table 5-1: the results obtained from productivity function practice on the human resources in industry.

Statistics	Possibility level	T & student statistics	Coefficient	Variable
$^{2}R=0.989$, $^{*2}R=0.985$, F=252.7, F(prob)=0, DW=2.365.	0.0003	4.438	0.458	LKPL
	0.0057	3.117	0.319	LY
	0.0006	4.112	0.951	LW
	0.0204	-2.529	-0.114	LRD
	0.0677	-1.938	-4.476	DUMI
	0.0008	-3.991	-0.856	DUM2

Reference: research results

The model's stagnancy has also been tested and the result obtained in the test indicates that the model's variables are stagnant.

Conclusion

Generally speaking, according to the obtained results of the practiced model and due to their significant statistics, it can be concluded the product, capital intensity, wages, salaries and rewards and exports have direct and significant relationship with labor force productivity in the regarded period and a negative relationship with applied investment variable in the field of research and development.

The privatization virtual variable coefficient indicate the concerned company's management changes. The cause of existing a significant negative relationship between explicatory and virtual variables can be resulted from policy making continuity and the intensity of decision making in private and public sectors due to not having controlling and management proportion and also lack of compatibility in the company's status

based on the desired methods of private sector. Lack of real privatization and transferring some parts of proportion from government to other public institutes can be among the other reasons of this negative relationship.

Because of the critical nature of the virtual variable related to war periods, a negative relationship is expected between this variable and the model's explicatory model which the results obtained from the model indicates that this prediction has been approved in a high possibility level.

Suggestions

Due to the obtained results from estimating the affecting factors model, the following policy guidelines can be presented:

Due to the fact that capital intensity has a direct and significant effect on human resources productivity, it is therefore required that sufficient attention is paid to forming capital and increasing its amount in industry. Because of the used product technologies in machine manufacturers companies, this industry has relatively capital-oriented technology in which future policies and long-term and medium-term strategies are required regarding capital in this context.

Given the high intensity of production variable, it is clearly required that labor force productivity be achieved through increasing products. The economy resulted from the scale as an economic principle to reduce production costs and much more better productivity out of the factors are proved and it can be made use to improving efficiency and performance of the product factors including human resources. Industrial policy makers must pay attention to the issue of allocating required resources to increase industrial production (qualitative and quantitative). The priority is given to proving resources with lower costs (such as using reserve funds facilities).

The obtained wages, salaries and rewards coefficients from the labor force indicate a highly positive relationship on labor force productivity in the industry and it also indicates that labor force achievements as a motive factor is related to their improved performance of the productivity.

In addition, appropriate direction of specialized resources for wages and salaries and also preventing from excessive gap between employer's wages and that of employees (which have the negative motive) can be effective on improving and growing labor force productivity.

The need to pay attention to this issue with considering the effect size of this variable on human resources productivity in industry become more evident. Due to the effect size of this variable, it can be assured that increasing wages and encouraging policies are so effective in high human resources productivity and it can be considered as a policy making tool. Despite the approved research records of the positive costs of research and development on productivity, however according to the obtained results, it has been proved that there is a reverse and significant relationship between the investment coefficient of development and research of this costs and labor force productivity. Therefore, the HO hypothesis is rejected for this variable and the cause of this issue can be due to applied insufficient investments in the field of development and researches. According to the current theories and the conducted studies precedents, the obtained results indicate that an appropriate attention is required in the field of research developmental investment strategies of the two companies.

Considering the research records are positively approved by exports on productivity, it has been figured out that the performed exports in regarded companies also significantly approve the HO hypothesis.

Despite the fact that from 1998 onwards, the main parts of government's stocks are assigned to the private sector in the two regarded company though stock exchange, yet it does not seem that the manager's decision-making process in a desirable way of private sector and under their supervision.

According to the studies made, the process of privatization in the period studied had no significant effect in labor force productivity which can be partly due to the continuous decision-making in macro-level through government authorities. Also, because their stock is mainly transferred as micro-stock, hence ownership transfer was not associated with management transfer. Hereby, it seems that stock market (privatization) of the companies is performed in packaging and major blocks in order the private sector of the stock's buyer be able to play a main role in company's management.

Moreover, in the years after their privatization, many organizations and public institutions have been involved into the shareholders network in companies and somehow they made public which necessary measures should be taken in the government's policies in this regard to provide the context for more presence of the private sector as meaningfully as possible.

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