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Providing a Model of Organization Downsizing Based on AR-WPF-DEA Model: Case Study of Iran Automotive Industry

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Abstract: Today, in the competitive markets, the cost factor is regarded as one of the competitive advantages of industries and firms. In automobile industry, the cost of raw material and parts procurement forms a considerable percentage of total cost of a manufacturing industry and given the high volume of raw materials and parts, raw materials and parts suppliers' performance is of high importance. This research intends to design a mathematical model to evaluate suppliers to SAIPA Car Manufacturing Company in order to retain the suppliers with competitive advantage and to abandon those with the worst performance. For this purpose, present study uses "worst practice frontier" data envelopment analysis (WPF-DEA). In addition, in WPF-DEA model introduced by Liu and Chen (2008), some decision making units (DMUs) may by assigning weight zero to remove some inputs or outputs with good performance within them from their process. To prevent this, assurance region worst practice frontier data envelopment analysis (AR-WPF-DEA) is developed which by imposing weight restrictions guarantees contribution of all criteria determined by decision makers and the analyst.

Key words: Downsizing . privatization . Data Envelopment Analysis (DEA) . worst performance . weight restrictions

INTRODUCTION

With increase in number of commercial bankruptcies and organizational crises, the established principles which considered organization size as one of the success factors were doubted and questioned. Gradually, the unnecessary and superfluous size was considered as an overhead factor and researchers found out that small organizations too are able to excel. Downsizing is a prominent feature of the today's business world which by reduction in work force and other sources tries to improve organization's performance. Reconstruction, the most suitable measure and size, efficiency increase, identification of surplus forces, costs reduction, intelligent contraction, reengineering and decision making expedition are only part of the reforms which have been stated in favor of downsizing (Datta *et al*., 2010). In the past, to deal with performance decrease, dismissal of employees was regarded as the last option, but today, size reduction is considered a usual matter. Between 1995 and 2007, about 11.5 million people lost their job in the downsizing process of the US (Lewin *et al*., 2010). Recently, superior firms throughout the world use downsizing as managerial strategy for cost reduction (Ferraro *et al*., 2005). For example, Citigroup company started its 5.2% reduction of work force when it was faced with a 35% growth in revenues (CNNMoney.com, 2007). In a similar example, Allianz AG in Germany, following a 69% increase in its net income in 2005 and 70% increase in 2006, declared elimination of 9000 jobs (Veysey and Miller, 2006). Studies carried out in the area of downsizing can be divided into two general groups:

1. Studies that investigate relationship of environmental conditions with downsizing;
   Prior studies by Filatotchev *et al*. (2000), Baumol *et al*. (2003) and Wagar (1997) indicate that in case organizations are confronted with demand reduction, they embark on downsizing. Contrary to this view, according to the studies carried out by Budros (1997, 2000 and 2002), no significant relationship has been found between economic condition (including demand reduction) and size reduction in organizations. Instead, he found that most companies undertake downsizing when they operate in the best economic condition.

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2. Studies that investigate relationship of downsizing with organization's performance;
   Researches carried out in this category can be divided into two groups. The first group includes the studies that suggest negative effects of downsizing on organization's performance. According to Gilson *et al*. (2004), reduced employees' creativity, increased employees' work load, reduced employees' morale and reduced organizational learning capacity are among the negative effects of downsizing. The second group includes the studies that consider reduced costs, improved effectiveness, increased competitive advantage among the positive effects of downsizing (Lewin, 2001; Lewin, 2003; McKinley *et al*., 2000).

By study of the two above mentioned general groups, two essential points can be derived: 1. despite the inconsistencies between various authors regarding positive and negative impacts of downsizing, all of them unanimously emphasize on inevitability of downsizing and in most cases, they consider it imperative. 2. The mentioned sources only investigate relationship of downsizing with different factors, or try to either approve or reject the phenomenon downsizing. However, none of the mentioned sources are not in search of a feasible method for implementation of downsizing. Therefore, providing a framework and method which is able to help organization as a guide seem necessary. The proposed framework and method ought to be able to show the organization that in today's competitive markets, downsizing should be implemented on disadvantageous or poorly performing sources in order to realize the maximum improvement in performance.

Relationship between downsizing and privatization: Transfer to private sector seems to be the most suitable way to prevent activities of an organizational unit with poor performance. Budros (1997, 2002) and Redman and Keithley (1998) found a close relationship between privatization and downsizing of organizations and considered privatization as a suitable tool of downsizing. They state that privatization is one of the motivational factors of downsizing. Since 1980, privatization of public institutes has become a current process and an important part principles and doctrines of public organizations management (peters, 1996) and is considered as a process through which the state prepares the grounds for transfer of its duties and assets to private sector. In most countries, privatization is accepted as a method for rationalization of economic structure, reduction of financial burdens imposed by state units, enhancement of resource efficiency, ownership extension, equipment of financial resources, maximum utilization of existing skills, reinforcement of work motivation, reduction of bureaucracy, dealing with deficit in balance of payments, revenue generation and lessening the heavy burden of public services. The following reasons can be stated for privatization (Howe, 1981):

1. Monopoly inefficiency
2. Better Adaptability of private companies with customers' tastes and preferences
3. Reduction in budget deficit
4. Lack of management and financial controls in public sectors.

In addition, according to Yarrow (1999), the most important privatization reasons are: 1. Efficiency improvement along with increased competition, 2. Reduction of budget deficit, 3. Reducing influence of labor unions, 4. Transfer of decision making process in goods and services market from public sector to private sector and 5. Redistribution of social wealth.

Many economists, policy makers and managers of institutes believe that performance of private firms is by far better than that of public firms. In Iran, by approaching to late 70s, numerous economic problems and continuous failures of economic policies, the grounds were prepared to raise question and cast doubt on state intervention in the economy and new studies were carried out to understand effects of downsizing of state organizations and transfer of their ownership to private section. These studies consider cost reduction, efficiency improvement, productivity increase, increase of competitive advantage among the positive impacts of downsizing and the following privatization. In car manufacturing industry, the costs associated to procurement of raw materials and parts absorbs a significant percentage of total costs in manufacturing firm and given the high volume of raw materials and parts, suppliers; performance is of high importance. The extensive research on evaluation of suppliers' performance proposes a large variety of models and approaches. However, all of them aimed to provide a method for selection of the best suppliers in a performance maximization scenario and do not try to provide a method for identification of the worst supplier in order to prevent its activity and to take action for downsizing and transfer to private sector. On the other hand, there plenty of sources which look for use of data envelopment analysis (DEA) technique for measurement and comparison of organizations; efficiency before and after downsizing and before and after transfer

to private sector. Apart from various analyses performed in these sources about positive and negative impacts of downsizing and privatization on organizations' performance, none of them takes any action to introduce a method for identification of the best option for transfer to private sector.

In addition, all of the used DEA models in this section belong to the group of best practice frontier (BPF) DEA models. Cooper *et al*. (2000) point out that in optimization process of BPF-DEA models, the weights which belong to decision making unit (DMU) are the most suitable weights which are able to maximize efficiency of the understudy unit. Although BPF-DEA models are somewhat able to identify the worst units, but measurement of units inefficiency in efficiency maximization scenario (by assigning the best weights which maximize efficiency of decision making unit) does not seem much desirable in the real world. For this purpose, Liu and Chen (2009) introduce a model for identification and assessment of investment risks and bankruptcy prediction. They believe that design of a model to assess and rank units in identification of the worst performances in an efficiency maximization scenario will be more logical. This model is known as worst practice frontier (WPF) DEA model.

However, in WPF-DEA model introduced by Liu and Chen (2009), decision making unit may quite freely choose the weights for its inputs and outputs in order to minimize its efficiency. This freedom in choice of weights puts the decision making unit in the worst possible situation. An inefficient unit in an efficiency minimization scenario may choose weight zero for inputs and outputs in which it has the best performance and may be identified as the worst unit the best candidate for transfer to private sector. This issue may not be acceptable on the part of decision makers (DMs) and analyst who after spending some time for selection of the most suitable inputs and outputs notice that some of criteria have been fully ignored by the understudy unit. Now, to prevent this problem, decision makers' opinions can be added to WPF-DEA model as the weight restrictions and a new model can be developed as assurance region (AR)-WPF-DEA which does not suffer from the mentioned problem.

Present research differentiates itself from previous studies worldwide from several aspects:

1. For the first time, AR-WPF-DEA model is developed to take account of weight constraints and by application of weight constraints in traditional WPF models, distinguishing power of these models is enhanced.
2. For the first time, DEA models are used based on the worst performance for identification and assessment of the worst suppliers in car manufacturing industry and for the purpose of downsizing an industrial group.

The remainder of this paper is organized as follows. In the second section, the studies so far carried out in selection of suppliers, downsizing and privatization are presented. In the third section, the suggested model for selection of the worst suppliers is introduced and in the fourth section, a case study for evaluation of the proposed model is presented. The final section presents the conclusion and provides some suggestions for future research.

RESEARCH BACKGROUND

Table 1 shows some of the methods used in performance assessment and selection of suppliers.

Table 1: A summary of suppliers' evaluation methods

Sources	Method name
Hou and Su (2007), Ozgen *et al.* (2008), Liao and Kao (2010),Yang *et al.*(2010).	Analytic Hierarchy Process (AHP)
Lin and Chen (2004), Chang *et al.* (2006), Jain *et al.* (2004), Hsu *et al.* (2010).	Fuzzy Set Theory
Sarkis and Talluri (2002), Bayazit (2006), Gencer and Gürpinar (2007).	Analytic Network Process (ANP)
Weber (1996), Talluri *et al.* (2006), Talluri and Narasimhan (2003), MohammadyGarfamy (2006), Mahdiloo *et al.* (2012), Noorizadeh *et al.* (2011).	Data Envelopment Analysis(DEA)

Putting restriction on subjective judgments is one of the most crucial aspects which differentiates DEA from the other introduced methods in Table 1 (Please refer to Wong and Wong, 2000, for further comparisons of DEA with other evaluation methods). However, purpose of all the presented methods in Table 1 is selection of the suppliers with the best performance (unlike the recommended method in this study which tries to select the worst supplier).

Badunenko (2010) used DEA technique to measure efficiency of chemicals producing German firms. This paper confirms the findings provided in Baily *et al*. (2001) suggesting that long term productivity of down-sized firms is greater than that of other firms. In addition, in this paper, it is stated that for analysis of firms' situation, Scale efficiency and Technical efficiency of firms should be simultaneously considered. Badunenko (2010) states that in their study, the smallest companies have scale efficiency and scale inefficiency of all companies is derived from their Decreasing Return to Scale (DRS). Instead, the largest organizations have a more desirable state in terms

of technical efficiency. In efficiency integration and simultaneous consideration of technical and scale efficiency, average-size organizations are in the best possible state. Lozano and Villa (2005), unlike current DEA models in which DMUs are supposed as independent and autonomous units, provide a model which allows organization to suspend activities of some inefficient units in order to increase the system's overall efficiency. Wu (2006) empirically and using ANCOVA method, investigated performance of 34 firms before and after privatization and concluded that efficiency of the firms after privatization was higher than that prior to privatization. Ahuja and Majumdar (1998) used DEA to investigate performance of the industrial firms in India between 1987 and 1991. In this study, no significant difference was observed between performance of firms before and after privatization.

Cullmann and Hirschhausen (2008) used DEA and Free Disposal Hull (FDH) for efficiency analysis of electricity distributing firms in three countries of Poland, Slovakia and Hungary. This study confirms positive relationship between privatization and efficiency increase. Chen (1998) used DEA for efficiency analysis and the benchmark in state and private banks. Besides, researches of Jain *et al*. (2008), Ircha (2001), Kang (2009) and Cullinane *et al*. (2004) all using DEA confirm positive effect of privatization on organizations' performance.

WPF-DEA concept for the first time was introduced by Paradi *et al*. (2004). They showed how WPF-DEA by identification of firms which in badness are efficient, assesses the worst performances. Yet they didn't provide a particular model for this purpose. To identify poor performances and for bankruptcy prediction, Liu and Chen (2009) proposed WPF-CCR model in an efficiency minimization scenario. Azadi and Farzipoor Saen (2011) by combination of Chance-Constraints in WPF-CCR (Charnes, Cooper and Rhodes, 1978) model assessed the suppliers in supply chain. To classify the firms' customers and for optimum allocation of marketing resources between them, Noorizadeh *et al*. (2011) developed WPF-CCR model so that it had the ability to take account of undesirable outputs.

However, in all the above mentioned models, some DMUs by assigning weight zero may remove some of inputs or outputs which have a desirable performance in them and represent their performance unrealistically poor. To prevent this problem, AR-WPF-DEA model which by imposing weight restrictions guarantees contribution of all the specified criteria by decision makers is developed. The purpose of this recommended model is selection of the suppliers which should be separated from the firm.

PROPOSED MODEL

DEA for the first time was introduced by Charnes, Cooper and Rhodes (1978). They proposed CCR model (Model 1) which is based on the assumption of Constant Return to Scale (CRS).

$$\max h_{jo} = \frac{\sum_{r=1}^{k} \mu_r y_{ro}}{\sum_{i=1}^{m} v_i x_{io}}$$

s.t.

$$\frac{\sum_{r=1}^{k} \mu_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}} \leq 1,\ j = 1, 2, \ldots, n \qquad (1)$$

$$\mu \geq 0,\ r = 1, 2, \ldots, k$$

$$v_i \geq 0,\ i = 1, 2, \ldots, m$$

The objective function of Model (1) for efficient units is equal to 1 and for inefficient units smaller than 1.

In this research, the problem's decision making parameters are as follows:

DMU_o the decision making unit under consideration

$j = 1,\ldots,n$: DMU set (supplier)
$r=1,\ldots, k$: Outputs set
$i=1,\ldots,m$: Inputs set
x_{io}: Input i for DMU_o
y_{ro}: Output i for DMU_o
μ_r: Corresponding weight to output r
v_i: Corresponding weight to input i
x_{ij}: Input i for DMU_j
y_{rj}: Output i for DMU_j
α_i: Weight constraint lower limit for inputs
ψ_i: Weight constraint upper limit for inputs

θ_r: Weight constraint lower limit for outputs
ζ_r: Weight constraint upper limit for outputs

To identify the units which in inefficiency have a better performance, Liu and Chen (2009) proposed Model (2) which is known as WPF-DEA fractional model. They believe in order to identify the worst performances, design of a model for evaluation and ranking of units in an efficiency minimization scenario will be more logical.

$$\min h_g = \frac{\sum_{r=1}^{k} \mu_r y_{rg}}{\sum_{i=1}^{m} v_i x_{ig}}$$

s.t.

$$\frac{\sum_{r=1}^{k} \mu_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}} \geq 1,\ j = 1, 2, \ldots, n \qquad (2)$$

$\mu_r \geq 0,\ r = 1, 2, \ldots, k$
$v_i \geq 0,\ i = 1, 2, \ldots, m$

Model (2) calculates inputs and outputs so that the least possible relative efficiency is considered for DMUs. The first constraint of this model guarantees that ratio of the outputs weighted sum to inputs weighted sum not to be smaller than 1 for any of DMUs. Using the second and third constraints, the weights which are specified for inputs and outputs will be greater than or equal to 0.

Using a standard technique, the Model (2) becomes linear as follows (for more information, please refer to Charnes *et al*., 1978):

$$\min h_C = \sum_{r=1}^{k} \mu_r y_{rg}$$

s.t.

$$\sum_{i=1}^{m} v_i x_{ig} = 1 \qquad (3)$$

$$\sum_{r=1}^{k} \mu_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} \geq 0,\ j = 1, 2, \ldots, n$$

$\mu_r \geq 0,\ r = 1, 2, \ldots, k$
$v_i \geq 0,\ i = 1, 2, \ldots, m$

Result of Model (3) includes the efficiency score 1 for the DMUs which according to WPF model have been known as the worst units. In addition, this model determines the efficiency score greater than 1 for the units which have not been able to represent themselves as weak units. Note that in this paper, those DMUs which have been known as efficient using BPF model are called BPF-efficient and those DMUs which have been known as efficient using WPF model are called WPF-efficient.

Since in Model (3), DMUs may freely choose weights for their input and output criteria in order to minimize their efficiency, this weights freedom may unrealistically represent DMUs as WPF-efficient. Hence, in this section, in order to resolve this problem and to achieve more realistic results, weight constraints are merged based on experts' opinions in Model (3) and Model (5) is introduced as AR-WPF-CCR.

Farzipoor Saen (2010) introduced a variety of weight restrictions as follows:

absolute weight restrictions
$\delta_i \leq v_i \leq \tau_i$ (g_i) $\rho_r \leq \mu_r \leq \eta_r$ (g_0),
type one (relative weight restrictions)
$\alpha_i \leq \frac{v_i}{v_{i+1}} \leq \psi_i$ (h_i)
$\theta_r \leq \frac{\mu_r}{\mu_{r+1}} \leq \zeta_r$ (h_0) (4)
Type two (weight restrictions of inputs and outputs)
$\varphi_i v_i \geq \mu_r$ (i)

The Greek letters (δ_i, τ_i, ρ_r, η_r, α_i, ψ_i, θ_r, ζ_r, φ_i) are the values that allow for contribution of experts' subjective judgments on significance of input and output factors. Absolute weight constraints are applicable when DM may specify precise numbers as relative significance of a criterion in comparison with another criterion. The left and right hand side of constraints (g) and (h) concern input and output weights. The first type is only able to compare

inputs and outputs weights. The constraint which is able to compare inputs and outputs weights is known as the second type of AR.

At this stage, using the first type of AR, Model (3) is developed. Note that use of this type of weight constraint is recommended when decision makers are not able to determine precise numbers as the weights' relative significance compared to each other.

$$\min h_D = \sum_{r=1}^{k} \mu_r y_{rD}$$

s.t.

$$\sum_{i=1}^{m} v_i x_{iD} = 1, \qquad (5)$$

$$\sum_{r=1}^{k} \mu_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} \leq 0, \; j = 1, 2, \ldots, n$$

$$\theta_r \mu_{r+1} \leq \mu_r, \; r = 1, 2, \ldots, k$$

$$\mu_r \leq \zeta_r \mu_{r+1} \; r = 1, 2, \ldots, k$$

$$\alpha_i v_{i+1} \leq v_i, \; i = 1, 2, \ldots, m$$

$$v_i \leq \psi_i v_{i+1}, \; i = 1, 2, \ldots, m$$

$\mu_r \geq 0, \; r = 1, 2, \ldots, k$

$v_i \geq 0, \; i = 1, 2, \ldots, m$

Therefore, Model (5) is a WPF model which meanwhile is able to take account of weight constraints.

CASE STUDY

In this section, the developed model is used for performance assessment of SAIPA Company's suppliers. SAIPA group was introduced to Iranian market as one of the largest Iranian car makers in 1966 under license of CITROEN. During more than four decades, SAIPS has been cooperating with French CITROEN, RENAULT, Japanese NISSAN and Korean KIA Motors. The used data in this research concern suppliers of SAIPA in 2009-2010. The suppliers are evaluated based on 5 criteria presented in Table 2. From among the five used criteria, number of employees is considered as the input. Ratio of return on investment (ROA), the firm's competitive state in the industry, product and process audit and delivery performance are considered as the output. Furthermore, Table 3 presents the data regarding 24 suppliers.

Table 2: Criteria used in suppliers assessment

Criterion	Definition
x_1	Number of employees
y_1	Return on investment
y_2	Firm's competitive state in the industry: since this is a qualitative criterion, Likert Scale is used, in which from DM's viewpoint, 1 = very bad, 2 = bad, 3 = average, 4 = good and 5 = very good.
y_3	Product and process audit: 70% score of this feature is dedicated to process audit and 30% to product audit. With regard to each audit, score giving is as follows: Score of product and process audit = 60×(process audit score×0.7+product audit score×0.3)
y_4	Delivery performance: percentage of timely delivered parts

Table 3: Inputs and outputs regarding each supplier

Suppliers	Number of employees	Return on investment	Firm's competitive	Product and process audit	Delivery performance
1	555	11.76	1	51.6	45
2	534	32.65	1	51.6	55
3	395	17.59	5	60.0	53
4	653	5.03	1	51.6	78
5	320	65.11	1	43.2	67
6	199	19.22	3	36.0	50
7	716	37.01	1	36.0	61
8	363	18.91	2	18.0	90
9	466	70.05	1	43.2	81
10	221	15.50	4	51.6	58
11	169	17.70	1	18.0	52
12	321	52.48	2	44.4	87
13	342	19.08	4	18.0	46
14	212	30.03	4	25.2	59

15	243	13.63	2	43.2	76
16	471	12.63	3	51.6	89
17	354	26.33	2	43.2	71
18	444	48.01	3	51.6	65
19	160	27.16	1	43.2	54
20	532	27.03	2	43.2	60
21	298	16.85	5	36.0	70
22	246	11.91	1	60.0	64
23	147	28.92	2	18.0	72
24	489	21.64	2	43.2	94

Table 4 shows results of suppliers' efficiency using Model (3). Note that in this model, weight constraints are not considered, the third column of this table presents the units' rank for transfer to private sector and separation from the complex based on which 19 suppliers are identified as the last options for separation from the organization.

Table 4: WPF efficiency results using model (3)

Supplier	WPF efficiency	WPF rank
1	1.000	1
2	1.228	3
3	1.653	8
4	1.000	1
5	2.237	13
6	2.738	19
7	1.000	1
8	1.000	1
9	1.536	7
10	2.886	20
11	2.085	12
12	2.671	18
13	1.050	2
14	2.371	14
15	2.552	17
16	1.512	6
17	2.030	11
18	1.750	9
19	4.035	21
20	1.280	4
21	1.878	10
22	2.550	16
23	2.459	15
24	1.397	5

Using Model (3), suppliers 1, 4, 7 and 8 with efficiency score of 1 were identified as WPF-efficient and the remaining 20 suppliers with an efficiency score of higher than 1 were identified as WPF-inefficient. Since the suppliers have been free in selection of weight of each input and output, Model (3) was not able to make distinction between all suppliers and failed in identification of the worst unit from among suppliers 1, 4, 7 and 8. Hence, the need id felt for use of a method which in addition to contribution of the experts' opinion in determining significance of the criteria is able to enhance the model's distinguishing power.

To reduce the units' freedom in determining weights' significance, views of the organization's experts and decision makers are presented as the following weight restrictions:

$1.5 \leq \frac{u_1}{u_2} \leq 2.5$

$3 < \frac{u_3}{u_4} < 5$

$3.5 \leq \frac{u_5}{u_6} \leq 6$

$1.3 \leq \frac{u_7}{u_8} \leq 2.8$

$2.2 < \frac{u_9}{u_{10}} < 3.9$

$1 \leq \frac{u_{11}}{u_{12}} \leq 2$

Table 5 presents results of suppliers' efficiency using the developed model (Model 5). The third column represents the suppliers' rank for separation from the set of SAIPA suppliers.

Table 5: Results on WPF efficiency in presence of weight restrictions

Supplier	AR-WPF efficiency	WPF rank-AR
1	1.102	2
2	1.792	7
3	2.046	9
4	1.000	1
5	4.486	22
6	3.445	19
7	1.354	3
8	2.057	10
9	3.357	17
10	3.389	18
11	3.354	16
12	4.081	21
13	1.723	5
14	3.944	20
15	3.036	15
16	1.755	6
17	2.544	12
18	2.791	13
19	5.208	23
20	1.627	4
21	2.524	11
22	2.982	14
23	5.584	24
24	1.898	8

At this stage, only supplier 4 was selected as WPF-efficient from among 24 suppliers and suppliers 1, 7 and 8 which in absence of weight restrictions had been identified as WPF-efficient, by re-execution of the problem in presence of weight constraints were identified as WPF-inefficient. Considering the obtained results above, supplier 4 was identified as the first supplier which should be separated from SAIPA Company and transferred to private sector. For statistical study of difference and similarity in suppliers ranking results in WPF and AR-WPF models, Spearman Correlation is used. Given that these data are of ordinal scale type, Spearman Correlation Test is recommended to be used (Chu *et al*., 2008). Since correlation coefficient between ranking results of the two methods at significance level of 0.01 is equal to 0.865, there is a close relationship between the two methods.

Figure 1 schematically compares the obtained results from Models (3) and (5) in which efficiency score for WPF-efficient suppliers is equal to 1 and for other suppliers higher than 1.

Figure 1. Model (3) vs. Model (5)

CONCLUSION AND SUGGESTIONS FOR FUTURE RESEARCH

In most countries, downsizing and following it privatization have been received as a method for rationalization of economic structure, reduction of financial stresses of public units, enhancement of work motivations, bureaucracy reduction, coping with deficit in balance of payments, revenue generation and reduction in burden of public services.

Present study investigated downsizing phenomenon in Iranian automobile manufacturing industry in general and in SAIPA Group in particular. The main purpose of this study is development of a model which helps managers in identification of the best option from among the parts suppliers for transfer to private sector. To achieve this purpose, a model is required to be developed which is able to identify the worst parts suppliers as the best option for transfer to private sector. For this purpose, WPF-DEA model was used. In the introduced WPF models in DEA history, the unrealistic weight assigning system is a problem which may lead to incorrect ranking of units. To solve this problem, experts' views were applied as weigh restrictions and the new model AR-WPF-CCR was developed.

In this paper, the applied aspect is taken into consideration so as the grounds for practical use of the recommended model can be easily prepared. Considering the obtained results from this research, some suggestions can be provided for future research in this regard;

- To obtain acceptable results, assessment of suppliers' performance in multi-year period is investigated.

- When some of input and output criteria are in the form of judgment, prediction or ranking data, a model is needed to be used which is able to deal with imprecise data. Hence, WPF model can be so developed that is able to take account of imprecise data.
- In DEA technique, there are variables which affect units' efficiency and at the same time are beyond control of management and are known as nondiscretionary factors. Most studies on selection of suppliers, consider assessment criteria as discretionary and have less addressed the nondiscretionary factors. Therefore, WPF model can be developed for taking account of nondiscretionary factors.

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