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Prioritization of Remedial Approaches for Dealing with Dutch Disease Consequences in Iran: an Application of Fuzzy-Modeling

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Abstract. During last decades, Iran’s economy has been stricken by Dutch Disease. In order to apply appropriate remedial policies for dealing with this phenomenon, it should be explained by scientific principles and its impacts on macroeconomic variables are evaluated. In this regard, it is necessary to determine the ranking of proposed remedial policies. The objective of present study is to detect and classify main fields affected by Dutch Disease and propose remedial policies based on the comments of economists and experts. To achieve this purpose, a fuzzy decision-making approach is designed in three ranking models. In addition, the short-run, medium-term, and long-run scheduling procedures are considered as the key decision-making criterion. Results signify that the dominance degree of “refinement of policies of National Development Fund” is 3.79 dedicating that it is the first priority among the six alternatives. The next priorities are “refinement of government budget policies”, “improving the monetary policies”, “refinement of policies of foreign trade sector”, “refinement the relative price mechanism”, and “refinement the policies of exchange rate” whose dominance degrees are respectively 3.508, 3.283, 1.735, 1.582 and 1.096. It is concluded that among remedial policies, “refinement of policies of National Development Fund” and “refinement of government budget policies” are found as the most preferable policies in the viewpoints of economists. Obviously, implement of these remedial policies can work for treatment of the disease. Moreover, the results of sensitivity analysis evince that all three models proposed in this research are constant and not affected by threshold values.

Keywords: Dutch Disease; Iran’s economy; fuzzy decision-making; prioritization; ranking.

1. INTRODUCTION

Growing export in an economic sector acts as a double-edged sword. On one hand, export increase results in the enhancement of national income and economic welfare. On the other hand, it can interrupt the balanced growth of the economic sectors; to be precise, the non-tradable sectors whose products are not competitive in the international markets are developed; while, tradable sector is weakened. In the research literature, this phenomenon is called as “Dutch Disease” (Ismail, 2005).

“Dutch disease” was introduced to the literature; first, on 1960’s, when the huge gas reservoirs were explored in the North Sea of Netherland. For the national income, gained by gas export, increased, the value of national currency of Netherland was enhanced; leading industry sector to lose its competitive advantage. The term “Dutch Disease” was imputed by the “Economist” Journal on 1977 for explaining the industrial deflation observed in Netherland. To cope with this harmful phenomenon, Netherland government applied several economic policies; all bearing unsatisfactory results. Since 1977, whenever this phenomenon occurs in any country, it is referred as “Dutch Disease” (Qorbani, 2011). It is noticeable that Dutch Disease is not restricted to exploration of gas reservoirs; as suggested by Corden and Neary (1982), the disease may occur by other causes such as the rise in international price of tradable goods; for example, increase of demand for tradable goods in Switzerland, technological advancement in merchant sector in Japan and Ireland, natural resource exploration in England, Bauxite industry in Jamaica, petroleum industry in Venezuela, gold exploration in Australia, and increase of coffee price in Colombia. In Iran; however, it is believed that the main origin of Dutch Disease is the income gained by oil export. The first evidence of Dutch Disease in Iran emerged on 1974, when the four-time increase in oil price resulted in the twice rise in government budget. The government spent the budget surplus for...
free education and reducing the price of basic commodities. As a result, the import increased while domestic products decreased due to 14% decrease in the oil income during 1976 to 1978, which led to an economic depression. Besides, the rise in money liquidity resulted in 35% inflation on 1978. Meanwhile, the government, which had spent an enormous fund on public budget, was rather unable to respond public demands due to drop in oil price (Khezri, 2009). In order to investigate Dutch Disease in Iran, it is important to consider the trend of oil income of Iran. Figure 1 presents trend of oil income from 1980 to 2012. As represented in the figure, despite the increase and decrease in imports, the annual oil income had little fluctuation from 1980 to 2001 and was around 20 billion USD. Since 2001, the increase in global oil price has resulted in a considerable rise in oil income; as in 2011, oil income of Iran was around 120 billion USD. During these years the injection of oil income to the national economy causes a considerable development of Dutch Disease in the country.

1.1. Theoretical principles

The mechanism of Dutch Disease in oil-exporting countries is performed by two factors: Resource Movement Effect and Spending Effect. To explain this phenomenon, commodities are classified into two categories:

- Tradable goods that are all commodities internationally tradable, such as all export and import goods; whose, prices are determined in the international markets.

- Non-tradable goods that are not transacted in the international markets due to their high volume, low value, high transportation costs or other government trade controls and are limited to the domestic markets. Therefore, these goods would have different prices in different countries despite the constant transaction rates.

The sudden raise of the oil incomes causes in surplus in balance of payments and causes aggregated demand to be increased. If this surplus is spent for monetary policies, the economy demand would dramatically rise. Besides, if both tradable and non-tradable are considered as normal goods (revenue elasticity is greater than zero for both goods), the demand for both goods will rise. It is obvious that after economy demand increases, the price inflation would ultimately depend to the supply response. Since supply of non-tradable goods is non-elastic in short-run and, on the other hand, supply of tradable goods can be increased through the imports, the relative price of the non-tradable goods would be increased. As the real exchange rate is equal to the ratio of price of non-tradable goods to of tradable ones (REXR = PN / PT), the real currency price will increase due to increase of relative price of the non-tradable goods and their profitability; causing portable resources to remove from the economy sector and transfer to the non-tradable sector. Such movement of resources towards the profitable sectors is called as Movement Effect, while the weakening of the tradable sectors and change in the relative prices is typically known as Spending Effect. Higher disposable income and profitability as well as higher relative price for non-tradable goods, and also the lower production of tradable goods because of their lower relative prices, in general, lead to the increase in imports, decrease in non-oil exports, and interruption of trade balance (Tabari, 1993). Furthermore, exchange of the income, gained from export, from international currencies into the local currency results monetary base and money liquidity to enhance; which, is another problem arising from Dutch Disease in the oil-exporting countries.

With regard to the fact that government owns oil and possesses its income, the main cause of Dutch Disease in oil-based economies is government budget. Reviewing the mechanism of Dutch Disease in economy of Iran reveals that the government’s fiscal policies are affected by the oil income. The share of oil income in the government budget is much more than tax. Injection of oil income to the economy through government budget is the main channel for emergence of Dutch disease in the country. The rise in government expenditure via exchange of foreign currencies earnings, obtained by oil export, into the local currency, which in turn leads monetary base and liquidity to increase, results in an increase in aggregated demand of economy. Such a demand in the tradable sector can be responded through the imports; whereas, in the non-tradable sector of the economy, due to lack of imports, a price raise is inevitable. Therefore, increase of the relative price of the non-tradable goods to of tradable ones leads to the reinforcement of the real exchange rate, followed by the growing rate of imports and decreased non-oil exports. Hence, one of the consequences of Dutch Disease in the country is the weakness of its computability in the international markets.

According to the fact that Dutch Disease has been recently growing in the Iran’s economy and is now one of major economic problems in Iran, it is essential to design and apply appropriate remedial policies based on the scientific principles as well as considering the effect of this phenomenon on different sectors of Iran’s economy. Dutch Disease is believed to influence on three parts of Iran’s economy; including, the real, monetary, and economic sectors. Six main approaches for dealing with consequences of Dutch disease are refinement of:

It is noticeable that this disease has been established in economy of Iran for a long time and its consequences; certainly, cannot be removed completely in a short-run period. Therefore, the remedial policies are considered for short-run (one year), middle-run (five years), and long-run (Iran's 20-year vision plan) periods.

1.2. Empirical literature

The literature review of the Dutch Disease demonstrates many studies working on its ominous consequences; including, reduction of economic growth and productivity in the countries dependent to natural resources, such as those performed by Gylfason (2001), Sachs and Warner (1995, 1999, and 2001), Salaii-Martin and Suberamanian (2003), Stevens (2003), Papyrakis and Gerlagh (2003), Davis and Tilton (2005), and Mehrara (2008). However, some studies have been conducted on undermining the agriculture sector due to Dutch Disease in developing oil-exporting countries. Farmanesh (1991), Olusii and Olagunju (2005), Corden and Neary (1982), Van winbergen (1984), Krugman (1987), and Matsuyama and Gylfason (1999) studied on negative impacts of resource transfer to other sectors, due to abundance of natural resources.

Yet, the studies performed in Iran, mainly, focused on various analytical descriptive methods applied to explore influences of real exchange rate increase, tradable sectors weakening, and non-tradable sectors strengthening, emerged from oil incomes in the country. Some of such works conducted by Tabari-Zadeh (1993), Khodaveysi (1997), Moulabeygi (2005), Amiri-Moghadam (1999), Fardi (2007), and Khoshakhlagh and Mousavi (2006). In addition, Bakhtiari (2001), Pasban (2004), and Bahrami and Farshchi (2008) explored the anti-agriculture phenomenon induced by the enhanced oil income in Iran.

However, no study has been conducted in Iran on planning and prioritization of available choices for remedy of the consequences of Dutch Disease by a fuzzy-ranking approach. Therefore, the present study looks at the phenomenon differently from the viewpoint of both the subject and the method. Some works conducted on programming are as below.

Li et al (2010) designed a model for planning the systems under uncertainty conditions by combined fuzzy and stochastic programming technique. Additionally, Cai et al (2009) designed a comprehensive system for management of renewable energies based on integer linear programming (ILP), two-step programming, and fuzzy logic-based programming.

2. MATERIALS AND METHODS

2.1. Fuzzy Ranking Model

The fuzzy set theory was first introduced by Zadeh on 1965 to deal with vague, imprecise and uncertain problems. The lack of data is the main reason for uncertainty in many problems. Fuzzy set theory has been utilized as a modeling tool for complex systems that can be controlled by humans but hard to define exactly. More detailed discussion of fuzzy set theory can be found in Zimmerman 1987, Lin 1995 and Ross 1995.

In this paper, an outranking approach is used to model an imprecise preference structure in order to select the best solution for the problem. The performance of each criterion for an alternative is described as a linguistic term related to a fuzzy set. The proposed approach is also applied to design evaluation (Wang, 1997). The fuzzy preference relation is utilized to compare two alternative performances for each criterion (Nakamura, 1986). As a result, a set of ranking relations is obtained. Three preference models are developed to evaluate available alternatives to get the “best” result. Each criterion of performance is estimated with a linguistic term represented by a fuzzy number. The fuzzy preference relation is used to discover the imprecise preference relations between designed alternatives. The fuzzy preference relation R on a set A is a fuzzy set on the product A*A, such that μR(A*B(0,1)). Let $P(a,b) \in R$ be the fuzzy preference relation between a and b, where $a, b \in A$. Then P(a) and P(b) are reciprocal and sum of them is equal to 1 (Zimmermann, 1987).

The Greater value of P(a, b) means a stronger intensity of preference. The fuzzy preference relation between two alternatives a and b for criterion i is obtained (i.e. gi(a), $\forall i \in C$) by a pair-wise comparison of gi(a) and gi(b) which show the linguistic performance of alternatives a and b, respectively. gi(a) and gi(b) are represented by fuzzy numbers. In this paper Hamming distance is used to obtain the preference relations between two alternatives for each criterion as mentioned by Tseng and Klein, 1989. The fuzzy preference relationship is given as relation (1):

$$P(a, b) = \frac{D(a, b) + D(a \cap b, 0)}{D(a, 0) + D(b, 0)}$$

(1)
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Where \( D(a, b) \) is the area where \( a \) dominates \( b \); \( D(a, 0) \) the area of \( a \), \( D(b, 0) \) the area of \( b \); \( D(a \cap b, 0) \) intersection areas of \( a \) and \( b \). As seen from this equation, preference relations are obtained by using related areas under fuzzy membership functions (Wang, 1997; Barajas & Agard, 2010). Three preference models are as follows.

### Table 1: Evaluation results for each project

<table>
<thead>
<tr>
<th>Remedial strategies</th>
<th>Period</th>
<th>Short-run</th>
<th>Middle-run</th>
<th>Long-run</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Refinement the monetary policies</td>
<td></td>
<td>Relatively good</td>
<td>Good</td>
<td>Medium</td>
</tr>
<tr>
<td>2. Refinement of relative price mechanisms</td>
<td>Poor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Refinement policies of government budget</td>
<td></td>
<td>Very good</td>
<td>Very good</td>
<td>Medium</td>
</tr>
<tr>
<td>4. Refinement the policies of balance of payment</td>
<td>Relatively poor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Refinement the policies of exchange rate</td>
<td>Relatively good</td>
<td></td>
<td></td>
<td>Relatively poor</td>
</tr>
<tr>
<td>6. Refinement the policies of National Development Fund</td>
<td>Medium</td>
<td>Relatively good</td>
<td>Relatively good</td>
<td></td>
</tr>
</tbody>
</table>

Reference: Economists and Experts’ comments

### Table 2: The fuzzy preference relations among the alternatives of each criterion

<table>
<thead>
<tr>
<th>Alternatives</th>
<th>Short-run</th>
<th>Middle-run</th>
<th>Long-run</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.5</td>
<td>0.916</td>
<td>0.084</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0.084</td>
</tr>
<tr>
<td>3</td>
<td>0.1</td>
<td>0.916</td>
<td>0.084</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0.084</td>
</tr>
<tr>
<td>5</td>
<td>0.1</td>
<td>0.916</td>
<td>0.084</td>
</tr>
<tr>
<td>6</td>
<td>0.5</td>
<td>0.084</td>
<td>0.916</td>
</tr>
</tbody>
</table>

Reference: author’s calculations

### Table 3: Relative importance of the scales

<table>
<thead>
<tr>
<th>Linguistic expression</th>
<th>Numerical scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very important</td>
<td>3</td>
</tr>
<tr>
<td>Important</td>
<td>2</td>
</tr>
<tr>
<td>Relatively important</td>
<td>1</td>
</tr>
<tr>
<td>Unimportant</td>
<td>0</td>
</tr>
</tbody>
</table>

Reference: (Grungor and Arikon, 2000)

### Table 4: Relative importance of criteria

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Numerical scale</th>
<th>Normalized weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short-run</td>
<td>1</td>
<td>0.166</td>
</tr>
<tr>
<td>Middle-run</td>
<td>2</td>
<td>0.334</td>
</tr>
<tr>
<td>Long-run</td>
<td>3</td>
<td>0.50</td>
</tr>
</tbody>
</table>

Reference: author’s calculations

1 The alternatives identify refinement policies for reduction of Dutch Disease consequences and the criterion is length of time (short-run, middle-run or long-run period).
where \( P_i, Q_i \) and \( I_i \) are irreflexive and antisymmetric relations that depict respectively strict preference, weak preference and indifference. The preference threshold \( p_i \) and indifference threshold \( q_i \) are used to discriminate between indifference, strict preference, and weak preference of two alternatives for criterion \( i \). If the difference between \( g_i(a) \) and \( g_i(b) \) does not exceed \( q_i \), then \( a \) and \( b \) are not considered significantly different. If the difference is greater than \( p_i \), then it means that \( a \) is strictly preferred to \( b \). The value of the indifference threshold may range from the smallest value that does not distinguish between two alternatives to the greatest value that allows one to distinguish between two alternatives. According to the three preference relations outranking is as relation (3) (Roy, Vincke, 1984).

\[
\forall a, b \in A \text{ and } i \in C: \\
\text{(Outranking)} \\
a S b \iff \{i \mid a P_i b \} \text{ and } |A| + |B| \geq |C| \\
\text{otherwise} \quad a R b \iff \text{(Incomparability)} 
\]

In relation (3), \( A = \{i \mid a P_i b\} \), the set of \( a \)'s strictly preferred to \( b \), \( B = \{i \mid a Q_i b\} \), the set of \( a \)'s weakly preferred to \( b \), \( C = \{i \mid b Q_i a\} \), the set of \( b \)'s weakly preferred to \( a \), \(|x|\) represents the cardinality of the set \( x \).

The above relations imply that project \( a \) outranks \( b \) if (1) no criterion considers that concept \( b \) is strictly preferred to \( a \), and (2) the number of criteria which consider that \( a \) is preferred to \( b \) is more than the number of criteria which consider that \( b \) is weakly preferred to \( a \). Otherwise, \( a \) is incomparable to \( b \).

### 4.2. The semi-order preference model

This model is used to obtain the nondominance set of alternatives when the relative importance of each criterion is predictable. It is considered in relation (4).

\[
\forall a, b \in A; \\
\text{(Outranking)} \\
a S b \iff \{i \mid a P_i b\} \text{ and } \sum_{j \in X} W_j \geq \sum_{k \in Y} W_k \\
\text{otherwise} \quad a R b \iff \text{(Incomparability)} 
\]

In equation (4), \( X = \{i \mid a P_i b\} \) and \( Y = \{k \mid b P_k a\} \), \( wi \) is the relative importance of criterion \( i \).

A outranks \( b \), if 1) no concept \( b \) is strictly preferred to \( a \), 2) the sum of weighted number of criteria that \( a \) is preferred to \( b \) is greater than the sum of weighted number of criteria that \( b \) is preferred to \( a \). Otherwise \( a \) is incomparable to \( b \).

### 4.3. The complete-preorder preference model

The complete-preorder preference model is utilized to rank the set of alternatives in a complete order so that the most promising “best” alternative is selected. This model is a special type of the pseudo-order preference model; herein, \( qi = pi = 0; i \in C \), that is, threshold value is not used. The degree of dominance is used to determine the complete-preorder preference model. A weighted function is used and defined as relation (6).

\[
P(a, b) = \sum_{i=1}^{n} w_i P(g_i(a), g_i(b)) 
\]

where \( wi \) is the relative importance of criteria \( i \) and the total weight of criteria is equal to 1. The degree of dominance of alternative \( a \), simultaneously, over other alternatives is defined as relation (7):

\[
\mu^D = \sum_{b \in A, b \neq a} P(a, b) 
\]
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The degree of dominance of alternative a which simultaneously preferred to b is obtained by relation (8):

\[ \forall a, b \in A \]

\[ a \succ b \iff \mu^D(a) > \mu^D(b) \]

\[ a \sim b \iff \mu^D(a) = \mu^D(b) \]  (Outranking)  (Indifference)

Our environment is a finite set of fuzzy numbers used to express an imprecise level of performance of each criterion. Seven levels are used: “very poor”, “poor”, “fairly poor”, “medium”, “fairly good”, “good” and “very good”. The linguistic terms are transformed into fuzzy number with Figure 2 and are listed in Table 1 (Zulal Gungor and Feyzan Arikan, 2000).

In this research, the experts in Dutch Disease were asked to fill some questionnaires, then the weighted averages of the questionnaire were calculated, and finally the derived results were converted to the linguistic expressions listed in Table 1.

As shown in Table 2, the fuzzy ranking relations can be derived using eq. 1 for 6 choices shown in Table 1. Considering the preferences expressed in Table 1, the developed model for ranking the corrective strategies for Dutch disease in Iran can be summarized as Table 2.

![Fig. 1: The income gained from oil export in Iran (in billion USD)](Reference: International Monetary Fund (IMF) and www.economywatch.com)

3. RESULTS AND DISCUSSIONS

The literature review declares that the last researches worked on the special aspects of Dutch Disease. The advantage of the present paper in compare with the last ones is considering different issues of the problem and presenting the comprehensive investigation on the consequences of Dutch Disease in Iran as well as recommending the remedial suggestions for dealing with this problem. For this, the ideas of experts about remedial solutions are gathered by questionnaires. For the information extracted from experts’ comments are qualitative and nondeterministic, the fuzzy decision making approach is employed in order to determine the position of each remedial solutions and rank them based on the experts’ views. Researches mentioned in literature review emphases each one on the part of problems related to Dutch Disease and the impact of such problems on the economic variables. As no study has been conducted in Iran on planning and prioritization of available choices for remedy of the consequences of Dutch Disease, the main difference of the present study is to survey the problem expansively by looking at various issues of the disease. The results of survey on several manners of Dutch Disease and ranking the remedial strategies are presented in the next parts of paper.
Fig. 2: Linguistic scale of fuzzy numbers

Table 5: Weight ranking matrix

<table>
<thead>
<tr>
<th>Alternatives</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.5</td>
<td>0.75</td>
<td>0.45</td>
<td>0.75</td>
<td>0.875</td>
<td>0.458</td>
</tr>
<tr>
<td>2</td>
<td>0.25</td>
<td>0.5</td>
<td>0.25</td>
<td>0.43</td>
<td>0.625</td>
<td>0.027</td>
</tr>
<tr>
<td>3</td>
<td>0.55</td>
<td>0.75</td>
<td>0.5</td>
<td>0.75</td>
<td>0.958</td>
<td>0.5</td>
</tr>
<tr>
<td>4</td>
<td>0.25</td>
<td>0.569</td>
<td>0.25</td>
<td>0.5</td>
<td>0.625</td>
<td>0.041</td>
</tr>
<tr>
<td>5</td>
<td>0.125</td>
<td>0.375</td>
<td>0.041</td>
<td>0.375</td>
<td>0.5</td>
<td>0.18</td>
</tr>
<tr>
<td>6</td>
<td>0.541</td>
<td>0.972</td>
<td>0.5</td>
<td>0.958</td>
<td>0.819</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Reference: Research results

Table 6: The degree of dominance of alternatives

<table>
<thead>
<tr>
<th>Alternatives</th>
<th>Dominance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.283</td>
</tr>
<tr>
<td>2</td>
<td>1.582</td>
</tr>
<tr>
<td>3</td>
<td>3.508</td>
</tr>
<tr>
<td>4</td>
<td>1.735</td>
</tr>
<tr>
<td>5</td>
<td>1.096</td>
</tr>
<tr>
<td>6</td>
<td>3.79</td>
</tr>
</tbody>
</table>

Reference: Research results

3.1. Results of Pseudo-order preference model

As the relative importance of the criteria is unknown, Pseudo-order preference model is used for a set of dominant and non-dominant alternatives (Zimmermann, 1987) and the model output is shown in the ranking graph. Each node in ranking graph presents an alternative project while the arcs show the interrelationships between two alternatives. If alternative a is superior to b, then an electrical arc is developed between a and b. The ranking graph shown in Figure 3 presents Pseudo-order preference model for the state $p_i = 0.85$ and $q_i = 0.25$.

The ranking graph shown in Figure 3 is obtained by relation (5) (and $p_i = 0.85$ and $q_i = 0.25$). Then, the dominant and non-dominant sets are derived as:

$$S_D = \{1, 6\}, S_{ND} = \{\{3\}, \{5, 4\}, \{2\}\}$$

Where, $S_D$ represents the dominant set implying that no other alternative is dominant to the members of dominant set and $S_{ND}$ represents non-dominant set. As shown in Figure 3, alternatives 1 and 6 (which are refinement the monetary policies and refinement the National Development Fund, respectively) have priority over the other alternatives. Alternative 3 (refinement the policies of government budget), alternatives 4 and 5 (refinement the policies of exchange rate and refinement the policies of balance of payment, respectively), and alternative 2 (refinement of relative prices mechanisms) are placed in the next positions.
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3.2. The semi-order preference model

Table 3 lists relative importance of each criterion in terms of linguistic conditions. Besides, Table 4 shows the calculated normal weights. To derive the results shown in Table 4, first a survey performed on the experts, the weighted average of the results was calculated, and the relative importance of time criterion was obtained.

Once indifference threshold is 0.25 ($q_i = 0.25$) and the ranking relations are obtained based on relation (5), the dominant and non-dominant sets are extracted as follows which are shown in Figure 4.

$$S_D = \{6,3\}, S_{ND} = \{\{1\}, \{4\}, \{2,5\}\}$$

Once the periods (short-run, medium-run, and long-run) were assigned with a different weight and importance, alternatives 6 and 3 (refinement the policies of National Development Fund and refinement the policies of government budget, respectively) were ranked by the model as the highest priorities. In this regard, alternatives 1, 4, and 2 and 5 were ranked as the next priorities.

3.3. Results of the complete-preorder preference model

Complete-preorder preference model detects “best” project among 6 introduced alternatives. Weighted ranking matrix is obtained based on eq. 3 and is presented in Table 5. Dominance level of each alternative (shown in Table 6) is calculated using eq. 4. Ranking graph, obtained by applying eq. 5, is presented in Figure 5. Among the presented alternatives, alternative 6 is determined as the highest priority. The next ranks according to their importance are 3, 1, 4, 2, and 5; precisely, “Refinement policies of government budget”, “Refinement the monetary policies”, “Refinement the policies of balance of payment”, “Refinement of relative price mechanisms” and “Refinement the policies of exchange rate” are the next alternatives recommended for remedy of Dutch Disease in the viewpoint of Iranian economists.
4. CONCLUSION

Different organizations, institutes, and sectors are consistently making decisions with various strategies, tactics, and operations in order to achieve their goals. Due to the unclear nature of information and criticality of the decision making process, fuzzy logic method was applied in this study. Due to the imprecise information of input variables, which are expressed as linguistic terms; including, highly important, medium important, and low important, the fuzzy logic can be of a great interest in terms of human perspective.

Based on the results obtained from three proposed models, alternative 6 (refinement the policies of National Development Fund)” is prioritized over the other five alternatives. Once applying the Pseudo-order preference model for ranking the alternatives, it is clearly observed that strategies; including, “refinement the monetary policies” and “refinement the policies of National Development Fund” are the top priorities; alternative 3 (refinement the government budget policies) stands in the second place; alternatives 5 and 4 (“refinement the policies of exchange rate” and “refinement the policies of balance of payment”, respectively) is the third priority; and, alternative 2 (“refinement the mechanisms of relative prices”) stands in the last position of this ranking system.

In the case of applying the semi-order preference model for ranking the applied policies, alternatives 6 and 3 are prioritized over the other alternatives; alternative 1 is in the second place; alternative 4 stands in the third position; and alternatives 2 and 5 have the least priority as compared to the other alternatives.

Based on the results of the complete-preorder preference model, alternative 6 is determined as the most important strategy. Alternatives 3, 1, 4, 2, and 5 stand in the second to sixth positions in the order of their ranking.

In order to make sensitivity analyses, we changed pi and qi which are, respectively, preference and indifference thresholds. The results of sensitivity analysis indicate that due to change of pi and qi the difference priority of the alternatives gets more significant; but, the ranking of alternatives has no change; implying that in any of these models and considering the mentioned criteria, ranking of the alternatives is independent from pi and qi, indicating the explanatory power of the proposed model.

The policy makers and planners of the national economy should focus their attention to the mechanism of National Development Fund, because of its importance as compared to the other 5 alternatives, and also precede other refinement policies for dealing with consequences of Dutch disease. To reach this purpose, the elaborate investigation of all mentioned strategies is required in order to find the operational method for remedy of the Dutch Disease in Iran. The main objective of this study is, firstly, to detect and introduce the main fields affected by Dutch disease and, secondly, detect and classify the refinement strategies of Dutch disease in Iranian economy considering the comments and opinions of the economists and experts who conducted vast studies on this phenomenon. Finally, using the fuzzy decision making approach and considering the most important time criterion and classifying it into short-run, middle-run, and long-run periods, 3 ranking models were proposed. In this way, it would be possible to apply the available strategies with a high confidence.

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Prioritization of Remedial Approaches for Dealing with Dutch Disease Consequences in Iran: an Application of Fuzzy-Modeling

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