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RESEARCH PAPER

# Investigation of Resiliency and Efficiency of Free Zones by Using DEA

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**Abstract**
From the perspective of local economic development, on the one hand, free zones increase trade and attract some necessary technical and capital expertise and therefore, lead to the economy dynamics. On the other hand, the resiliency of these areas causes free zones to observe less fluctuation over time and will suffer less damage. Today, the concept of efficiency and effectiveness is one of the things to be taken noticed by many economists. Therefore, using the indices of Burman et al. (2013) and Briguglio (2003) and window analysis, this paper is to investigate the resiliency and efficiency of Iranian free zones. Accordingly, using the resiliency indices of Burman et al. (2013) and Briguglio (2003), free zones of Kish, Qeshm, Chabahar, Anzali, Arvand, and Aras over the period of 2011–2015 are evaluated. Results indicate that most free trade zones have not operated in accordance with the resiliency based on the sub-indices of exports rate, imports, ratio of exports to total, trade balance, foreign and domestic investment, employment, income, and the number of registered firms. Results of the DEA indicated that the only free zone is Anzali which was functioning efficiently. Therefore, it is recommended that the government provides conditions for attracting foreign and domestic investment through giving tax incentives, refining laws, custom taxes, etc. The re-export of imported goods can be effective in improving performance in these areas.
**Keywords:** Free Zones, DEA, Export, Import, Briguglio Index.
**JEL Classification:** C14, D61, E20.

## Introduction

There are many definitions of the free zone, but defining the free zone it should be noted before that the terminology which has been used by different countries for free zones over time are not necessarily identical, and do not express the same purpose. According to International Labor Organization (ILO), free zone is an industrial zone with a particular function, which is decided to attract foreign investors to partially process the imported items before being re-exported (ILO, 2003). United Nations of Industrial Development Organization (UNIDO) refers to free zones as a stimulus to develop with the aim of exporting goods (Mohammadi Alamuti, 1995). The World Bank believes that free trade zone, as a certain territory, is often located in or near a port, where free trade is allowed with the world. Totally, free zone can be defined as an area of the territory locating outside the scope of the legal, administrative, and physical customs facilities. Entry and exit of capital and profit and specialists labor mobility occurs easily in the region, goods and materials without legal

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prevention can be transited or kept in warehouses or transformed in factories or turned to other commodities without any customs preventions. The products are more export-oriented and will be subject to the rules and customs when entering the host countries (Haddadi, 1997).

The idea of creating free zones in Iran dates back to 1960. The free zones of Kish, Qeshm, and Chabahar were established due to the law, and then the free zones of Arvand, Aras, and Anzali, and the free zone of Maku were built, so that there is a total of seven free trade-industrial zones in Iran.

Countries must attract capital financing, create the basic infrastructure for economic growth, get new technologies, join foreign business, create jobs and stuff, etc. Therefore, creating free economic zones has been one of the most important policies of countries in the world in recent decades (Piri Sarmanlou, 2017; Mohammadi and Arefi, 2016). A look at the amount of foreign investment in the whole country during the period of 2006–2014 and its comparison to the investment level in free zones shows that the ratio of investment in free zones to the whole country is about 3.5%. Import of goods through free zones is estimated to be between $3 billion and $4 billion a year, and about 10% of the whole imports. More than 50% of companies are registered in free trade zones, and the share of service, industrial, and tourism companies is 35%, 11%, and 1%, respectively (Report of free trade, industrial, and special economic zones, 2016).

The most important goal by establishing free zones is to increase exports. However, since the implementation of the infrastructure was the areas' function from the beginning, free zones became imports corridors to supply their own costs. According to statistics published by High Council of Free Zones (2013), the investments by internal resources in free zones were 52,732 billion Rials, and foreign investment has been estimated at $31 million. Certain export value of 410,988 tons of production in these areas was reported as $132 million, in which the highest export from Anzali was $46 million, and no export was done from Arvand and Maku. The export value of 755,988 tons of domestic products, which have been sent abroad using Free Zone facilities by Iran Customs, has been declared as a total of 14,462 billion Rials, equivalent to $409 million. The export of domestic goods of Kish, Qeshm, Chabahar, and Maku did not participate. Meanwhile, the highest export was from Arvand as $377 million, and the least was from Bandar Anzali as $170,000 (Report of free trade, industrial and special economic zones, 2016).

Imports have been examined through three scopes, i.e. the region location, imports of raw materials and commodities for purposes other than the production, and processing operations. Accordingly, 2,124,668 tons of goods have been entered through the region to the main land, equivalent to $41782 million and 302 billion Rials. Arvand with $745 million of imports took the first place. Yet, some lowest value of imports belonged to Maku. The import value of raw materials used in production units in the region is $215 million, equivalent to 2708 billion Rials, for importing 118,311 tons of goods. The value of importing other goods to the region including goods for non-production and processing operations has been announced as $1201 million, equivalent to 38,794 billion Rials (Report of free trade, industrial and special economic zones, 2016).

Accordingly, 325,307 tons of goods entered the free zones. Kish was in first place with imports of $425 million, and Qeshm was ranked as second with imports of $410 million. The total exports from free zones in 2012 were about $716 million, and imports of goods in the same period were $3198 million. Therefore, imports in free zones were about 5.4 times more than export and re-export, with total share of about 26.6% in the last year. However, the share of exports from the free zones in the same period was 1.72% of the total exports of the country (Report of free trade, industrial and special economic zones, 2016). Therefore, due to weaknesses in the system of free zones, it is necessary to consider economic resistance to increase the country's economic power. Based on the resistance economy policy, this paper is

to study the performance of free zones to transfer advanced technologies, expand and facilitate production, export of goods and services, provide essential financial resources from abroad, and also reduce the vulnerability of oil and gas export revenues. The main purpose of this study is to investigate the function of free trade zones and these zones efficiency, by using of DEA.

The remainder of this paper is organized as follows. In section 2, a literature review is presented, i.e. the relationship between free zones and global trade, strategies applied in free zones, efficiency, data envelopment analysis (DEA), and research background. Section 3 discusses the resiliency indicators, and introduces DEA. Section 4 provides the results, and finally, Section 5 concludes the paper.

## Literature Review

*The Relationship between Free Zones and World Trade*

World experience (at least before the big trade blocs) indicates a broad awareness of the role of free zones in the economic, regional, technological development, and marketing and developing linkages with global markets. These experiments indicate a broad awareness about the causes of success and failure of free zones, and this kind of attitude can be seen in the content of laws and regulations and administrative practices regarding free zones. Among the above sets, the degree of political stability, the socio-economic beliefs, scattering or consensus views about the purpose, benefits and disadvantages of free zones, government support or lack of support, and finally software (knowledge and rules) and hardware (infrastructure, facilities, and enjoyment and failures) can have the highest effect on the use or non-use of the free zones as a development tool and the success or failure of this region.

The main role of free zones in the countries such as India, China, Iran, etc. is to make changes in economic thinking and alignment of the national economy with the global economy. Good examples of this large extent change in thinking are China and India. These two countries used free zone as a tool to open their economy, and changed their rules by attracting foreign investment. Meanwhile, they created an appropriate space to benefit foreign technology and science, and changed the internal space of their national economy by increasing the number of free zones. Furthermore, they adjusted the rules and overall economic policy with global economy. China implemented open economic policies to encourage the foreign investment in recent years, and despite governmental ownership, used liberalization policies, so that free zones developed economically, and achieved broad reforms. The secret of China's success was unity in decision making, and the government's strong support for the economic reforms, which were aligned with the goals of free zones.

*Strategies Applied in Free Zones*

*Applying Export Development Strategies Rather than Import Replacement*

Replacing domestic products with imported ones is called as the strategy of import replacement. This development strategy formed between the two World Wars, and up to the early 1960s. These two wars and the economic depression of the 1930s made the process of importing industrial goods for developing countries difficult and even impossible; because the currency earnings of the developing countries, which are resulted from the raw materials export, decreased, and the developed countries at war were not able to export their industrial goods (Sarlak, 1995).

The above conditions and evoking the feelings of nationalism, up to the end of the 1950s,

somehow led to independence and self-sufficiency strategy which was called as the strategy of import replacement in academic assemblies. But the relative failure of economic and industrial policies and programs in undeveloped countries, on the one hand, and the changing nature in the self-sufficiency strategy of revolutionary countries of Asia, Africa, and Latin America, on the other hand, have seriously questioned the authenticity of development practices which advocated economic isolationism and, following another pattern in 1970s and 1980s, inspired the developing countries which was named as export development strategy. Meanwhile, free zone is a tool (widely believed by economic thinkers), which can reduce damages of the transition period for the economy of these countries confront them with less damage in creating gradual coordination with the global economy (Karimi-Kia and Moqaddam, 2012).

*Applying the Strategy of Using the Principle of Relative Superiorities*

Based on the theory of relative superiority, each country should tend to produce a good which has superiority, because each country supply a particular good at lower prices than any other countries. The superiority theory, which was developed by Rigardo, the famous English economist, includes the dominant theory of international trade for years. A free zone is a tool by which developing countries can enjoy the principle of relative superiority through employing cheap labor, raw materials, and intermediate goods to promote free trade in such zones, and accelerate their economic development process (Karimi-Kia and Moqaddam, 2012).

*Applying the Strategy of Foreign Trade as the Driving Force of Development*

Global economic development after World War II indicated the experience of today's developed countries in the 19$^{th}$ and the first half of the 20$^{th}$ century, and that of the newly industrialized countries during the last three decades, during which foreign trade can be the driving factor of development. Especially in today's economic world that technology changes are fast and impressive, no country alone is able to produce everything. Thus, development will not occur without cooperation and benefiting from trade with others. Also, as one of the ways of expanding foreign trade is the development of the free zone tool, many economists consider this tool as useful (Karimi-Kia and Moqaddam, 2012).

*Efficiency*

Efficiency is the success of the firm or institution in producing the maximum possible output from a set of production factors, so that all inputs and outputs are carefully measured (Farl, 1957). Efficiency is the outcome of the quality of three issues: method (technical), allocation (price), and economic (cost). Performance is evaluated by two parametric and non-parametric methods. In the parametric method, the production function and its unknown coefficients can be estimated by assuming a certain form of the production function. Then, the maximum production of consumer inputs is extracted from the firm. Non-parametric method, by means of mathematical programming, calculates the relative efficiency, and does not need to estimate the production function. DEA is a typical nonparametric method (Rajabi and Nasrollahi, 2012).

*Data Envelopment Analysis (DEA)*

DEA is a linear programming method which estimates the boundary production function or the efficiency boundary. Boundary production function is the maximum product produced

from a given amount of production factors (Mehregan, 2004). The DEA method does not require any particular functional form (including the regression equation or production or cost function). Meanwhile, it is a non-statistical method, and does not require any statistical tests. In this method, performance is measured reliably, and each decision making unit (DMU) is compared to the best available unit of that industry (Basiri, 2007).

Using the DEA model for the relative evaluation of units, it is necessary to determine two basic characteristics, the nature of the model and the return to the scale of the model. In the nature of the input, by keeping the output level constant, we decrease the inputs, and in the nature of the output, by keeping the input level constant, we increase the output level (Khajavi et al., 2005).

The return to scale is the link between the input changes and the outputs. Constant return to scale means that each input produces the same number of outputs. Variable return to scale means that each input produces various numbers of outputs (the same, less, or more) (Banker and Tral, 1992).

*Research Background*

Shakeri and Salimi (2006), using AHP method, found that the main problem of Chabahar free zone was lack of appropriate executive organizations and proper efficient management. Sanboli (2008) examined the development limitations and capacities of Qeshm free trade and industrial zone. Results indicated that poor management and the inability to attract local and global investment was the main challenge of the area. Rukn al-Din Eftekhari et al. (2009), using MADM method, studied the optimal allocation of Iranian economic sources. They prioritized free zones by utilizing multivariate decision methods in 2006, and ranked the zones by using different techniques (i.e. Burda, Copeland, and Pozet). Results from using a combination of these techniques indicated that Kish had the highest economic sources, and then Qeshm and Chabahar had the most economic resources, respectively. Therefore, increased foreign investment and reaching regional and global markets should be the center of attention. Ismaeili (2010) prioritized influencing factors on investment attraction in Ara free zone by using AHP technique. Results demonstrated that the lack of appropriate executive organizations, efficient management, and basic infrastructure facilities, the adverse effect of government policies at the macro level on the zone, and finally the restrictions and failure in lack of appropriate rules led to a lack of foreign investment attraction. Taqavi and Rezaei (2010) examined the effect of inflation and local investment on attracting FDI[1] in commercial-industrial free zones of Iran. They showed that inflation had a negative, and local investment had a positive effect on attracting foreign investment. Karimi-Kia and Moqaddam (2012) studied the effective factors on investment attraction in Arvand free zone, by using Delphi and student t-test. Results indicated that lack of infrastructure facilities and appropriate governmental investment, and failure of laws were the main obstacles to investment in Arvand free zone. Mamipoor et al. (2014) used Delphi and AHP methods to study and rank the investment attraction factors in Anzali free zone. Results indicated that different factors influenced both the local and foreign investment attraction in Anzali, which could be summed up in seven major factors. These factors are as follows, respectively: facilities, policymaking, economy, laws, management, supporting, and location. Panahi (2015) studied the role of free trade zones in foreign trade. The investigations showed that these zones were not successful in four major factors, i.e. export, national and local employment, the attraction of foreign investment, and transfer of technology. Therefore, special attention should be given to the development of these zones, and stable economic and political conditions should be provided

1. Foreign direct investment

to attract foreign investment. So that these zones can have a positive effect on national economies. Zirak (2015) studied the vulnerability of Iranian economy based on the resistive economy. Results indicated the existence of legal barriers and the lack of access to modern national and international innovations in this regard. Ultimately, each sector of resistance economy and its relationship with other areas of general policy requires drawing a development pattern to realize the resilience approach in the economy, in which the interaction of critical and priority sectors are a necessity. Mohammadi and Arefi (2016) studied the role of free zones for the implementing the introversive and extraversive elements of resistance economics. Their study of the performance of commercial-industrial zones during a decade in Iran, and its comparison with the goals of the establishment of these zone, indicated that failure to fulfill some of these objectives and the emergence of some problems required the establishment of appropriate mechanisms to improve the performance of free zones. Piri Sarmanlou (2017) studied the development of Chabahar free trade zone according to the economic system. Results of exports and imports of Chabahar and other free zones in Iran indicated that the lack of access to export targets was not due to their geographical potential. At the same time, the lack of a port with drinking water and convenient port facilities is clearly visible. Mostafaei (2014), Poorsafar et al. (2014), and Kamran and Fasihi (2014) are some other studies on this issue.

## Methodology

*Resiliency Indicators*

In order to investigate the resiliency of free zones, some indicators should be clarified. Mombini (2012) considered indicators like the low rate of unemployment and underemployment, high productivity of labor, lack of bipolarity in the community, high social capital, and diversity of export income, economic independence, and high economic growth as indicators of resilience economics. After specifying indicators, the desired model in different economic sectors was offered by utilizing resilience (resistive economy) measurement methods. The indicators, which showed resilience in the national level, included Briguglio et al. (2008) and continental resilience index, the American international development agency index, evaluation of national resilience by world economic forum, and world resilience indicator of FM. The resilience indicators in regional level include: Yorkshire economic resilience, and society economic resilience: Advantage West Midlands. It should be noted that each of these indicators puts emphasis on a specific variable.

In this paper, according to the availability of data, economic resilience of free zones is targeted, and the two indicators of Boorman et al. (2013) and Briguglio et al. (2008) are used. In order to calculate the economic resilience of free zones, the overall index by Boorman et al. (2013) is used.

The requirements for the internationalization of free trade zones are investigated in this paper. Accordingly, and considering the availability of the statistical data, exports indices (million dollars), imports (million dollars), the share of export for the free zone (percent), trade balance (million dollars), the amount of foreign investment (million dollars), the domestic investment (billion Rials), employment (people), income (billion Rials), and the number of registered companies are going to be concerned.

There are three steps to calculate the free zone resilience:

1. Aligning the variables: Variables which have a negative effect on resilience are reversed for alignment.
2. Normalizing the variables: All variables are put into a new collection through normalization process. All values in this process are between zero and one. In this case,

the values can be compared with each other.

$$Z_i = \frac{x_i - x_{min}}{x_{max} - x_{min}} \quad (1)$$

where $Z_i$ is the normalized value, $X_i$ is the value of each of the data, $X_{min}$ is the minimum possibility of the data, and $X$ max is the maximum amount of data.

3. Weighing: Resistance of an economy requires all variables to have desired values. If one of these variables, regardless of its importance in the economy, is in a disadvantageous condition, it will put the resistance of an economy into risk due to the feedback effects it has. Therefore, with respect to this issue, and following studies conducted in foreign countries in the field of resilience, all variables are given the same weight. Finally, the average weight of these variables is calculated as the resilience indicator. Resilience indicator value is between zero and one, so that the closer it is to zero, the lower is the resiliency, and the closer is the value to one, the higher is the resiliency.

*DEA*

In evaluating DEA models and measuring decision makers, each decision unit is evaluated only in a specific time period. Yet, in actual studies, observations are often related to DMU as time series data. As a result, it is very important when it comes to checking the efficiency of the DMU over a period of time. One of the methods used in this regard is window analysis.

Window analysis is based on the moving average principle (You, 1992), and is used to assess the performance of firms over a period of time. In this method, the performance of each DMU over time is evaluated as if it has a different identity at any given time. On the one hand, it helps the performance of each DMU over time. On the other hand, it makes it possible to distinguish between pure technical efficiency and scale efficiency. This method is suitable for measuring the efficiency of a small sample, because it creates a higher degree of freedom for the sample.

The window procedure was introduced by Charles and Cooper (1985) for the first time under the name of window analysis. Each window is made up of the enterprises in a certain number of years, starting from the beginning of the year and continuing as much as the length of each window. In this method, the efficiency values of each firm are calculated in each year, and then the average of the calculated efficiency in this window is called the efficiency of that firm in that window. The window of efficiency in the new window can be calculated for the firms by moving the window to the new period (year-base removal and adding year to end), and finally, the efficiency of each firm is evaluated and compared through comparing the efficiency values of each window during the period with other firms (Webb, 2003). There is no theoretical and logical definition of window size. In most studies, windows have been used for 2 to 5 years.

The matrixes of inputs and outputs for window analysis can be seen in the Equations 2 and 3, respectively.

$$X_{kw} = (X_K^1, X_K^2, \dots, X_K^n, X_{K+1}^1, X_{K+1}^2, \dots, X_{K+1}^n, X_{K+W}^1, X_{K+W}^2, \dots, X_{K+W}^n) \quad (2)$$

$$Y_{kw} = (Y_K^1, Y_K^2, \dots, Y_K^n, Y_{K+1}^1, Y_{K+1}^2, \dots, Y_{K+1}^n, Y_{K+W}^1, Y_{K+W}^2, \dots, Y_{K+W}^n) \quad (3)$$

The input-oriented of window analysis for $DMU^n{}_t$ is defined by the assumption of constant returns to scale in the Equation 4:

$$\acute{\theta}_K = \mathrm{MIN}_{\theta,\lambda}(\theta) \quad (4)$$

$st$:

$$-\mathrm{X_{KW}}\lambda + \theta \acute{\mathrm{x}}_\mathrm{t} \geq 0 \rightarrow \mathrm{t} + 1,2, \dots, \mathrm{T}$$

$$-\mathrm{Y_{KW}}\lambda + \acute{\mathrm{Y}}_\mathrm{t} \geq 0 \rightarrow \mathrm{t} + 1,2, \dots, \mathrm{T}$$

$\lambda_n \geq 0$

Finally, it should be noted that the inputs of the present study include exports, foreign investment, domestic investment, and the number of registered companies, and its outputs are employment and income in free zones in the period 2011–2015.

## Results and Discussion

Due to the availability of data over the period 2011–2015, and the use of Burman et al. (2013) index, six free trade zones, i.e. Kish, Qeshm, Chabahar, Anzali, Arvand, and Aras were studied.

Table 1 indicates the index of reconstructing free trade zones. Initially, variables are arranged (the variable which has a negative correlation (import) with resilience is reversed). After arranging the variables, they are normalized using the standardized value of $Z_i$. Then, the variables are weighed and, finally, the weighted average of these variables is considered. As can be seen, over the period 2011–2013, the indices of determining to reconstruct Kish free zone have been away from resistance, and have reached the lowest and worst conditions in 2013. In years 2014 and 2015, the index shows a significant increase, which indicates approaching the objectives of the resistive economy in the last two years. Retrofitting index in Qeshm over the period 2011–2015 indicates a pendulous procedure, the highest value of which was in 2012 (0.54) and the lowest was in 2015 (0.36). Chabahar is another free zone, which was studied in this paper. As Figure 1 indicates, the lowest value of retrofitting index is in 2012, and the highest is in 2015, which indicates that this free trade zone has gradually been closer to the objectives of the resistive economy.

Retrofitting index of Anzali free zone in the first two years was almost constant, and had a significant growth in 2013, declined the next year, and again indicated a growth in 2015. Aras has indicated inappropriate performance in retrofitting area in the early years of shown. However, this performance has dramatically improved in the last years. In the overall summing of the index, it could be argued that most free trade zones in the early years indicated inappropriate poor performance, and the closer they get to the last years, their performance has been improved, and they have been closer to the objectives of the resistive economy.

**Table 1.** Retrofitting Indices of Free Trade Zones over the Period 2011–2015

| Free trade zones | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|
| Kish | 0.58 | 0.26 | 0.09 | 0.65 | 0.63 |
| Qeshm | 0.45 | 0.54 | 0.42 | 0.42 | 0.36 |
| Chabahar | 0.26 | 0.24 | 0.45 | 0.55 | 0.62 |
| Anzali | 0.24 | 0.23 | 0.56 | 0.22 | 0.74 |
| Arvand | 0.09 | 0.19 | 0.12 | 0.73 | 0.80 |
| Aras | 0.16 | 0.42 | 0.43 | 0.76 | 0.61 |

**Source**: Research findings.

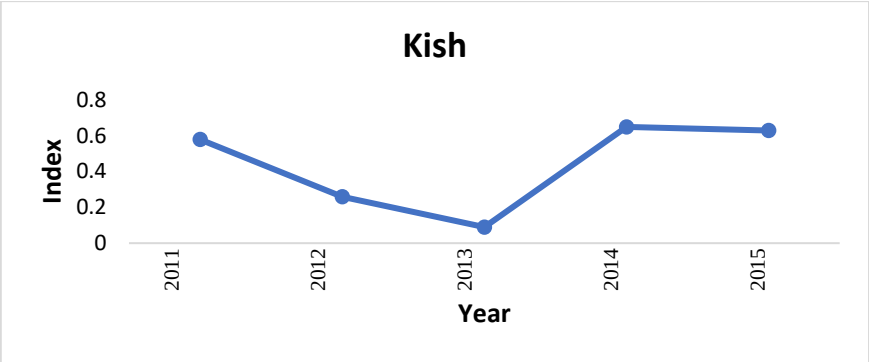


**Figure 1.** Retrofitting Index of Kish
**Source**: Research findings.

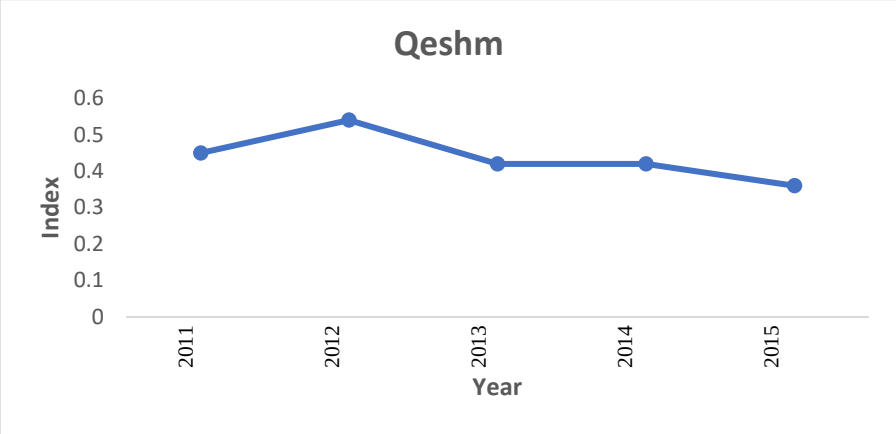


**Figure 2.** Retrofitting Index of Qeshm
**Source**: Research findings.

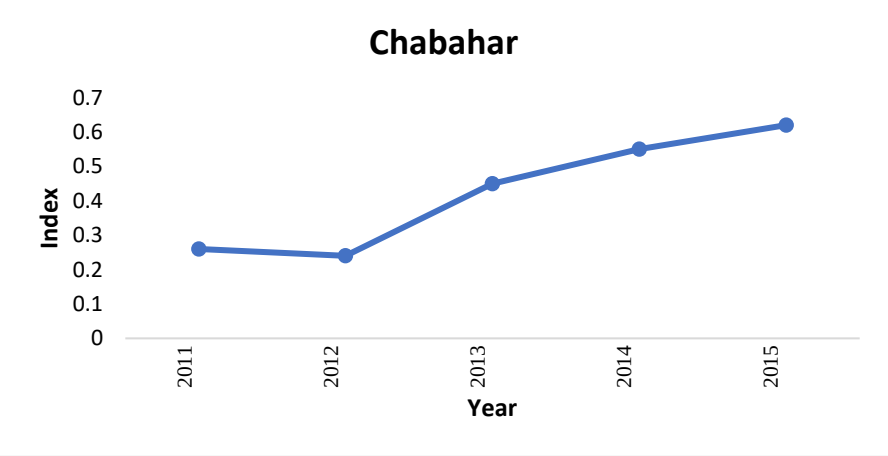


**Figure 3.** Retrofitting Index of Chabahar
**Source**: Research findings.

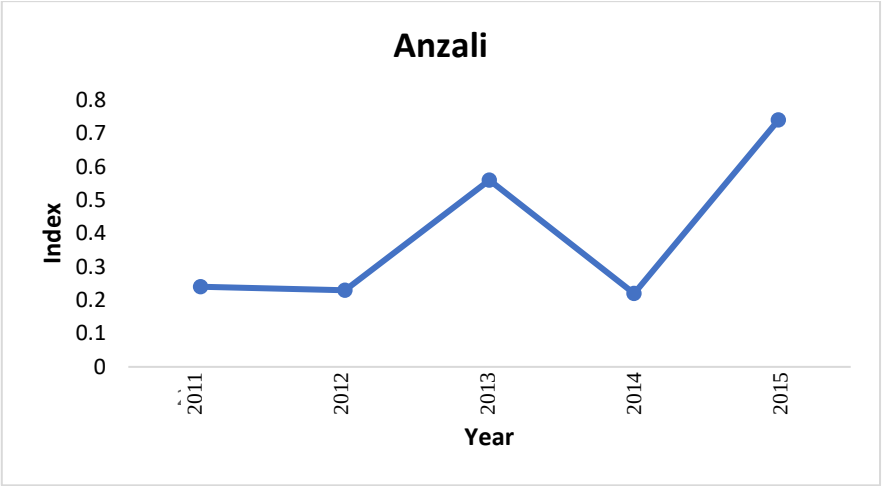


**Figure 4.** Retrofitting Index of Anzali
**Source**: Research findings.

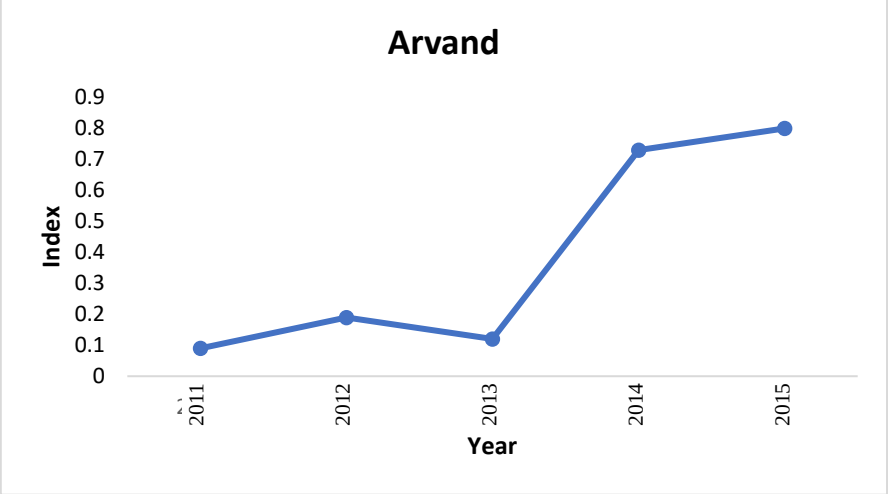


**Figure 5.** Retrofitting Index of Arvand
**Source**: Research findings.

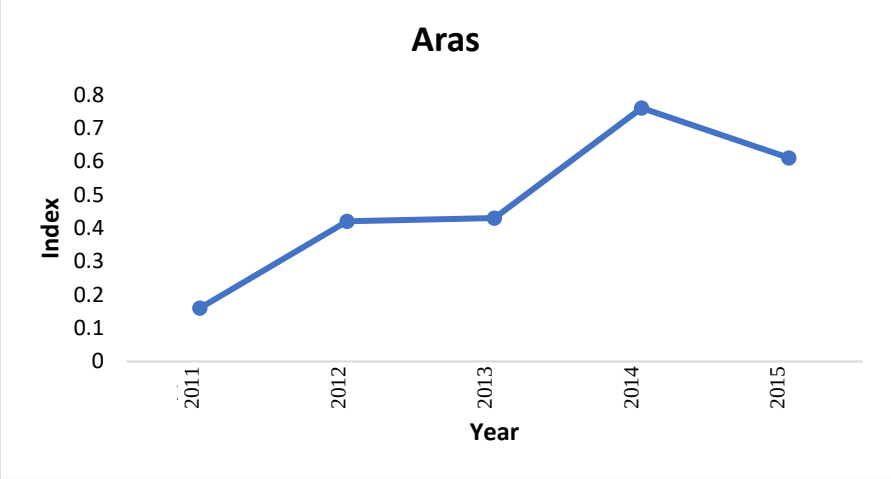


**Figure 6.** Retrofitting Index of Aras
**Source**: Research findings.

The technical efficiency in constant returns to scale determines whether a firm works in the long-run optimal scale condition or not. In other words, the assumption of constant returns to

scale will be applicable only if firms operate on an optimal scale (corresponding to the flat part of the long-run cost curve).

It should be noted that in this paper, in order to evaluate the efficiency of free trade zones, we used the output-oriented approach with the assumption of constant returns to scale using a window analysis. The reason for the output-oriented choice is that free zones do not play a role in determining their inputs (exports, domestic investment, foreign investment, and the number of registered companies), but the maximum output is required. Therefore, their outcomes depend on the activities, and how resources are allocated to different sectors. Hence, the output-oriented models are more suitable for the evaluation of free zones.

To conduct a window analysis, information is available on six free trade zones (N=6) in a 5-year period (P=5). First, a two-year periodic (W=2) analysis was selected as a review period. Each DMU (free zones), as a different DMU each year, was placed at the beginning of the window for a period of two years, and then the analysis was made as Twelve DMU (N×W=2×6=12). Then, the window is shifted to a forward foregone period, and the analysis for the next two years and twelve other DMUs were carried out. The process continued in the same way, and the window shifts each time in a forward direction until finally the fourth window and the last analysis for the twelve division units were completed in another two-year period. The properties of these windows are shown in Table 2 with regard to the constant returns to scale.

**Table 2.** The Properties of the Current Research Windows

| DMU | Window 1 | | Window 2 | | Window 3 | | Window 4 | |
|---|---|---|---|---|---|---|---|---|
| 1 | 2011 | 2012 | 2012 | 2013 | 2013 | 2014 | 2014 | 2015 |
| 2 | 2011 | 2012 | 2012 | 2013 | 2013 | 2014 | 2014 | 2015 |
| 3 | 2011 | 2012 | 2012 | 2013 | 2013 | 2014 | 2014 | 2015 |
| 4 | 2011 | 2012 | 2012 | 2013 | 2013 | 2014 | 2014 | 2015 |
| 5 | 2011 | 2012 | 2012 | 2013 | 2013 | 2014 | 2014 | 2015 |
| 6 | 2011 | 2012 | 2012 | 2013 | 2013 | 2014 | 2014 | 2015 |

**Source**: Research findings.

As shown in Table 3, Anzali in all studied years is at a high-performance level than other free zones. The average efficiency of the study period for Anzali was 100%, which according to the average of other free zones, has the highest rank rather than other free zones. Qeshm is in full capacity in the years of 2013, 2014, and 2015, and its average performance is 0.849. Chabahar is also fully operational in the years 2011, 2012 and 2015, and in 2013 and 2014, is inefficient. The average free zone is 0.936, which is ranked second among free zones after Anzali. Arvand, Kish, and Aras are in the next ranks with the efficiency of 0.806, 0.792, and 0.565, respectively.

**Table 3.** The Performance Results of Free Trade Zones over the Period of 2011–2015

| | | 2011 | 2012 | 2013 | 2014 | 2015 | Average efficiency of each window | Rank |
|---|---|---|---|---|---|---|---|---|
| Kish | Window1 | 0.331 | 0.704 | | | | 0.517 | |
| | Window2 | | 0.704 | 0.615 | | | 0.659 | |
| | Window3 | | | 1 | 1 | | 1 | |
| | Window4 | | | | 0.983 | 1 | 0.991 | |
| | Average efficiency of each term | 0.331 | 0.704 | 0.807 | 0.991 | 1 | 0.792 | 5 |
| Qeshm | Window1 | 0.419 | 0.668 | | | | 0.554 | |
| | Window2 | | 0.668 | 1 | | | 0.844 | |
| | Window3 | | | 1 | 1 | | 1 | |
| | Window4 | | | | 1 | 1 | 1 | |
| | Average efficiency of each term | 0.419 | 0.688 | 1 | 1 | 1 | 0.849 | 3 |
| Chabahar | Window1 | 1 | 1 | | | | 1 | |
| | Window2 | | 1 | 0.714 | | | 0.857 | |
| | Window3 | | | 0.951 | 1 | | 0.975 | |
| | Window4 | | | | 0.825 | 1 | 0.912 | |
| | Average efficiency of each term | 1 | 1 | 0.833 | 0.912 | 1 | 0.936 | 2 |
| Anzali | Window1 | 1 | 1 | | | | 1 | |
| | Window2 | | 1 | 1 | | | 1 | |
| | Window3 | | | 1 | 1 | | 1 | |
| | Window4 | | | | 1 | 1 | 1 | |
| | Average efficiency of each term | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Arvand | Window1 | 0.674 | 0.673 | | | | 0.674 | |
| | Window2 | | 0.649 | 0.934 | | | 0.791 | |
| | Window3 | | | 1 | 1 | | 1 | |
| | Window4 | | | | 1 | 0.515 | 0.757 | |
| | Average efficiency of each term | 0.674 | 0.661 | 0.967 | 1 | 0.515 | 0.806 | |
| Aras | Window1 | 0.948 | 0.693 | | | | 0.820 | |
| | Window2 | | 0.693 | 0.350 | | | 0.521 | |
| | Window3 | | | 0.425 | 0.272 | | 0.348 | |
| | Window4 | | | | 0.137 | 1 | 0.568 | |
| | Average efficiency of each term | 0.948 | 0.693 | 0.387 | 0.204 | 1 | 0.565 | 6 |

**Source**: Research findings.

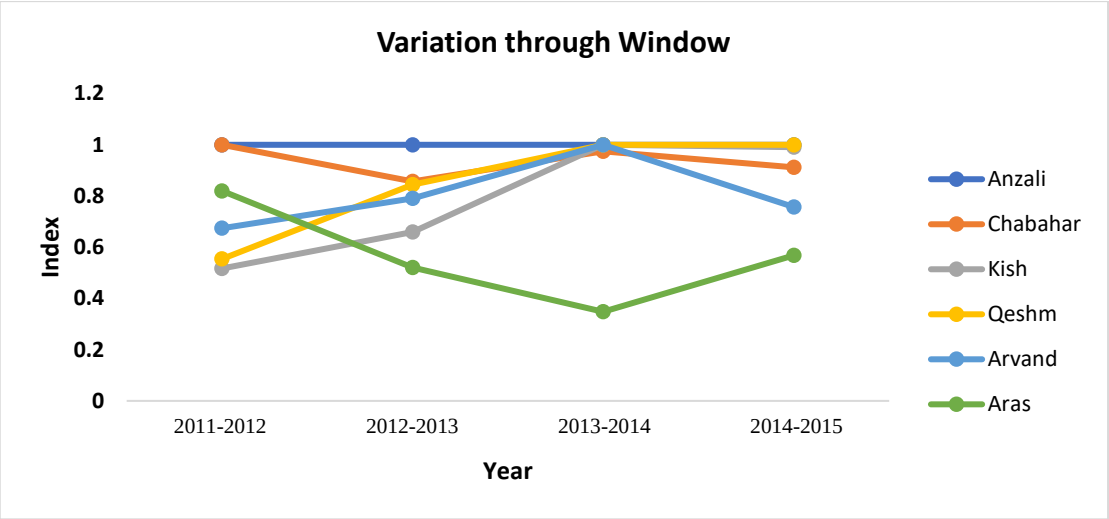


**Figure 7.** Variation through Window
**Source**: Research findings.

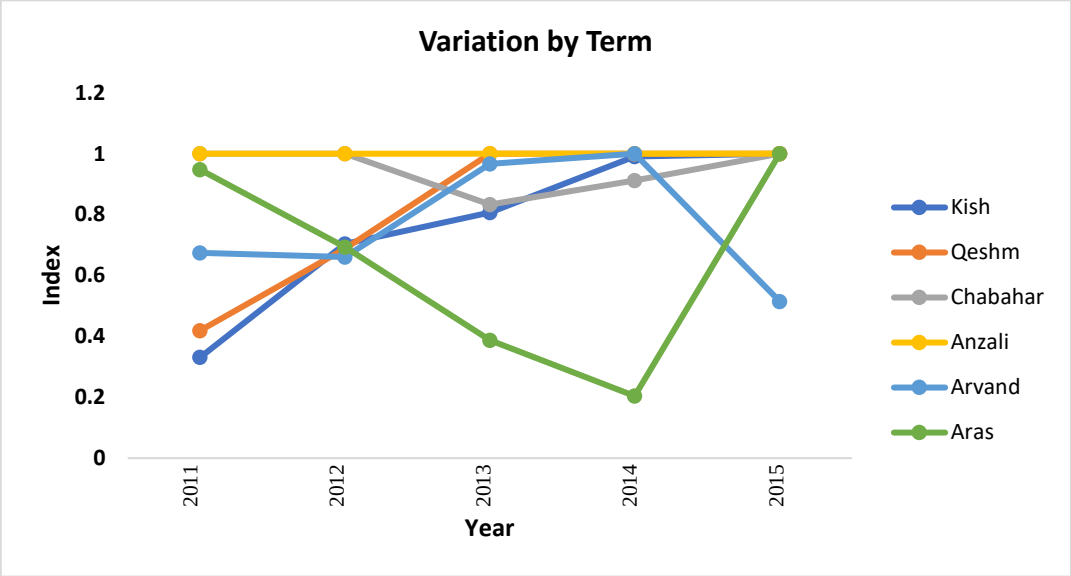


**Figure 8.** Variation by Term
**Source**: Research findings.

## Conclusions

In a general summary of the issues, it can be stated that the free zones have not been able to function in the direction of their resiliency, and the inefficiency of these areas also reflects this. Also, the study of the status and functioning of free zones since its inception shows that these areas have, rather than produced and exported, exacerbated the import and spread of smuggling phenomena and false employment.

Since no similar study has been conducted in this area, the optimal performance of these zones depends on the macroeconomic policies, the important of which can be suggested as follows:

1. The government should provide the condition for attracting investment and foreign and domestic financing in these areas through giving tax incentives (thematic tax exemptions, investment tax credits, and tax breaks), reviewing regulations, customs exemptions, etc.
2. Strength and weaknesses should be considered as opportunities and threats for these zones

in order to reduce fluctuations in these zones through proper planning in the long-run.
3. Using appropriate technology, investment attraction, and efficient management, goods should be produced with the aim of exports, so that these zones can easily indicate a good performance in exports.
4. Re-exporting imported goods can be effective to improve performance in these zones.

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