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## Resisting Urban Economy by Optimizing Efficient Urban Population

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**Abstract:** Resistance economy is a term come across in literature of Iran economy that include lots of paper in this topic. Cities in national economy are a basis of production. Primer cities and metropolises are economy engines that cover major of goods and services production, and they are most important market for the goods and services produced in these cities, so that if these regions were not existed or the population was distributed sporadically or evenly, such a mass production and market volume were not formed. Given the importance of the metropolitan scale in the economy, based on urban economic theories, it is possible to determine efficient population of cities toward resistive urban economy. In this paper, resisting cities is analyzed by determining efficient population of cities. For calculating efficient population of city, urban social welfare function is specified and estimated. Results show Tehran population exceed efficient population level and bringing the efficient size to the actual size or vice versa by controlling urban population can resist urban economy, and consequently the national economy. Control policy is not enough for resisting urban economy but urban development and urban infrastructure development policies are recommended to increase the capacity of the city.

**Keywords:** Efficient Scale, Urban Economics, Resistance Economy, Resisting Cities

**JEL Classification:** P25, O18, P23, J11

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## 1- Introduction

Today, cities are on the rise, and in addition to the physical increase in the dimensions of these societies, their populations grow increasingly. Migration from villages to cities continues in developing countries, and it results in a population concentration in the cities. According to the World Bank, economic development has two features (Geography, 2009): 1. Move from a largely agricultural economy to an economy that works in most industrialized way. 2. The second part of this economic development is provided in the service-based economy. In fact, moving from village to city, which is more common in most countries of the world, especially in developing countries, is the evolution of cities or in the sense of the growth of the service sector. Cities are major centers of economic activity and a base for production so that a large share of GDP in their urban area occurs in developed countries. According to the World Bank, in 2019, about 16% of the world's gross domestic product will be concentrated in nearly 30 of the world's largest cities. It should be noted that urban development provides a place for improvement, and from one point on, losses from this growth will go beyond its benefits. Hence, the question is what is the optimal size of a city? Some think of the enlargement of the cities necessary for progress and some are opposed to this. The increasing population of cities, especially in developing countries, and its relation to economic growth and the benefits of urbanization, along with the dissatisfaction of most of the city's residents, have caused the attention of specialists due to the effects of population overflows such as pollution, high rentals, heavy traffic,

noise pollution, etc. It does not include the size of both economic growth and the welfare of the inhabitants. In recent decades, the optimal size or the optimal size of the city has been the subject of discussion by many scholars; so that this has led to limited policies for the development of cities in some parts of the world. For example, Singll (1974) quoted historians as saying that urban-scale issues of urban size in the 1950s were raised without scientific considerations and led to the control of urban growth, including the cities of Michigan, Florida and California, by many officials. In this paper, it has been tried to explain the basics of resistance economy in relation to the economic situation in Iran. Then, from this perspective, we tried to analyze the city as a production center.

## 2- Literature Review

### *a) Foreign Researches*

Au & Henderson (2006) using the method of maximizing the city's average benefits, estimate U-shaped inverse relationship for cities in China for the first time by using the method of maximizing the city's average benefits. One of the reasons for not estimating this relationship before this time is the lack of required data, such as value added for different cities.

Another approach that has been used in recent years is the use of Marginal Social Benefits with Marginal Social Cost. One of the studies that used this method to estimate the optimal size of the city is the study of Zheng (2007) and Camagni et al. (2013). Zheng (2007) estimated the optimal city size for Japanese metropolis by defining the surplus function as the difference between the total available income and the total

expenditure of households working and living in the city. The optimal size of the city in his view is the level of the population that maximizes the surplus function.

Percoco (2013) found that the geography and institutions in determining the urban development and sustainable size of modern cities in Italy were decisive in the process of developing the Italian cities, and this trend has maintained its shape over the years.

Gaigne & Zenou (2015) in a study titled "Accumulation, City Size and Crime" showed that, as in the big cities, nominal wages and product diversity are higher, the crime rate is also higher. They also found that higher transport costs and higher housing costs would lead to more people facing more urban costs, despite getting higher wages.

Kim et al., (2014) measured the size of the South Korean metropolitan area according to the national production benchmark in a study entitled "Optimal Urban Size: National Efficiency versus Local Efficiency". Using the inter-regional general equilibrium technique, they found that the size of the population is efficient in terms of producing a metropolitan area larger than the size of a metropolitan area in terms of national efficiency.

#### ***b) Iranian Researches***

Abedin-Darkoosh & Nasiri (2010) examined and estimated the optimal size of Iran cities with surplus function method. The results showed that the optimal limit of city with over consumption method is about 1 million and 25 thousand people.

Akbari et al., (2006) studied the distribution of Iranian cities from 1946 to 2001 using Ziff rule (rank-size), Gibberetic rule and Gini Space Coefficient. The results of these models indicate an increase in inequality in the distribution of Iranian cities over time.

Shateriyan et al., (2011) conducted an article aimed at investigating the status of Iran in terms of city size distribution indicators, among neighboring countries of Iran. In this research, two methods of primary index and unconcentricity indices were used. The results of all indicators indicate that the prime phenomenon exists in Iran and neighboring countries, and the unequal urban system has shown that the first urban phenomenon exists in all of these countries and that the unequal urban system and distribution of the population are unbalanced; while this focus in Iran is moving towards balance.

### **3- Theoretical Background**

Production is of great importance in cities. Turnover in the urban areas is very high; accordingly, urban economy based on the resistive economy should be focused on as the main guide. In fact, cities are the places to run resistive economy. The importance of cities has been emphasized in many books. For example, in *Keys to the City* by Micheal Storper, a leading geographer, a fundamental question is raised that why some cities grow economically and some do not.

The optimal city-size is one of the topics transformed by the concept of the benefits of agglomeration. Until the 1970s, many studies on the proper size of the city were limited to minimizing the cost of providing public services or municipality services. In other words, in the decades prior to 1970, urban experts' the criterion to determine the city size was the cost to local governments to manage the city. The results of such studies were those introduced as

suitable size or efficient size, and their output was a constraint for the development of the city (Singell, 1974).

Increase in urban population in the world, especially in developing countries, besides growing and benefiting from the effects of growth and development, had many consequences, including over-concentration of population, unbalanced development, pollution, traffic, and so on, which attracted economists' attention to optimal size.

Many factors are involved in determining the size of the city, including population size, the economic strength of the city (city income, average per capita income of households), physical size of the city (city size), population density and distribution. In most studies of city size, population is considered as a factor in city size. In his book *The Republic*, Plato states the population of his utopia as 5040 people, and believes that if that city's population is more than the determined limit, there will be no possibility of proper city administration. In his book of *Politics*, Aristotle argues that the increase in the number of inhabitants of a biological complex more than a given limit will affect the relationship between them and the features of the city (AbedinDarkoosh & Nasiri, 2010)

#### ***Theory of Resistance Economy***

The review of the country's economy shows that in some periods the vulnerability of the national economy has been high. For example, during the period of intensifying economic sanctions at the beginning of the 2010s, most of the national economy sectors suffered from these sanctions, although the effects of sanctions on the national economy were less than estimates. According to

estimates, the Iranian economy should face the phenomenon of collapse as a result of sanctions, but the experience of the national economy has been opposite to the expectations of the sanctions (Barkhordari & Jafari, 2015).

Resistance economy is a term that has just entered Iran's economic literature. In fact, it is a solution to economic shocks and crises. This term was first introduced in the meeting of the entrepreneurs with the Supreme Leader of Iran in 2010, and there the country's basic need for entrepreneurship was introduced to be due to the country's readiness for progress and the economic pressure of the enemies. Resistance economy can be traced as follows: As a contemporary version of the economic system of Islam, the country is in a situation where people live in Iran where is now full of economic hostilities. This is the same as the mirror; the light that comes to it is the rays of the Islamic school of thought, and now the reflection of what is happening is an economic system called the "resistance economy system" (Abdolmaleki, 2014).

Policies of resistance economy were communicated in mid-February 2014 in the implementation of Article 110 of the Constitution to the Heads of State and the Expediency Council after consultation with the Expediency Council (Publishing Office of Ayatollah Khamenei' works, 2010). This is while the pre-requisites of resistive economy had repeatedly been explained to officials in the statements of the Supreme Leader in previous years. For example, in May 2001, in an eight-article message to the heads of the states, he wrote, "Today, we are thirsty for healthy economic activities and creating employment for young people and

investing” (Publishing Office of Ayatollah Khamenei' works, 2001). Resistive economy is the bail for the realization of Vision 2025. Iran 2025 Landscape Document is a written program that has explained cultural, scientific, economic, political and social development in Iran in form of four five-year programs, and the Iranian community has the following features in this landscape:

- Developed in accordance with the cultural, geographical, and historical context of the country and based on the principles of morality and Islamic values with an emphasis on religious morality
- Possessing knowledge in the production of science and technology
- Establishing security through a comprehensive deterrent defense
- Having health, well-being, food security, social security, equal opportunities, adequate income distribution, and so on
- Active, responsible, sacrificial and faithful with conscientious, cooperative, and so on
- Achieving the first economic, scientific, and technology rank in the Western Asia region (including Central Asia, the Caucasus, the Middle East and neighboring countries) with an emphasis on the software movement
- Effective in the Islamic world by consolidating the pattern of religious democracy
- Constructive and effective interaction with the world based on self-esteem and wisdom and expediency

According to this vision, as stated above, Iran should rank the first in the region at the mentioned time, and today the best way to reduce the power of a country is to create economic wars and dependencies.

In these conditions, the Supreme Leader of the Islamic Revolution of Iran proposes the idea of resistive economy as a plan and a solution to these threats to achieve the long-term goals mentioned in Vision 2025.

The main purpose of naming years in Iran is to attract people's attention to a particular value or the problems of the present society. A glimpse over this naming makes the importance of economics, especially after 1999, become clearer. This implies that the importance of economy is recognized as a process that influences culture, values, education, technology evolution, social structure, economic structure, legislative systems, as well as geography and natural benefits.

In general, one can state that resistance economy is an attempt to reduce pressure leverages, with the aim of providing dynamic growth and improving indicators of economic resistance and achieving the goals of a twenty-year vision with a jihadi approach. In the communiqué of the Supreme Leader to the heads of powers, the main axes of general policies are the activation of the financial, human, and scientific capitals of the country, the national system of innovation and the growth of productivity or strengthening the factors of production, the empowerment of the workforce, strengthening the competitiveness of the economy. Moreover, this communiqué states considering fair share for factors in production chain up to consumption in proportion to their role in creating value and consumption management with an emphasis on implementation of general policies for reforming consumption pattern, and promoting consumption of domestic goods along with planning to

promote quality and competitiveness in the production. Furthermore, this communiqué includes all-inclusive reforming and reinforcement of the country's financial system with the aim of meeting the needs of the national economy, stabilizing the national economy, pioneering in strengthening the real sector, saving the country's public expenditures by emphasizing the preservation and development of oil and gas production capacities, especially in common areas. In addition this communiqué states saving public expenditures by emphasizing the fundamental transformation in structures, rationalizing the size of government and eliminating parallel and unnecessary costs, reforming the government's revenue system by increasing the share of tax revenues, clarifying the economy and making it more sophisticated, and preventing corrupt practices and activities in monetary, commercial, and currency. Furthermore, it entails making distribution and pricing system transparent and updating of market surveillance practices, increase of standard coverage for all domestic products, and promotion of them as the general policies (Institute for Preserving and Publishing Works by Ayatollah Khamenei).

In fact, the resistance economy is the fundamental solution for Iran's economic problems. This issue is expressed in the Supreme Leader's statements as well. In the meeting on the elaboration of the policies of Resistive economy in the presence of a group of officials he said, "The collection of resistive economy policies is, in fact, a native and scientific pattern derived from our revolutionary and Islamic culture, in line with our present and tomorrow's situation. I will describe that it is not about the current

situation and the current state of the country but a long-term strategy for the economy of the country." (Office of Preservation and Publication of the Works of Ayatollah Khamenei, 2013)

This strategy, which the Supreme Leader states in his statement is, in fact, an economic rehabilitation that can be done through both strengthening the national economy and strengthening the urban economy through increased utility and cost savings, which ultimately results in a city that is as efficient as possible.

Much literature has been expressed in various areas of resistive economy, but little of this has dealt with the importance of cities and the rehabilitation of cities in the resistive economy. In his statements, in the presence of the officials of the country, the leader of the revolution states that, "I call on the authorities to take the resistive economy seriously. In resistive economy, the dependency is on domestic production and strengthening the domestic base of economy. The economic boom is achieved with production, and activating the internal capacities of the country, not with anything else" (Ayatollah Khamenei's Office of Publication, 2014).

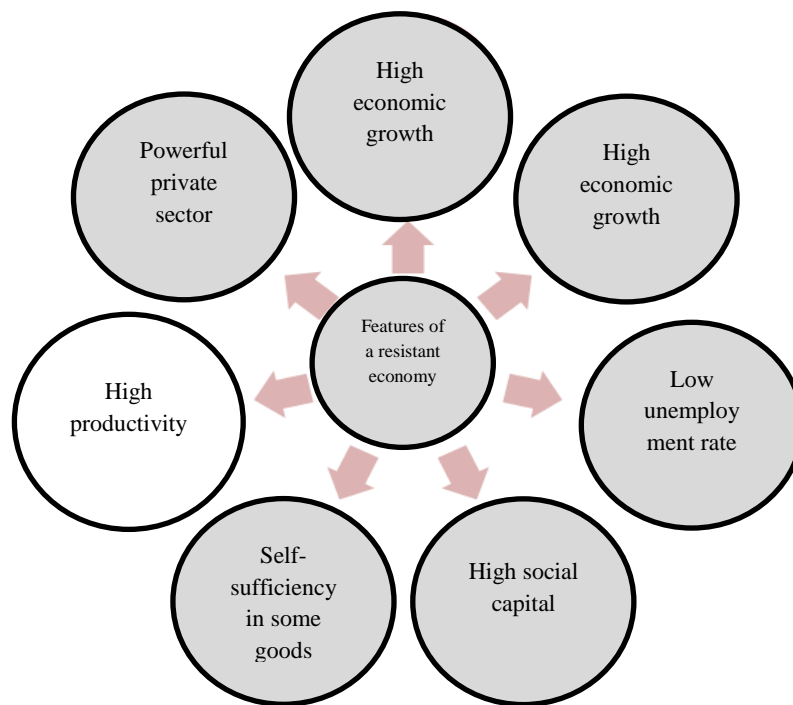
Nevertheless, where does production happen? Should this production not be investigated in the dimensions of a city? In fact, urban economy deals with our national economy; so to achieve development in the urban economy, we must stick to resistive economy. In solving Iran's economic problems in a crowd of workers across the country, the leader of the revolution says, "We need to find the solution to the country's economic problems within the country, and the backbone is production" (Khamenei's Office

of Publication, 2015). Resistance economy is not just in Iran, but also in other literature with other titles such as economic resilience. Resilience in the economy is also the reaction of society to existing tensions; in fact, it is a way to reduce the losses caused by these tensions.

The theory of resistance economy depicts an economy that has the ability to deal with the shocks imposed on the economy. Such an economy should have flexibly and repelling the effects of crisis and shock, and prepare buffers to deal with

the crisis. On the other hand, resistive economy means strengthening the economy by addressing weaknesses and improving strengths. For example, if an economy suffers from low productivity, it should look for policies to improve the productivity index.

Resilient economy is an economy that is in a good condition in some indices. An economy with high economic growth has high export share and good variety of goods, is self-sufficient in strategic goods, has low unemployment, high social capital, high productivity, and so on.



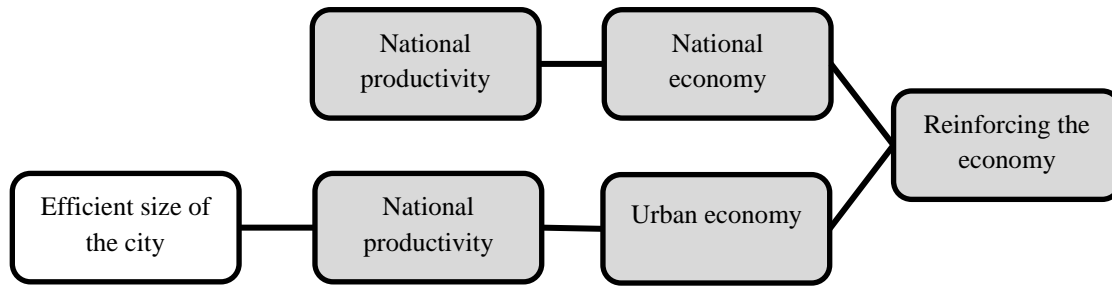
**Fig1. Characteristics of Resistance economy**

One of the most important characteristics that Iran's economy is suffering from is the productivity of the economy. Productivity at the level of the urban economy means a proper utilization of the benefits of agglomeration (local and urban). In fact, a

city that can create a good balance between the benefits of agglomeration and the effects of congestion is recognized as an efficient city. An increase in population, on the one hand, creates savings for the city known as Jacobian and Marshall-Arrow-Romer (MAR)

externalities in the literature. On the other hand, negative externalities and the effects of congestion, such as pollution, traffic, and so on are due to increasing population. The level of the population, which leads to the

maximum net cost savings, is known as the efficiency of the city and will be accompanied by the resistance of the urban economy.



**Fig2. Status of optimal size of city in rehabilitation**

Apart from the national and Islamic roots of a resistance economy, this concept has roots in the literature of economics as well as international economy: for example, economic resilience, economic vulnerability, economic anti-fragility, economic solidarity, economic deterrence, and so on.

The most extensive literature is related to economic resilience, which is presented in various disciplines of science, including engineering for various systems. One of the most extensive literatures is economic resilience, which is presented in various disciplines of science, including engineering for various systems. Resilience is well known in the fields of natural sciences and engineering, as well as management of urban crises, and the organization of the debate. However, the issue of national resilience has gained importance for the elite of this field in recent years, especially after the financial crisis of 2008 (Research Center of Islamic Consultative Assembly, 2014).

#### 4- Research Method

To estimate the city's optimal size, it is necessary to estimate the surplus function. To estimate the surplus function, the function of the city's benefits and expenditures are separately identified and estimated. The justification of the function of the total benefits and the total cost of the city is in accordance with the Mizutani (2015) and Yarmohammadian et al, (2014) model.

$$\ln\left(\frac{TB_{it}}{P_{it}}\right) = \beta_0 + \beta_1 \ln(Tr_{1it}) + \beta_2 \ln(N_{it}) + u_{it}$$

Where  $\frac{TB_{it}}{P_{it}}$  represents the real city benefits, or in other words the city's value added,  $Tr_{1it}$  and  $Tr_{2it}$ , are the variables for controlling the urban transport status and  $N_{it}$  is the city population. For urban transport control variables, two indicators of the number of individual trips per person and the number of bus lines in metropolitan areas have been used. The  $i$  and  $t$  indices represent the  $i$ -th city and  $t$ -th time. In this



equation,  $u_{it}$  is an error component which has an average of zero, fixed standard deviation, and normal distribution.

In addition, the function of the whole city according to the city's economic model is dependent on the level of prices, rental prices of housing, the level of utility in the city, the population and the tax rate (Yarmohammadian et al., 2014). For simplicity, two hypotheses are made: first, the level of satisfaction is the same in all studied cities; otherwise, it is not possible to estimate the total cost equation. This assumption is, of course, true in the long run, since, according to the Indifference Principle in an economy where intra-urban migration is feasible, living satisfaction in all cities is equal to each other. Another hypothesis is related to the tax rate. The tax rate is assumed to be the same in all studied cities, which is not a far-fetched assumption, since in Iran the value added tax rate and the direct tax rates are the same throughout the country. With these interpretations, the total cost regression equation is specified as follows:

$$\ln(TC_{it}) = \alpha_0 + \alpha_1 \ln(P_{it}) + \alpha_2 \ln(Pm_{it}) + \alpha_3 \ln(En_{it}) + \alpha_{14} \ln(N_{it}) + u_{it}$$

Where  $TC$ ,  $P$ ,  $Pm$ ,  $En$  and  $N$  represent the total expenditure in the city, the general level of prices, the rental rate of housing, the number of polluted days in the city and the city population respectively. Similarly, with the generalized regression equation,  $i$  and  $t$  represent the  $i$ -th city and  $t$ -th time. For total expenditure variable in the city, the total budget function of the municipalities of the cities studied has been used and polluted days in the city are based on the AQI index for the threshold above 200.

After estimating the function of the city's benefits and costs, the surplus function is obtained. In order to determine the size of the city, in terms of efficiency, the city must maximize the surplus function relative to the urban population, and the optimal population,  $N^*$ , which maximizes the net profit of the city.

$$TW = \text{EXP}[\beta_0 + \beta_1 \ln(Ti_{it}) + \beta_2 \ln(Tr_{2_{it}}) + \beta_3 \ln(N_{it}) - \text{EXP}[\alpha_0 + \alpha_1 \ln(P_{it}) + \alpha_2 \ln(Pm_{it}) + \alpha_3 \ln(En_{it}) + \alpha_4 \ln(N_{it})]]$$

Since the size of the city is of interest, the surplus function must be maximized relative to the urban population; therefore, the first condition of the problem, maximization, or in other words the condition of the city's size, is:

$$\text{EXP}[\beta_0 + \beta_1 \ln(Ti_{it}) + \beta_2 \ln(Tr_{2_{it}}) + \beta_3 \ln(N_{it})] \frac{\beta_3}{N_{it}} - \text{EXP}[\alpha_0 + \alpha_1 \ln(P_{it}) + \alpha_2 \ln(Pm_{it}) + \alpha_3 \ln(En_{it}) + \alpha_4 \ln(N_{it})] \frac{\alpha_4}{N_{it}} = 0$$

Moreover, the city's optimal size is equal to:

$$N^* = \text{EXP} \left\{ \frac{1}{\alpha_4 - \beta_3} [\beta_0 - \alpha_0 + \ln(\beta_3) - \ln(\alpha_4) + H_1 - H_2] \right\}$$

$$H_1 = \beta_1 \ln(Ti_{it}) + \beta_2 \ln(Tr_{2_{it}})$$

$$H_2 = \alpha_1 \ln(P_{it}) + \alpha_2 \ln(Pm_{it}) + \alpha_3 \ln(En_{it})$$

The city's optimal size is the amount of population obtained from a central planner through maximization of the surplus function. Basically, the optimal in the economy is the situation with the highest efficiency. Here too, the maximum efficiency is taken into account with the final cost of equality of final benefits, where the surplus function has reached its peak. In an efficient situation, the benefits brought by the last person to the city are equal to the costs imposed and if more people enter the city, the charges imposed on the city will be more than the benefits created. Nevertheless, this is not

necessarily the case, because immigrants still have enough motivation to enter the city. The motivation to enter the city is by immigrant people until there is a surplus-positive  $TW > 0$  or, in other words, the average city's benefits are greater than its average costs  $\frac{TB}{N} > \frac{TC}{N}$ . When the average benefits are equal to the average costs, the private incentive to enter the city is eliminated, as the city's population increases, resulting in the loss of the interests of all individuals, including those entering the city. The situation where the surplus function becomes zero ( $TW = 0$ ) and the private incentive to enter the city are considered to be stable and its population is called the sustainable city size  $\bar{N}$ ; therefore, the condition of the sustainable city size is:

$$\begin{aligned} & \text{EXP}[\beta_0 + \beta_1 \ln(T\bar{r}_i) + \beta_2 \ln(T\bar{r}_u) + \beta_3 \ln(N_{it})] \\ & = \text{EXP}[\alpha_0 + \alpha_1 \ln(P_{it}) + \alpha_2 \ln(Pm_{it}) + \alpha_3 \ln(En_{it}) + \alpha_4 \ln(N_{it})] \end{aligned}$$

In addition, the sustainable population of the city is equal to:

$$\bar{N} = \text{EXP} \left\{ \frac{1}{\alpha_4 - \beta_3} [\beta_0 - \alpha_0 + H_1 - H_2] \right\}$$

The data collection for model variables is difficult to accomplish, because most of the data in Statistical Center of Iran and other sources of information are aggregated for an area such as the province or at the lowest level for the city, while the variables used in this article is specifically related to the city. Another reason is the lack of heterogeneity among the urban statistical yearbook; in other words, metropolitan municipalities with a metropolitan statistical yearbook do not use the same structure and classification for information provision. For example, it is sometimes seen that in some years there is no urban transportation season or those with a season of urban transportation

have completely different indicators.

However, data collection has been extracted from the information sources of Statistical Center of Iran, Central Bank, and Metropolitan Urban Planners and Metropolitan Bulletins in Isfahan Municipality. For example, for the general level variable of prices and rental rates, the index of commodity prices and urban utilities used by the regional center and the index of housing prices in the urban areas of Iran, which is published by the Statistics Center of Iran, has been used. For urban population variable, data from the census years of 2006 and 2011, and for the middle years, existing estimates have been used.

The total city benefits are calculated using the city's value added estimate, with the average ratio of urban population to province and national provincial accounts published by Statistical Center of Iran.

For variables  $Tr_1$  and  $Tr_2$ , which are modeled as urban transport status control variables, the variables "number of daily trips by one person" and "number of bus lines in metropolitan areas" in one year from the city statistics have been used. For  $En$  variable, the number of unhealthy and worse days in the studied cities is based on the air quality index (AQI). The reason for using this variable is that this indicator shows the condition of air pollution in the city after the production of public goods as discussed in the model. This variable is also extracted from the urban statistics that are published separately for each of the metropolitan areas studied.

It should be noted that the study period has been determined due to statistical constraints from 2008 to 2012. In addition,

statistical constraints have caused the metropolitan areas be limited to the cities of Isfahan, Ahvaz, Tehran, Shiraz and Mashhad, since only urban statistics were available for these cities.

## 5- Results

For the estimation, first the regression equation for the total city interest and then the total cost equation were estimated separately. Eviews 7 software is used to estimate. After estimating the two equations, the function is extracted. The estimated results are presented in Table 1.

**Table1. Results of estimation of research model**

Urban interest equation		Urban cost equation	
Variable	Coefficient value (probability value)	Variable	Coefficient value (probability value)
Fixed coefficient	24.53 (0.000)	Fixed coefficient	22.52 (0.000)
First transport control variable	-0.62 (0.001)	Price index variable	1.05 0.000
Second transport control variable	1.5 (0.000)	Variable of Housing Ratio Index	-0.82 (0.000)
Urban population variable	1.06 (0.127)	Pollution variable	0.63 (0.011)
-	-	Urban population variable	0.74 (0.000)

The results of the estimation of the first equation in the first two columns and the results of the estimation of the second equation are placed in the second two columns. As it can be seen, the coefficients are given in order of variables, and the probability value of each coefficient is given in parentheses.

The value of probability expresses the significance of the coefficients, the lower the probability, the greater significance level of the coefficients is. If the probability value is less than 5%, the confidence coefficient of 95% can be considered as significant estimation coefficients. As can be seen, the significance level for all coefficients other than the population is 0.00. Therefore, it can be said that the coefficients are significant at a high level of certainty. For the urban

population variable, the estimated coefficient is significant at 85% confidence level, since the level of significance level has been less than 0.12. For the total cost function, the results also show that all coefficients were significant at 95% confidence level.

A review of some of the fittest strengths and the significance of the entire regression are presented in Table 2. As can be seen, the coefficient of determination is 94% and the value of the F statistic to test the hypothesis that all coefficients are insignificant, which indicates that H0 is rejected.

The determination coefficient, which indicates the explanatory power, is 62%, and the significance level of the F statistic, which tests the significance of all coefficients, is equal to 0.00, which indicates the rejection H0 that the coefficients are insignificant.

**Table2. Some statistics related to estimated equations**

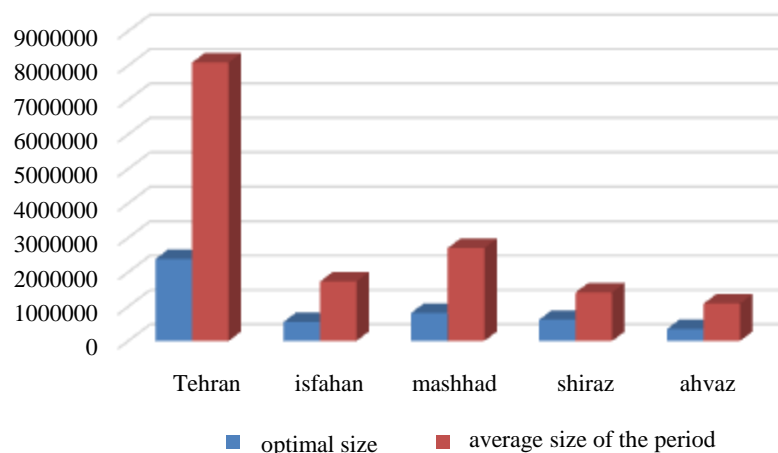
Some statistics related to urban interests		Some statistics related to urban costs	
The coefficient of determination	0.94	The coefficient of determination	0.62
F statistics	113	F statistics	8
Significance level of F statistics	0.000	Significance level of F statistics	0.000

After estimating the coefficients, it is possible to determine the optimal size of city and sustainable size of city by using two relationships between city size and sustainable size for the studied period.

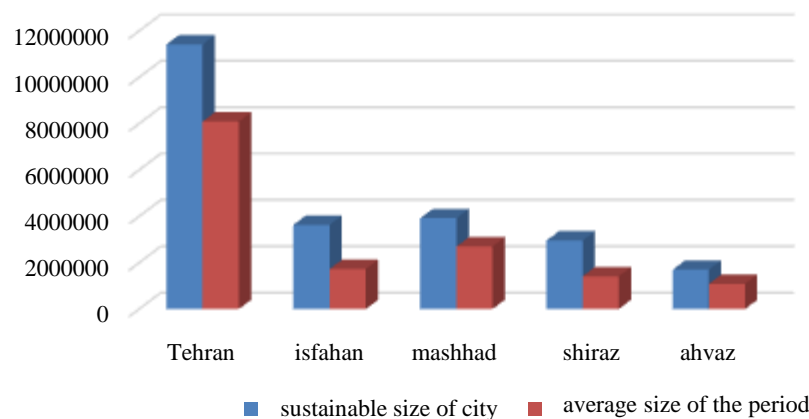
In order to obtain the optimal size and sustainable size of the cities studied, the relevant relationships are then used, then the average values are taken so that each city receives an optimal and sustainable amount. The optimal size for five metropolises of Tehran, Isfahan, Mashhad, Shiraz and Ahvaz has been equal to 2.385, 549, 818, 616 and 354 thousand people respectively. As it is seen in Fig 1, all studied cities are of less than the average size of the study period. In other words, for all of these metropolises,

the ultimate interests of a person's entry are less than its final cost, and there is no optimal condition for any of the cities.

The sustainable size for metropolises of Tehran, Isfahan, Mashhad, Shiraz and Ahvaz is 11.417, 3.628, 3.920, 2.952, and 1.696 thousand people, respectively. In Figure 2, the status of the sustainable size and the average size of the period are shown side by side. Contrary to Fig. 1, which is less than actual size, in this figure, the sustainable size for all metropolises is greater than the average size of the period studied. In other words, all metropolises are far away from the point where the average benefits of the city are less than the average cost of a city.



**Fig1. Optimal and average size of the period**



**Fig2. Sustainable and average size of the period**

Another method of analyzing the optimal and sustainable size of the studied cities is by measuring the size of the actual size to the size of the optimal size, as well as the size of the actual size to sustainable size. These ratios indicate the population status of the studied cities relative to the optimal and sustainable level. For example, for the first ratio, if this ratio is less than one, it means that the population of cities is less than optimal level, and if these ratios are more than one, it means that the size is less than actual size or, in other words, the population of cities has passed from optimal level. For a true-to-sustainable ratio, the same is true, if this ratio is more than one unit, it means that the population of cities is lower than the sustainable level, and if it is, less than one that means that the actual size of cities is greater than the sustainable level. It is expected that the proportion of actual size as sustainable for the studied cities is less than unit because

if a city has crossed the sustainable state of the population, it means that the average net benefits for the inhabitants are negative. In addition, the status of the quality of life of the residents in terms of income status is inappropriate. However, the distance between each of these indicators makes it possible to evaluate and compare metropolises together.

The actual-size ratio to optimal size for all cities studied is more than one unit, but the largest number belongs to Tehran (3.4), followed by Mashhad and Isfahan cities with a ratio of 3.3 and 1.3 respectively.

The actual size ratio to sustainable size is for all cities is less than one unit, and the closest city to sustainable size is Tehran, which is 30% distant from its sustainable size, and then the cities of Mashhad and Ahwaz are in the next ranks, which 32 and 36 percent are distant from their sustainable size respectively.

**Table3. The ratio of actual size to optimal and sustainable size**

Metropolis	The ratio of actual size to optimal size	The ratio of actual size to sustainable size
Tehran	3.4	0.7
Isfahan	3.1	0.47
Mashhad	3.3	0.68
Shiraz	2.3	0.48
Ahvaz	۳	0.64

## 6- Conclusion and Discussion

One of the characteristics of resistant economy is high productivity and economic growth through increased productivity. Major economic factors are operating in cities and the growth of urbanization in developing countries is more than the developed countries in the transition period of the urbanization of these countries. On the other hand, the location of economic factors according to the Marshall Consolidation (1890) theory affects their productivity and efficiency.

In line with the theory of the optimal size of the city, one can imagine a population that has final benefits equal to the final cost of any resident in the metropolitan area. In this situation, efficiency is maximized, and the optimum situation is considered central to the scheduler.

Since living in cities is associated with external influences, the existence of these external influences leads to the emergence of a gap between private interests and social interests; therefore, market forces in cities create a tendency for a private residence in the city, which tends to be in conflict with the interests of society and social planning inclinations. Consequently, the level of equilibrium that occurs in cities usually occurs at a higher population level than the efficient and optimal situation. However, one can imagine a situation in which the average net benefits are negatively or, in

other words, everyone is losing out of the city, so that the negative externalities are equal or greater than the private benefits that individuals obtain from living in the city. This threshold is defined as the sustainable size.

The results showed that all cities studied had their optimal status, so that the ratio of actual size as efficient as Tehran, Isfahan, Mashhad, Shiraz and Ahvaz metropolises was equal to 3.4, 3.1, 3.3, 2.3, and 3. In addition, none of the studied cities has reached their sustainable level, so that the proportions of the actual size to sustainable size for these metropolitan areas are in order of 0.7, 0.47, 0.68, 0.48, and 0.64. The nearest cities to sustainable size are Tehran, Mashhad and Ahwaz, respectively.

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