The Assessment of Turkey's Exposure and Susceptibility to Disasters and Hazards with IDB Indicator System

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ABSTRACT

The aim of this study is to determine the exposure and sensitivity of our country against the increasing natural, technological and man-made disasters with the help of index system and to reveal the deficiencies and competencies in this subject.

The study was prepared with a semi-numerical method and the scope of the study was all provinces of our country. The data covers the period of 2015, 2016, 2017 and their averages. The ESI (Exposure and Susceptibility Index) consists of 8 sub-factors and the index value is between 0 and 1. Classification of index values was done according to international standards as follows; between 0-0.20 as low, between 0.20-0.40 as medium, between 0.40-0.80 as high and between 0.80-1.00 as very high.

In the results of the study; in terms of exposure and sensitivity, 14.82% of Turkey provinces were in high, 81.47% were in the middle category and 3.70% were in the low category. It is noteworthy that among the provinces in the high category, large cities such as İstanbul (0.58), Adana (0.44), İzmir (0.42), Gaziantep (0.41) and Şanlıurfa (0.40) took place. In the international arena, the calculation is made out of 20 countries that Turkey has the lowest 10th countries. In addition, Turkey's ES Index value is below the average compared to the general average of the countries.

Accordingly, it is necessary to make investments and studies on irregular population growth, population density, poor population rates, agriculture and distribution of continuous products for our provinces with high ESI value.

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INTRODUCTION

Exposure in disaster management is the infrastructure, housing, production capacities and other material human assets of people in hazardous areas. In addition, exposure measures may include the number of people or types of assets in a region (UNDRR, 2017). In addition, exposure is the way in which a vulnerable recipient receives contact with a phenomenon generated by the risk source, and the exposure rate is included in the hazard index and vulnerability calculations (Marzocchi et al., 2009: 8).

Susceptibility is defined as social vulnerability, sensitivity and predisposition (AFAD, 2009), while the degree to which a system or species is affected negatively or positively according to changing conditions (IPCC, 2014).

In addition, susceptibility covers more institutional, economic and social aspects, starting with physical impacts on risk factors that are defined as potential structural fragility. Therefore, any damage occurring is considered a prerequisite for structural and economic sensitivity, while institutional sensitivity and social aspects provide a framework for vulnerability in general (Fuchs, 2009: 338).

In addition, exposure, susceptibility, sensitivity, resilience and adaptation can be included in the concept of vulnerability (Birkmann, 2006: 18). Accordingly, exposure and susceptibility can be defined as the vulnerability level of assets such as human, infrastructure, housing and production capacities in vulnerable areas.

Vulnerability and exposure are dynamic. In other words, it differs in temporal and spatial scales and is based on economic, social, geographical, demographic, cultural, institutional, governance and environmental factors (Cardona et al., 2012: 67).

Assessment of vulnerability and exposure ranges from global to local participatory approaches that need to be integrated using appropriate platforms. The suitability of the method used for these assessments depends on the purpose of the analysis, time and geographical scale, available resources, number of actors, type and economic management aspects (UNDRR, 2016: 8).

In order for disaster hazards to pose a risk, endangered assets must be vulnerable. Risk factors for environmental and natural phenomena can be defined as a function of the probability of occurrence of a particular event and the extent of harm to human, environment and objects (Marzocchi et al., 2009: 8).

Many cities are located in areas where multiple hazard risks are growing rapidly. For example, in the Asia-Pacific region, the population in over-risk regions in 2015-2030 is expected to increase by more than 50% in 26 provinces and by 35-50% in 72 provinces. As a result, it is inevitable that the number of inhabitants exposed to excessive and high risks will increase significantly. In addition, urban growth takes place on vulnerable terrain, along river banks, on drainage channels and on steep slopes exposed to hazards (ESCAP, 2017: 6).

As the GDP (Gross Domestic Product) of the regions and cities increases, the damage rates increase in part. The reason for this is that more physical assets are at risk as GDP increases. Proportionally, the ratio of disaster damage to GDP increased from 0.17% in the 1970s to 0.40% in 2016 (ESCAP, 2017: 7).

According to recent research, when the demographic characteristics of the regions are taken into consideration, increasing socio-economic exposure to natural hazards constitutes the main risk factor. Trends in economic risks are increasing for almost all sub-regions and all hazards. According to the growth rate, disaster losses have increased 16 times since 1980, while GDP per capita has increased 13 times in the same period. In addition, most of the biggest losses occur in middle-income countries and developing economies (as Turkey, Thailand, and India) (ESCAP, 2012).

IDB (Index-Data-Base) Indicator System

This method was originally developed by Omar Dario CARDONA and his team at the National University of Colombia (IDEA) in 1990 for the Inter-American Development Bank (IDB). In addition, this method has been accepted by the United Nations University as a risk analysis method against disasters.

This method is used in a series of indicators to compare countries at different periods (eg: from 1980 to 2000) to make cross-national and international comparisons in a systematic and quantitative manner. Each index is empirically measurable and is a number of variables associated with it. The selection of the variables is carried out by considering a number of factors.

These factors are; country coverage, data robustness, the relationship between the indicators to be measured with fact or phenomenon and quality. The four components or composite indicators reflect the key components that represent vulnerability and illustrate the progress of different countries in risk management. These components are; Disaster Deficit Index (DDI), Local Disaster Index (LDI), Prevalent Vulnerability Index (PVI) and Risk Management Index (RMI) (Cardona, 2006: 2).

The main purpose of the indicator program is explained according to the Institute of Environmental Studies as;

The main objective of the "Indicators Program" was to establish an indicator or index system that

identifies disaster risk in different countries in a comparative manner and allows the identification of key factors that contribute to the structuring of risk in each of them. The model is based on readily available and reasonably robust variables that allow for a coarse data test analysis on an appropriate scale for national decision-making. However, other comparisons at other sub-national levels have been examined, such as country regions, city regions and towns. The resulting risk profile not only highlights comparative risk levels between disaster-prone regions or units, but also factors that need to be considered to reduce this risk.

The system of vulnerabilities and risk indicators is multi-sectoral and multi-focused, given the relative possibilities of a society's inability to absorb impact and recover from a range of hazardous events. Each index model is "indicative" and should not appear to be exhaustive or conclusive. The system of indicators is therefore useful for informing decision makers in priority areas.

There is a clear need for detailed risk assessments and profiles for action and resource allocation, but mainly for planning at national and sub-national levels. (IDEA, 2005).

The Exposure and Susceptibility Index (ESI) ranges from 0 to 1. A value between 0.80 and 1.00 means very high sensitivity, a value between 0.40 and 0.80 means high, a value between 0.20 to 0.40 means medium value and values less than 0.20 means low sensitivity.

In the new phase of the Indicators Program, the Exposure and Susceptibility Index (ESI) for the countries currently assessed should be recalculated for all periods due to the values of various databases that were unknown, currently available or modified as a result of revisions. After the previous assessment of the index, new assessments are made for new results. In this old assessment, changes can be made to the maximum and minimum reference values to standardize the values of the sub-indicators for the old and newly assessed countries (IDB, 2011: 20).

Exposure and Susceptibility Indicators

In the case of exposure and/or physical susceptibility, the indicators that best perform this function are those that reflect the vulnerable population, assets, investments, production, livelihoods, core assets and human activities (Lavell, 2003: 7). It is important to have data from the most vulnerable segments, such as poor populations, infrastructure and insecure settlements, fragile products, unbalanced business resources. Those reflecting growth rates and population, agricultural or urban concentration are also considered indicators of this species. Table 1. presents a group of variables defined as general indicators of physical exposure at a city center scale.

These variables provide an idea of the context of the direct physical effect. "Exposure and Susceptibility" is a necessary but not sufficient condition to be a risk. It is possible to determine whether exposure is related to any viable threat by acknowledging that certain variables constitute a basis at national level. Assuming that natural threats are present, the relatively negative case characterizations exist as a permanent external factor (Carreño et al., 2005: 41).

Table 1. Exposure and Susceptibility Indicators

Indicator	Explanation
ESI1. Annual Average Growth Rate of Population	In general, the growth of the population means more people who can occupy areas that are exposed to hazards or those affected by the occurrence of hazardous events.
ESI2. Annual Growth Rate of Urban Population	A rapid process of urbanization, with migration from rural areas to the city or displaced persons, means urban environmental problems, difficulty in providing services, insecure housing and occupation of disaster-prone areas.
ESI3. Population density (people/5 km^2)	Increasing density of the population supports the impact of common human settlements, particularly in marginal areas overlapping areas with greater risk due to floods and landslides.
ESI4. Poor population with daily income less than $ 1	The lowest-income population groups are often the most affected when risk occurs. They cannot afford safe places in urban areas and lose their livelihoods repeatedly in rural areas.
ESI5. Capital stock: in millions US dollar per thousand square kilometers	The assets of both the public and the private sectors constitute the physical elements that emerge as infrastructure, buildings, content and investment that may be directly affected by the dangerous events.
ESI6. Imports and exports of goods and services as a percent of GDP (%)	These are economic transactions that represent the volume of commercial activities, agricultural sector, industry and services and represent the relationships and economic flows that may be affected by disasters.
ESI7. Gross domestic fixed investment as a percentage of GDP (%)	It represents capital expenditures by the government, investments in assets increasing capital stock, and thus the volume and value of items that may be affected.
ESI8. Ratio of Agricultural Land and Permanent Products to Total Land (%)	It is sensitive to the effects of certain events such as permanent crops and arable land, floods, landslides or volcanic eruptions, or represents livelihoods for vulnerable populations.

Reference: Martha Liliana Carreño, Omar Dario Cardona and Alex H. Barbat, "Sistema de indicadores para la evaluación de riesgos", Inter-American Development Bank, 2005, Barcelona, p. 43.

MATERIALS AND METHODS

The study is a semi-quantitative study, and the index calculation method is used by weighting from a series of sub-indicators. The study covers 2015-2017 periods and it was applied to all provinces of Turkey. ESI consists of 8 sub-factors and the index value is between 0 and 1. Classification of index values according to international standards is made as the following: 0-0.20 low, 0.20-0.40 medium, 0.40-0.80 high and 0.80-1.00 very high.

For Exposure and Susceptibility Index;

1- Annual Average Growth Rate of Population
2- Annual Growth Rate of Urban Population (%)
3- Population Density (people/5 km2)
4- Poor population with daily income less than $ 1
5- Capital stock: in millions US dollar per thousand square kilometers
6- Imports and exports of goods and services as a percent of GDP (%)
7- Gross domestic fixed investment as a percentage of GDP (%)
8- Ratio of Agricultural Land and Permanent Products to Total Land (%) are sub-factors.

Table 2. Exposure and Susceptibility Index Weights

Indicators	Index Weights
ESI1. Annual Average Growth Rate of Population	5
ESI2. Annual Growth Rate of Urban Population	12.4
ESI3. Population density (people/5 km^2)	9
ESI4. Poor population with daily income less than $ 1	25.4
ESI5. Capital stock: in millions US dollar per thousand square kilometers	12.3
ESI6. Imports and exports of goods and services as a percent of GDP (%)	11.7
ESI7. Gross domestic fixed investment as a percentage of GDP (%)	12.4
ESI8. Ratio of Agricultural Land and Permanent Products to Total Land (%)	11.8

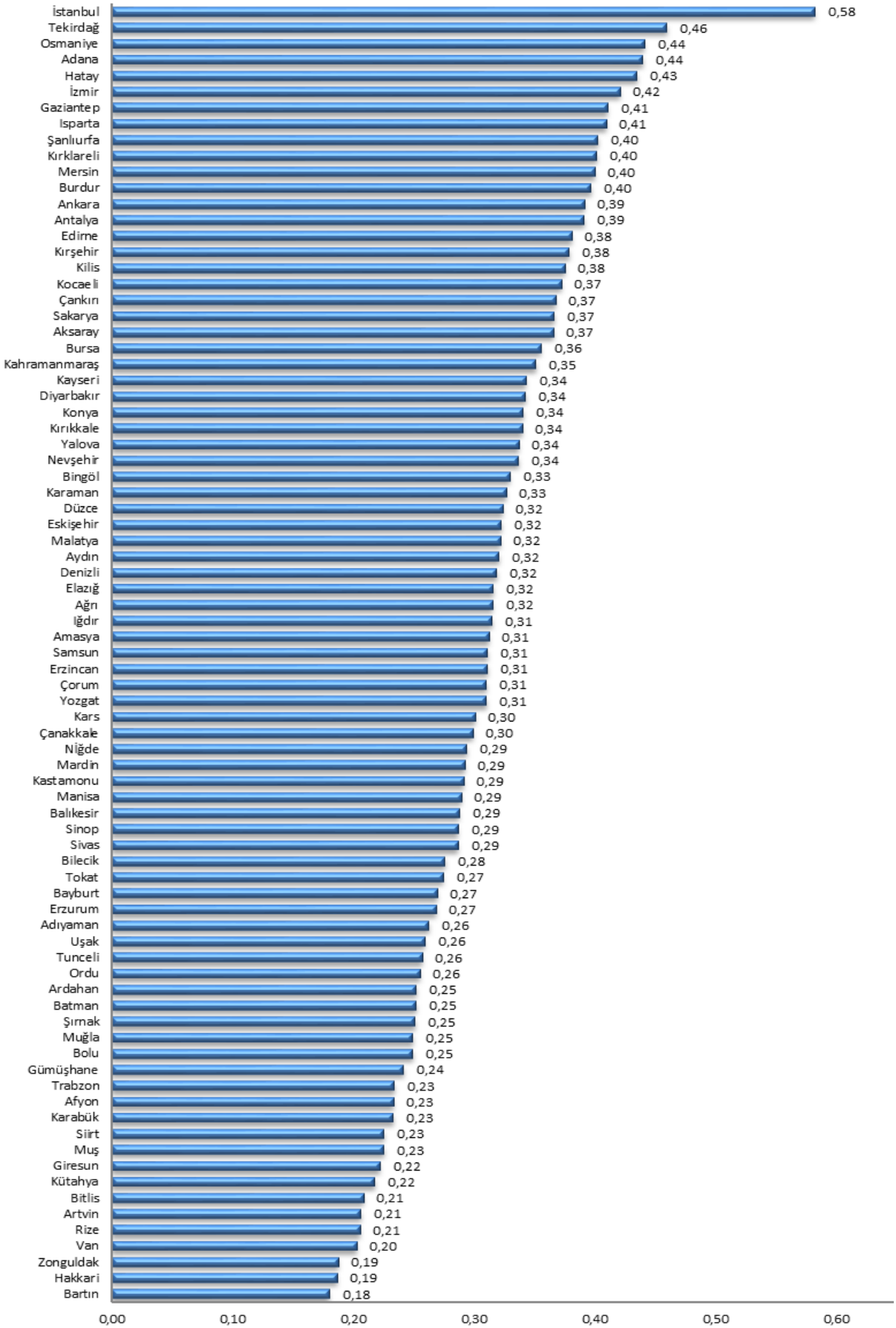
RESULTS

The findings of the study were presented in the form of tables, graphs, maps and interpretations.

Table 3. Provinces Exposure and Susceptibility Index Indicators for the Period 2015-2017

Provinces	2015	2016	2017	Mean	Provinces	2015	2016	2017	Mean
Adana	0.34	0.50	0.48	**0.44**	Konya	0.33	0.34	0.36	**0.34**
Adıyaman	0.25	0.26	0.28	**0.26**	Kütahya	0.19	0.22	0.24	**0.22**
Afyon	0.19	0.24	0.26	**0.23**	Malatya	0.27	0.32	0.38	**0.32**
Ağrı	0.36	0.28	0.31	**0.32**	Manisa	0.26	0.29	0.31	**0.29**
Amasya	0.32	0.29	0.33	**0.31**	Kahramanmaraş	0.34	0.35	0.36	**0.35**
Ankara	0.38	0.38	0.41	**0.39**	Mardin	0.29	0.28	0.31	**0.29**
Antalya	0.39	0.38	0.41	**0.39**	Muğla	0.22	0.25	0.27	**0.25**
Artvin	0.18	0.21	0.23	**0.21**	Muş	0.10	0.27	0.30	**0.23**
Aydın	0.30	0.31	0.36	**0.32**	Nevşehir	0.28	0.36	0.37	**0.34**
Balıkesir	0.31	0.26	0.29	**0.29**	Niğde	0.25	0.32	0.32	**0.29**
Bilecik	0.25	0.27	0.31	**0.28**	Ordu	0.27	0.24	0.25	**0.26**
Bingöl	0.24	0.30	0.45	**0.33**	Rize	0.20	0.19	0.22	**0.21**
Bitlis	0.10	0.25	0.28	**0.21**	Sakarya	0.34	0.35	0.40	**0.37**
Bolu	0.26	0.23	0.25	**0.25**	Samsun	0.31	0.29	0.33	**0.31**
Burdur	0.37	0.40	0.42	**0.40**	Siirt	0.21	0.23	0.23	**0.23**
Bursa	0.34	0.36	0.36	**0.36**	Sinop	0.29	0.27	0.30	**0.29**
Çanakkale	0.31	0.27	0.32	**0.30**	Sivas	0.30	0.27	0.29	**0.29**
Çankırı	0.34	0.38	0.38	**0.37**	Tekirdağ	0.37	0.50	0.51	**0.46**
Çorum	0.32	0.29	0.32	**0.31**	Tokat	0.28	0.26	0.29	**0.27**
Denizli	0.31	0.31	0.34	**0.32**	Trabzon	0.23	0.23	0.24	**0.23**
Diyarbakır	0.35	0.32	0.35	**0.34**	Tunceli	0.19	0.26	0.32	**0.26**
Edirne	0.29	0.42	0.44	**0.38**	Şanlıurfa	0.42	0.38	0.41	**0.40**
Elazığ	0.27	0.32	0.36	**0.32**	Uşak	0.22	0.27	0.29	**0.26**
Erzincan	0.37	0.26	0.29	**0.31**	Van	0.09	0.25	0.27	**0.20**
Erzurum	0.25	0.26	0.30	**0.27**	Yozgat	0.32	0.29	0.31	**0.31**
Eskişehir	0.31	0.32	0.34	**0.32**	Zonguldak	0.21	0.16	0.19	**0.19**
Gaziantep	0.41	0.41	0.41	**0.41**	Aksaray	0.31	0.39	0.40	**0.37**
Giresun	0.23	0.21	0.22	**0.22**	Bayburt	0.36	0.25	0.20	**0.27**
Gümüşhane	0.30	0.21	0.21	**0.24**	Karaman	0.31	0.32	0.35	**0.33**
Hakkâri	0.06	0.22	0.28	**0.19**	Kırıkkale	0.29	0.36	0.37	**0.34**
Hatay	0.43	0.43	0.44	**0.43**	Batman	0.25	0.24	0.26	**0.25**
Isparta	0.41	0.40	0.42	**0.41**	Şırnak	0.22	0.25	0.29	**0.25**
Mersin	0.31	0.43	0.46	**0.40**	Bartın	0.20	0.16	0.18	**0.18**
İstanbul	0.58	0.57	0.59	**0.58**	Ardahan	0.31	0.21	0.24	**0.25**
İzmir	0.41	0.41	0.45	**0.42**	Iğdır	0.35	0.27	0.32	**0.31**
Kars	0.33	0.25	0.33	**0.30**	Yalova	0.34	0.31	0.36	**0.34**
Kastamonu	0.31	0.27	0.29	**0.29**	Karabük	0.27	0.20	0.24	**0.23**
Kayseri	0.36	0.33	0.34	**0.34**	Kilis	0.31	0.46	0.36	**0.38**
Kırklareli	0.33	0.45	0.43	**0.40**	Osmaniye	0.37	0.46	0.49	**0.44**
Kırşehir	0.34	0.39	0.40	**0.38**	Düzce	0.32	0.30	0.35	**0.32**
Kocaeli	0.37	0.35	0.40	**0.37**	**General Mean**	**0.29**	**0.31**	**0.33**	**0.31**

According to Table 3, when we examine the 2015-2017 period, the provinces with the highest index value for 2015 were İstanbul (0.58), Hatay (0.43) and Şanlınurfa (0.42) for 2016 İstanbul (0.57), Adana (0.50), Tekirdağ (0.50), Kilis (0.46) and Osmaniye (0.46), for 2017 İstanbul (0.59), Tekirdağ (0.51) and Osmaniye (0.49) respectively.



Graph 1. Provinces Exposure and Susceptibility Index Indicators for 2015-2017 period

According to Graph 1, when the average index values for 2015-2017 were analyzed, the index values of İstanbul, Tekirdağ, Osmaniye, Adana, Hatay, İzmir, Gaziantep, Isparta, Şanlıurfa, Kırklareli, Mersin and Burdur were in the high category, respectively. Besides, only Zonguldak, Hakkâri and Bartın provinces were in the low category. The remaining 66 provinces were in the middle index category. Therefore, 14.82% of the provinces were high, 81.47% were in the middle category while 3.70% were in the low category in terms of exposure and sensitivity.

Table 4. 2015-2017 Period Exposure and Susceptibility Classification of Exposure and Susceptibility Index Averages of Provinces of Turkey

Exposure and Susceptibility Index	Provinces
≤0.10	-
0.11-0.20	Bartın (0.18), Hakkâri (0.19), Zonguldak (0.19)
0.21-0.30	Artvin (0.21), Bitlis (0.21), Rize (0.21), Giresun (0.22), Kütahya (0.22), Afyon (0.23), Muş (0.23), Siirt (0.23), Trabzon (0.23), Karabük (0.23), Gümüşhane (0.24), Bolu (0.25), Muğla (0.25), Batman (0.25), Şırnak (0.25), Ardahan (0.25), Adıyaman (0.26), Ordu (0.26), Tunceli (0.26), Uşak (0.26), Erzurum (0.27), Tokat (0.27), Bayburt (0.27), Bilecik (0.28), Balıkesir (0.29), Kastamonu (0.29), Manisa (0.29), Mardin (0.29), Niğde (0.29), Sinop (0.29), Sivas (0.29), Çanakkale (0.30), Kars (0.30)
0.31-0.40	Amasya (0.31), Çorum (0.31), Erzincan (0.31), Samsun (0.31), Yozgat (0.31), Iğdır (0.31), Ağrı (0.32), Aydın (0.32), Denizli (0.32), Elazığ (0.32), Eskişehir (0.32), Malatya (0.32), Düzce (0.32), Bingöl (0.33), Karaman (0.33), Diyarbakır (0.34), Kayseri (0.34), Konya (0.34), Nevşehir (0.34), Kırıkkale (0.34), Yalova (0.34), Kahramanmaraş (0.35), Bursa (0.36), Çankırı (0.37), Kocaeli (0.37), Sakarya (0.37), Aksaray (0.37), Edirne (0.38), Kırşehir (0.38), Kilis (0.38), Ankara (0.39), Antalya (0.39), Burdur (0.40), Mersin (0.40), Kırklareli (0.40), Şanlıurfa (0.40)
0.41-0.49	Gaziantep (0.41), Isparta (0.41), İzmir (0.42), Hatay (0.43), Adana (0.44), Osmaniye (0.44), Tekirdağ (0.46)
≥0.50	İstanbul (0.58)

According to Table 4, there were no provinces with an index value less than 0.10, while there was only İstanbul which was more than 0.50. The majority of our provinces were concentrated in the range of 0.21-0.30 and 0.31-0.40.

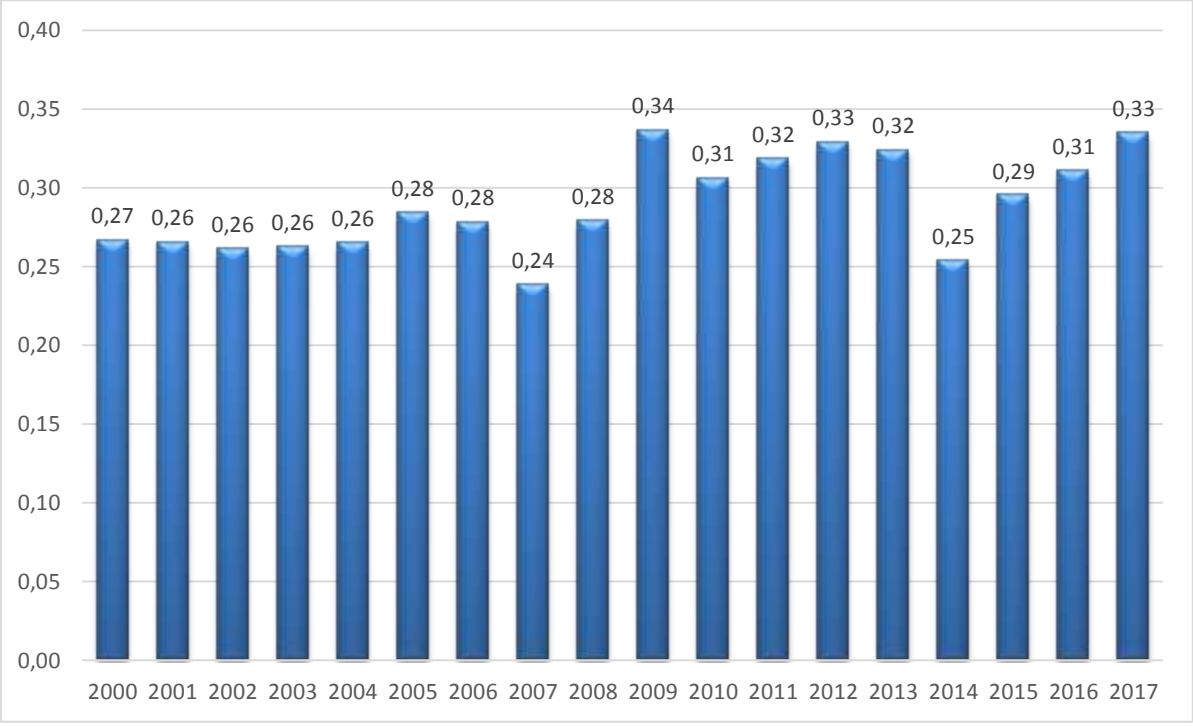
Figure 1. Exposure and Susceptibility Index for 2015-2017 Period

Exposure and Sensitivity Indicators are factors that negatively affect vulnerability. Because the indicators that make up this sub-index consist of data such as the average annual growth rate of the population, the annual growth rate of the urban population, population density, capital stock, daily income of the poor population less than $ 1, and the gross investment rate of fixed investments. For example, due to rapid urbanization, the increase in the annual growth rate of the urban population leads to the emergence of problems such as increased environmental problems, difficulty in providing services and unsafe housing. In addition, the increase in capital stock also means the increase in the value of goods and values to be damaged in case of disasters. Furthermore, the population whose daily income is less than $ 1 is more affected by the risks that may occur and they have difficulty in becoming safe again.

In the period 2015-2017, while the provinces of Istanbul, Hatay, Gaziantep and Sanliurfa were brown and red again, the color tone of Izmir, Isparta, Osmaniye, Adana, Mersin, Kirklareli and Tekirdag provinces changed from medium level yellow color to high level brown color. The reason for this may be considered as the change in the urban population structure as a result of the migrant movement consisting of Syria, which is the neighboring country to the provinces close to the Syrian border (Figure 1).

Table 5. Change of Average Exposure and Susceptibility Index for Period 2000-2017 for the General of Turkey

Years	General Index Value
2000	0.27
2001	0.26
2002	0.26
2003	0.26
2004	0.26
2005	0.28
2006	0.28
2007	0.24
2008	0.28
2009	0.34
2010	0.31
2011	0.32
2012	0.33
2013	0.32
2014	0.25
2015	0.29
2016	0.31
2017	0.33
Mean	**0.31**



Graph 2. Change of Average Exposure and Susceptibility Index for Period 2000-2017 for the General of Turkey by Years

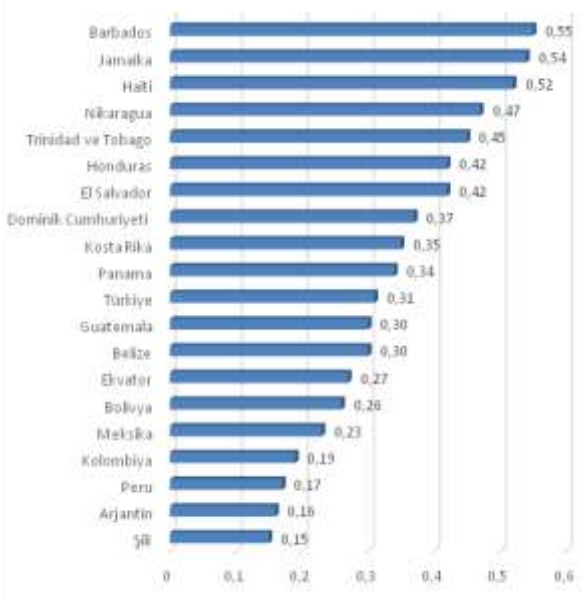
According to Graph 2. Turkey's Exposure and Susceptibility Index showed a sudden rise in 2009 while was partially stable until the year 2009. Even though it showed a partial decline afterwards, it entered an upward trend after 2014 and reached an index value of 0.33, which was a medium category.

Moreover, when we look at the whole time period, there was generally an upward trend.

Table 6. ES Index Values of Some Countries

Country	ES Index Values
Argentina	0.16
Barbados	0.55
Belize	0.30
Bolivia	0.26
Dominican Republic	0.37
Equator	0.27
El Salvador	0.42
Guatemala	0.30
Haiti	0.52
Honduras	0.42
Jamaica	0.54
Colombia	0.19
Costa Rica	0.35
Mexico	0.23
Nicaragua	0.47
Panama	0.34
Peru	0.17
Chile	0.15
Trinidad and Tobago	0.45
Turkey	0.31
Mean	**0.34**

The index value of 19 countries has been calculated by IDB (Inter American Development Bank). With this study, the number of calculated countries has increased to 20.



Graph 3. Countries' Ranking by ES Index Values

According to Graph 3 ranking in the ES Index Turkey has become the 10th country among the lowest indexed 20 countries. Besides, it was seen that the ES Index value of our country was below the general index average of the other countries. However, this value was in the middle category in terms of index value.

However, if the index calculations of more countries can be made, especially in developed countries such as European countries, international comparisons and evaluations can be made more accurately.

DISCUSSION

Although there are various studies in the literature on exposure and susceptibility to disasters, exposure and susceptibility factors are generally presented within the scope of risk and vulnerability concepts. In this context:

Davidson and Shah (1997) conducted a study on the City Earthquake Disaster Risk Index. The Earthquake Disaster Risk Index in the study is a composite index that provides a direct comparison of the relative general earthquake disaster risk of cities in the world and explains the relative contribution of various factors to this overall risk. This index provides a systematic way to directly compare general earthquake disaster risk in a large number of cities or regions. Furthermore, this comprehensive index shows that even in low-seismic urban areas, there may be an earthquake and other characteristics of the city can turn a single event into a major disaster and can be used to track trends in earthquake risk over time.

Mabel C. Marulanda, Omar Darío Cardona and Alex H. Barbat conducted a study on the social and economic impacts of minor disasters in 2008. The study aimed to present a new revision of the Local Disaster Index under the Disaster Risk Management Indicators Program in the United States. Disasters that rarely enter international and national disasters databases but constitute a cumulative problem for local areas were discussed here.

Fuchs (2009) conducted a study of the paradigms of susceptibility and vulnerability to mountain hazards in Austria. Here, the issues that determine structural, economic, institutional and social sensitivity to the mountain hazards in Austria were discussed.

Cardona et al. (2012) evaluated and explained exposure and vulnerability factors, which were the most important factors for risk, in their studies on risk determinants. Here, a conceptual framework had been presented in detail by considering factors such as disaster risks, danger, exposure and vulnerability.

The study, prepared by Pedcris M. Orencio and Masahiko Fujii (2013), proposed an index for a disaster-resistant coastal community at the local level

to reduce and mitigate natural disasters caused by climate change, whose impacts were more common in the coastal areas of the Philippines. According to the study, for a disaster-resistant coastal community in terms of its components and criteria, the composite index represents the outcome indicators at the local level. Therefore, it was emphasized that the index could be used by local governments as a tool to reduce disaster risk and facilitate its management.

In the study prepared by Sena et al. (2017), the indicators affecting the health risks of drought in Brazil were investigated. Accordingly, efforts to understand the risk and response capacities of local communities emerge as a means of developing hazards, exposures and vulnerabilities.

In 2017, Kintziger et al. conducted a technical study on the health-related exposure and intervention functions of meteorological events. As a result of this study, it was revealed that developing strong exposure and response functions and retrospective analysis would provide a strong basis for planned adaptation activities.

It was also calculated for 19 of the South American countries for the calculation of the Exposure and Sensitivity Indices of the countries in general and regionally.

According to the index study prepared for Argentina; while Argentina's ESI value was 0.16, Turkey’s ESI (0.31) was seen to be higher than the indices of Argentina. In addition, in the study prepared for Argentina, no calculation was made on provincial or regional basis.

According to the index study for Bahamas, a country in the Caribbean; ES index value was 0.35 for the year 2007 and was higher than the value of Turkey (0.31).

According to the index study for Barbados, a Latin American country the nationwide ES index value was 0.55 and higher than that of Turkey.

According to the index study for Belize in 2011; the overall ES index value of the country (0.30) was lower than our country's value.

According to the index study prepared for Bolivia; the ES index value of the country (0.26) was lower than Turkey (0.31).

According to the index study prepared for Chile in 2015, the ES index value for the country in the last period was 0.16, which was much lower than our country's value.

According to a study prepared for Costa Rica, the ES index value was 0.35 which was higher than Turkey's index value (0.31).

According to the study prepared for Ecuador, the country ES index value was 0.27, lower than our country's index value.

According to a study conducted in 2004 for Jamaica, ES index value for the year 2000 was 0.56, considerably higher than that of Turkey.

The index study prepared for Colombia in 2005, the value of ES index was 0.23, which was lower than the index value of Turkey.

According to the index study prepared for Mexico, the ES index value of the country was calculated as 0.22, less than our country's index value.

The index study conducted for Nicaragua in 2015, the countrywide ES index value was 0.28, lower than our country's index value.

According to the index study conducted for Panama the country-wide ES index value was 0.34, higher than Turkey's ES index value (0.31).

According to a study conducted for Peru in 2015 the ES index value was 0.19, quite low than Turkey’s index value (0.31).

In the study prepared for the Dominican Republic in 2010; for the period 1991-2000 the ES index value was 0.37, higher than the index value of Turkey.

The index study prepared for the Republic of Suriname, a South American country in 2018; the ES index value of the country was 0.22, lower than the index value of Turkey.

According to a study prepared in 2010 for Trinidad and Tobago, a country in the Caribbean; the ES index value of the country for the period 1996-2000 was 0.45, this value was calculated quite high than Turkey's index value (0.31).

CONCLUSIONS

According to the results, it was noteworthy that there were socially and economically developed provinces such as İstanbul, Adana, İzmir, Gaziantep and Şanlıurfa among the ten provinces with the highest ESI values. Among the ten provinces with the lowest index value, in addition to Eastern Region and Southeastern Region provinces such as Hakkâri, Van, Bitlis and Muş, there were also the Black Sea Region provinces such as Bartın, Zonguldak, Rize, Artvin and Giresun.

When the sub-indicators of provinces with low index values were examined; in particular, the population density, capital stock, goods and services, the ratio of imports and exports to the GNP, the ratio of fixed investments to the GNP and the ratio of agricultural land and permanent products to the total land was quite low.

It is seen that especially our metropolitan cities are weaker against hazards and disasters because exposure and Sensitivity represent being open to disasters and dangers.

In addition, considering that it is accepted as a type of biological disaster in epidemic diseases, more exposure of provinces such as Istanbul, Izmir and Gaziantep to this disease is parallel with high index values against today's pandemic.

For this reason, it is important to make the necessary investments and practices in these provinces to avoid possible hazards and disasters with less damage.

In the mid-value category average of Turkey in the international arena and calculating the index value according to the average of the countries where it is seen below, but close.

However, considering the socio-economic development levels of these countries, it is seen that the index value of our country should be at a better level.

In the international arena, the calculation is made out of 20 countries that Turkey has the lowest 7 countries. In addition, our country's Resilience Deficiency Index value is below the average compared to the general average of the countries. However, our country is in a high category in terms of index value. Therefore resilience aspect, Turkey is conspicuous that in general there is a lack.

Ethical Approval

Since there was no issue related to ethical principles in the study, no certificate of ethical compliance was obtained.

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