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Evaluation of socio-economic fragility index against disasters: Example Turkey provinces

Afetlere karşı sosyo-ekonomik kırılabilirlik endeksinin değerlendirilmesi: Türkiye illeri örneği

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ABSTRACT

Objective: SFI (Socio-Economic Fragility Index) is represented by indicators of poverty, human insecurity, addiction, illiteracy, social inequality, unemployment, inflation, dependency, debt and environmental degradation. This index reflects the relative weaknesses or deterioration conditions that exacerbate the direct effects caused by disasters or hazardous events. **Methods:** The study is a semi-quantitative study and the index calculation method is used by weighting from a number of sub-indicators. The study covers the period of 2015-2017. Turkey has been applied to all provinces. **Results:** When the index averages of the provinces were examined for the 2015-2017 period, the first four provinces with the highest index value were Şırnak, Batman, Siirt and Mardin. In addition, no province was included in the low index category while 26 provinces were in the high category. The remaining 55 provinces were in the middle level. Accordingly, 32% of our provinces were in the high index category, while 68% were in the middle index category. **Conclusion:** It is observed that provinces with high SFI values are generally concentrated in the East and Southeast regions. Additionally it is remarkable that provinces with high index values generally have problems such as unemployment, income inequality, dependence on agricultural growth, deprivation of basic health facilities and under-5 malnutrition. The studies to be carried out in the recommended areas for the provinces will help to reduce the socio-economic vulnerability of the provinces against disasters.

Keywords: Disaster, risk, vulnerability, socio-economic fragility

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ÖZ

Amaç: SEKE (Sosyo-Ekonomik Kırılganlık Endeksi) yoksulluk, insan güvensizliği, bağımlılık, eğitimsizlik, sosyal eşitsizlik, işsizlik, enflasyon, bağımlılık, borç ve çevresel bozulma göstergeleri ile temsil edilmektedir. Bu Endeks, afetlerin veya tehlikeli olayların neden olduğu doğrudan etkileri daha da kötüleştiren göreceli zayıflıkları veya bozulma koşullarını yansıtmaktadır. **Yöntem:** Çalışma yarı kantitatif bir çalışmadır ve endeks hesaplama yöntemi bir dizi alt göstergeden ağırlıklandırılarak kullanılmaktadır. Çalışma 2015-2017 dönemlerini kapsamaktadır ve Türkiye'nin tüm illerine uygulanmıştır. **Bulgular:** 2015-2017 döneminde illerin endeks ortalamaları incelendiğinde, endeks değeri en yüksek ilk dört il Şırnak, Batman, Siirt ve Mardin'dir. Buna ek olarak, 26 il yüksek kategoride iken, düşük endeks kategorisine hiçbir il dahil edilmemiştir. Kalan 55 il orta düzeydeydi. Buna göre illerimizin% 32'si yüksek endeks kategorisinde, %68'i orta endeks kategorisindeydi. **Sonuç:** SEKE değeri yüksek olan illerin genel olarak Doğu ve Güneydoğu bölgesinde yoğunlaştığı görülmektedir. Ayrıca endeks değeri yüksek olan illerde genellikle işsizlik, gelir eşitsizliği, tarımsal büyümeye bağımlılık, temel sağlık imkânlarından yoksun olma ve 5-yaş altı yetersiz beslenme gibi sorunlar olduğu dikkat çekicidir. İller için önerilen alanlarda yapılacak çalışmalar, illerin afetlere karşı sosyo-ekonomik savunmasızlığının azaltılmasına yardımcı olacaktır.

Anahtar Kelimeler: Afet, risk, savunmasızlık, sosyo-ekonomik kırılganlık

Introduction

Disasters have lasting effects on people, communities and socio-economic development. Ensuring economic preparation enables governments to respond quickly to disasters and minimize secondary impacts on the economy¹. Fragility is defined as a combination of risk exposure and insufficient coping capacity of the state, system and / or communities to manage, absorb or mitigate these risks. Fragility can lead to negative consequences such as violence, disintegration of institutions, displacement, humanitarian crises or other emergencies².

In the last 40 years, the urban population in low-income and fragile countries has increased by 326%³. It is estimated that continued population growth and urbanization will add 2.5 million people to the urban population by 2050⁴. Factors such as population growth, urbanization, economic vulnerability and climate change are the main factors of the interactive growing vulnerability model⁵.

Socio-economic sensitivities in risky and unplanned settlements and economic fragility of the threatened area can lead to major losses and chain damages in the event of a disaster. This will adversely affect the recovery and restructuring processes⁶. Approximately 1.5 billion people in 40 countries live in contexts by persistent fragility and marked fragility⁷.

According to the World Bank's independent assessment report, although significant achievements have been made to reduce disaster fragilities (such as housing, evacuation, monitoring and warning systems), country sensitivities generally deteriorate socially and economically. In the light of experiences, local fragilities and the importance of preventing these fragilities emerge as much as emergency response to disasters⁸. In addition, natural disasters are linked to human capacity to respond. In other words, in a fragile context with weakened state structures and social systems, meeting the needs of those affected will be insufficient⁹.

It is widely accepted that the concept of fragility is multidimensional and universal. The OECD bases its fragility framework on five dimensions of fragility (economic, environmental, political, social and security).

Socio-Economic Fragility, measures the conditions of individuals and households for safe, flexible livelihoods and welfare.

Fragility has two important dimensions: economic and social. Of these dimensions, the main supporters of the first components of economic fragility are: *Education*: It is a measure measured by the average duration of education and the expected duration of education for adults aged 25 years and older².

Men in the workforce: It is a measure of the male labor force participation rate.

Regulatory quality: Measures perceptions of government's ability to formulate and implement sound policies and regulations that support private sector development.

Distance: The trade weighted average distance to world markets¹⁰.

Food safety: Food safety measures include the prevalence of malnutrition, average nutritional supply adequacy, local food price index and inflation in local food prices¹¹.

Fragility can vary and be typical for subregions and cities rather than a term that describes an entire country. For example, some fragile states can be very powerful in some respects or in some regions¹². Morgan Stanley's long-term economic fragility report issued under the public fiscal sustainability and sovereign credit notes (2013) described Brazil, India, Indonesia, South Africa and Turkey as "fragile five". In this characterization, parameters such as high current account deficit, fragility of high inflation rates, low foreign reserves per total external debt and high volatility in domestic currencies have been evaluated¹³.

IDB (Index-Data-Base) Indicator 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.

Material and Methods

The study is a semi-quantitative study, and the index calculation method is used by weighting from a series of sub-indicators. Semi-quantitative techniques express risk in terms of risk indexes, where numerical values are usually between 0 and 1. In numerical methods, risks are expressed in numerical terms (For example; average annual loss, possible maximum loss (1400 TL every 100 years, etc.)). Semi-quantitative approaches consider the factors that have an effect on risk as a number. The arrangement and a range of scores for each factor can be used to determine the extent of the negative or positive factor to the occurrence of instability (danger) and damage or losses (consequences). The reasons for using this method in this study;

- This method is a first screening process to identify hazards and risks,
- The risk level does not have any pre-acceptance and time confirmed,
- It is possible to list as limited availability of numerical data (In general, data in data sources are given proportionally).

In addition, the indexing method considers the factors that have an impact on risk as a number. The arrangement and a range of scores for each factor are used to determine the breadth of the negative or positive factor and to obtain the ranking of the risk value, to the occurrence of instability (danger) and damage or losses (consequences).

In addition, the semi-numerical indexing method approach is adaptable to cover large areas (spatial or GIS-based). Of course there will always be a dilemma of adapting the point system of each particular region in any situation and place.

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 phenomenon or fact 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) ¹⁴. The Socio-Economic Fragility factor is within the scope of PVI. Socio-Economic Fragility is represented

by indicators of poverty, human insecurity, addiction, illiteracy, social inequality, unemployment, inflation, dependency, debt and environmental degradation. Indices reflecting relative weaknesses or deterioration conditions that worsen the direct effects caused by dangerous events^{15,16}. Although these effects have no direct contribution and may be considered indirect or related in some cases, their effects are particularly important at economic and social level¹⁷.

Table 1. defines a group of variables defined as general indices of socio-economic fragility at the national level.

Table 1. Socio-Economic Fragility Index Indicators

Indicator	Description
SF1. Human Poverty Index, HPI-1	Human insecurity and conditions that do not have access to basic services reflect a greater fragility to any threat. People in extreme poverty are most severely affected by disasters.
SF2. Proportional dependence of working age population	The ratio of elderly and children to the population who can work represents a segment that is often disadvantageous to face extreme crisis situations such as disasters.
SF3. Social inequality, income intensity measured using the Gini Index	The concentration of income at a lower percentage of the population, despite economic growth, represents a situation that reduces "prosperity" and quality of life for the majority of the population . The absence of social welfare and human development means lack of security against threats.
SF4. Ratio of unemployed to total labor force (%)	Non-employment is an additional economic disadvantage for the population, as the lack of income means reduced capacity in access to resources and means of protection.
SF5. Annual inflation of food prices (%)	The loss of purchasing power is an economic disadvantage that reflects economic problems that have a macro impact on society's response, which means an additional reduction in the population's capacity to access resources.
SF6. Dependence of agriculture on GDP growth (%)	The dependence of the economic growth of the agricultural sector generally reflects the impact on society through the impact of agricultural production as a result of repetitive events caused by climate variability and global environmental change.
SF7. Debt service burden as a percent of GDP (%)	High indebtedness, means that the debt needs to be increased, including a low margin of its own resources and recovery after a disaster. If there are restrictions on assuming new obligations, the debt may become unsustainable and there is a possibility that it will not recover.
SF8. Soil degradation resulting from human activities (GLASOD) (%)	Anthropically induced soil degradation reflects the level of environmental degradation and insufficient use of natural resources. This deterioration makes it difficult to produce threats of socio-natural origin and reduce extreme events.

Reference¹⁸

It is seen that the concept of Socio-Economic Fragility is defined with different and less number of sub-factors in the literature. However, when researches and studies on socio-economic vulnerability are examined, it is seen that the most comprehensive set of sub-factors that will represent the highest level of vulnerability to threats are these 8-sub-factors used by the American Development Bank. In other words, these variables usually sensitively capture a negative and internal predisposition of society before dangerous events act, regardless of the nature and severity of the events.

Therefore, this 8-sub-factor sequence was used in the study to better determine the fragility level and sensitivity. In addition, the 8-sub-factor Socio-Economic Fragility Index method is accepted as a risk analysis method by the Tokyo-based United Nations University.

The study covers 2015-2017 periods. It was applied to all provinces of Turkey. SF Index consists of 8 sub-factors and the index value is between 0 and 1. Classification of index values according to international standards is as the following: 0-0.20 low, 0.21-0.40 medium, 0.41-0.80 high and 0.81-1.00 very high.

The data used in the study, Turkey Statistical Institute (TÜİK) data from the open-access site has been obtained from the relevant governmental agencies and related reports some studies. Source details of the sub-factors are given in Table 2. The sub-indices and all index conversions used in the study were calculated by the authors using the necessary formulations with the help of the Excel program. For the Human Poverty Index, "Average Life Time", one of the sub-indices, was calculated by the author on a provincial basis, using TÜİK data.

The second sub-index "Percentage of the Non Read and Write Population" was obtained from TÜİK data on a provincial basis. One

of the three sub-indices of the third sub-index, "Percentage of People Without Healthy Drinking Water" was calculated using raw data obtained from TÜİK.

Technical and formulation information on the Human Poverty Index (HPI) was obtained from the study titled "Human Development Reports" published by the United Nations. The Human Poverty Index (HPI) is derived from the arithmetic mean of the Average Life Time (HPI₁), the Percentage of the Illiterate Population (HPI₂) and the HPI₃ sub-indices. The HPI₁ here reflects the percentage of the population less than 40 years old for developing countries and less than 60 years old for developed countries. Since our country belongs to the category of developing countries, the percentage of the population less than 40 years old is used in this study. In addition, the HPI₃ sub-index was calculated using the weighted averages method from the sub-indices Percentage of Population Deprived of Basic Health Facilities (HPI₃₁), Percentage of Population Without Healthy Drinking Water (HPI₃₂) and Percentage of Population Undernourished under 5-year-old (HPI₃₃) (Formulation Table 2).

The Gini Index, which is one of the sub-indices, was obtained readily from the TÜİK open access database. Soil Degradation Due to Human Activities (GLASOD) was obtained from the official activity reports of the General Directorate of Forestry and TÜİK crop and product statistics. Finally, the general SFI values were calculated using the 8-sub factor weighted average method.

In the weight values of the sub-factors used in the study calculations, the index weights common to all countries from the studies prepared by the American Development Bank (IDB) for other countries were taken as basis.

Table 2. Indicator Data of Socio-Economic Fragility Index and Index Weights

Indicator (SF _i)	References	Index Weights (a _i)	*Formulations
SF1. Human Poverty Index, HPI-1	TÜİK ^{19,21} , MEB ²² , Ministry of Health ²³ , UNICEF ²⁴ , Avşar Kurnaz (2009) ²⁵	20.9	$HPI_3 = (HPI_{31} + HPI_{32} + HPI_{33}) \div 3$
SF2. Dependents as a proportion of the working age population	TÜİK ²⁶ , İŞKUR ^{27,28,29}	8.5	-
SF3. Social inequality, income intensity measured using the Gini Index	TÜİK ³⁰ , DİE ³¹ , Filiztekin ve Çelik (2010) ³²	16.4	-
SF4. Unemployed as percent of the total labor force (%)	TÜİK ²⁰	12.5	-
SF5. Annual inflation of food prices (%)	TÜİK ³³	9.4	-
SF6. Share of agriculture in total GDP growth (%)	TÜİK ³⁶	9.6	-
SF7. Debt service burden as a percent of GDP (%)	T. C. Ministry of Treasury and Finance ³⁴ , TÜİK ¹⁹	9.6	-
SF8. Soil degradation resulting from human activities (GLASOD) (%)	General Directorate of Forest ³⁵ , TÜİK ³⁶	13	-
SFI			

* $Q=3$, $w_i=1\div 3$, ($w_1+w_2+w_{3=1}$, $Q\geq 1$)

Strength and Limitations of the Study

The indices obtained in the study reveal the weaknesses or strengths of the provinces against various risks, dangers and disasters. In addition, these indices are important in that they provide a comparison between provinces or regions. In addition, the periodically calculated indices allow us to compare according to the period. Besides this, this study is a first study prepared by the IDB Indicator System in Turkey and is therefore an important contribution to the literature. On the other hand, the necessity of obtaining the data used in the study from different sources and the difficulties in obtaining it

appear as a limitation. In addition, while the data of some sub-indexes are not readily available in a resource, they had to be calculated separately by the authors. In addition, in terms of the method, the values in the range of 0-1 used in the study do not directly express the expected losses. They are only relative indicators of risk, and in this case risk is expressed with relative sensitivity.

Results

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

Table 3. Provinces Socio-Economic Fragility Index Indicators for 2015-2017.

Provinces	2015	2016	2017	Mean	Provinces	2015	2016	2017	Mean
Adana	0.46	0.53	0.50	0.50	Konya	0.42	0.34	0.48	0.42
Adıyaman	0.38	0.34	0.44	0.39	Kütahya	0.35	0.28	0.30	0.31
Afyon	0.37	0.30	0.34	0.34	Malatya	0.34	0.32	0.35	0.34
Ağrı	0.44	0.47	0.43	0.45	Manisa	0.33	0.28	0.28	0.30
Amasya	0.23	0.22	0.30	0.25	Kahramanmaraş	0.55	0.44	0.49	0.50
Ankara	0.39	0.39	0.37	0.38	Mardin	0.60	0.62	0.64	0.62

Antalya	0.30	0.28	0.31	0.30	Muğla	0.30	0.28	0.28	0.29
Artvin	0.23	0.29	0.28	0.27	Muş	0.43	0.51	0.65	0.53
Aydın	0.31	0.29	0.29	0.30	Nevşehir	0.27	0.34	0.33	0.31
Balıkesir	0.35	0.35	0.31	0.34	Niğde	0.31	0.37	0.36	0.35
Bilecik	0.34	0.30	0.33	0.32	Ordu	0.22	0.30	0.31	0.28
Bingöl	0.47	0.42	0.41	0.43	Rize	0.23	0.30	0.29	0.27
Bitlis	0.41	0.51	0.65	0.53	Sakarya	0.34	0.25	0.33	0.31
Bolu	0.30	0.27	0.32	0.30	Samsun	0.34	0.30	0.36	0.33
Burdur	0.37	0.34	0.36	0.36	Siirt	0.60	0.67	0.63	0.63
Bursa	0.36	0.31	0.33	0.33	Sinop	0.26	0.33	0.32	0.30
Çanakkale	0.35	0.36	0.30	0.34	Sivas	0.42	0.46	0.44	0.44
Çankırı	0.25	0.33	0.26	0.28	Tekirdağ	0.26	0.32	0.33	0.30
Çorum	0.26	0.23	0.32	0.27	Tokat	0.34	0.29	0.33	0.32
Denizli	0.33	0.30	0.30	0.31	Trabzon	0.23	0.31	0.31	0.29
Diyarbakır	0.65	0.55	0.59	0.60	Tunceli	0.41	0.33	0.34	0.36
Edirne	0.22	0.27	0.32	0.27	Şanlıurfa	0.66	0.57	0.55	0.59
Elazığ	0.33	0.31	0.34	0.33	Uşak	0.35	0.28	0.28	0.30
Erzincan	0.35	0.30	0.38	0.34	Van	0.44	0.53	0.64	0.54
Erzurum	0.38	0.33	0.39	0.37	Yozgat	0.42	0.43	0.48	0.44
Eskişehir	0.35	0.29	0.28	0.31	Zonguldak	0.27	0.36	0.39	0.34
Gaziantep	0.40	0.35	0.42	0.39	Aksaray	0.31	0.38	0.36	0.35
Giresun	0.21	0.28	0.29	0.26	Bayburt	0.35	0.30	0.34	0.33
Gümüşhane	0.28	0.34	0.41	0.34	Karaman	0.42	0.32	0.39	0.38
Hakkâri	0.50	0.60	0.77	0.62	Kırıkkale	0.27	0.34	0.32	0.31
Hatay	0.41	0.36	0.45	0.41	Batman	0.64	0.63	0.63	0.64
Isparta	0.39	0.37	0.38	0.38	Şırnak	0.75	0.70	0.72	0.72
Mersin	0.44	0.47	0.44	0.45	Bartın	0.26	0.38	0.33	0.32
İstanbul	0.43	0.42	0.46	0.44	Ardahan	0.39	0.48	0.44	0.44
İzmir	0.45	0.41	0.45	0.44	Iğdır	0.41	0.43	0.40	0.41
Kars	0.42	0.42	0.49	0.44	Yalova	0.40	0.29	0.33	0.34
Kastamonu	0.25	0.37	0.27	0.30	Karabük	0.27	0.37	0.37	0.34
Kayseri	0.42	0.52	0.49	0.48	Kilis	0.38	0.34	0.41	0.38
Kırklareli	0.21	0.27	0.30	0.26	Osmaniye	0.50	0.43	0.49	0.47
Kırşehir	0.17	0.27	0.32	0.26	Düzce	0.32	0.25	0.35	0.31
Kocaeli	0.36	0.30	0.39	0.35	General Mean	0.37	0.37	0.40	0.38

When the 2015-2017 period is analyzed, according to the Socio-Economic Fragility Index values, Şırnak (0.75), Şanlıurfa (0.66) and Diyarbakır (0.65) provinces reached the highest index values for 2015, Şırnak (0.70) and Siirt (0.67) and Batman (0.63) provinces reached the highest index values

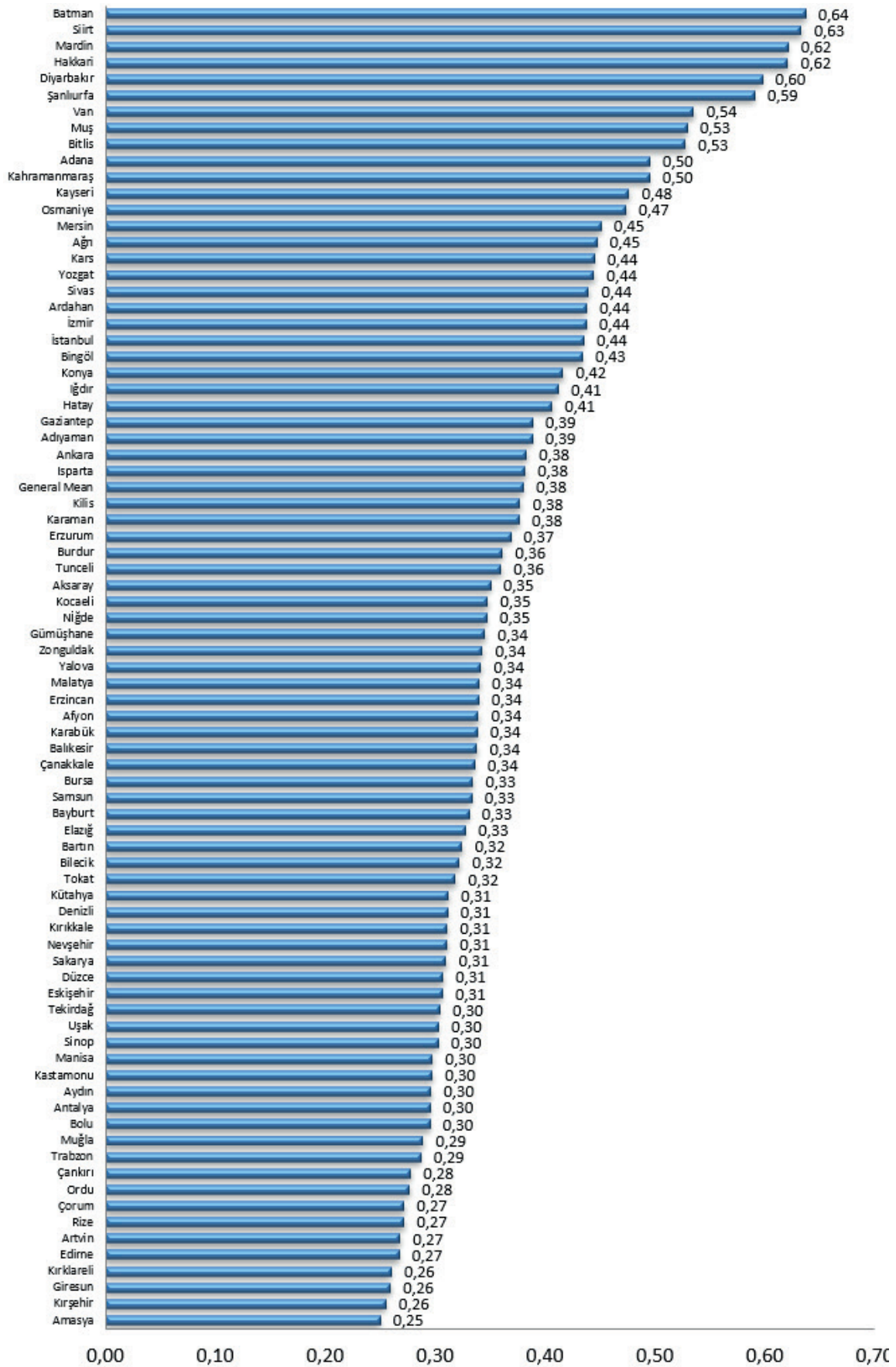
for 2016, and lastly Hakkâri (0.77), Şırnak (0.72), Bitlis (0.65) and Muş (0.65) provinces reached the highest index values for 2017. It is noteworthy that the province of Şırnak is in the highest value group in every three years (Table 3).

Table 4. Socio-Economic Fragility Index Averages of the Provinces for 2015-2017

Provinces	Mean	Provinces	Mean
Adana	0.50	Konya	0.42
Adiyaman	0.39	Kütahya	0.31
Afyon	0.34	Malatya	0.34
Ağrı	0.45	Manisa	0.30
Amasya	0.25	Kahramanmaraş	0.50
Ankara	0.38	Mardin	0.62
Antalya	0.30	Muğla	0.29
Artvin	0.27	Muş	0.53
Aydın	0.30	Nevşehir	0.31
Balıkesir	0.34	Niğde	0.35
Bilecik	0.32	Ordu	0.28
Bingöl	0.43	Rize	0.27
Bitlis	0.53	Sakarya	0.31
Bolu	0.30	Samsun	0.33
Burdur	0.36	Siirt	0.63
Bursa	0.33	Sinop	0.30
Çanakkale	0.34	Sivas	0.44
Çankırı	0.28	Tekirdağ	0.30
Çorum	0.27	Tokat	0.32
Denizli	0.31	Trabzon	0.29
Diyarbakır	0.60	Tunceli	0.36
Edirne	0.27	Şanlıurfa	0.59
Elazığ	0.33	Uşak	0.30
Erzincan	0.34	Van	0.54
Erzurum	0.37	Yozgat	0.44
Eskişehir	0.31	Zonguldak	0.34
Gaziantep	0.39	Aksaray	0.35
Giresun	0.26	Bayburt	0.33
Gümüşhane	0.34	Karaman	0.38
Hakkâri	0.62	Kırıkkale	0.31
Hatay	0.41	Batman	0.64
Isparta	0.38	Şırnak	0.72
Mersin	0.45	Bartın	0.32
İstanbul	0.44	Ardahan	0.44
İzmir	0.44	Iğdır	0.41
Kars	0.44	Yalova	0.34
Kastamonu	0.30	Karabük	0.34
Kayseri	0.48	Kilis	0.38
Kırklareli	0.26	Osmaniye	0.47
Kırşehir	0.26	Düzce	0.31
Kocaeli	0.35	General Mean	0.38

According to Table 4, it is seen that the three-year general index average is 0.38. Accordingly, it is noteworthy that

big cities such as Istanbul (0.44), Izmir (0.44), Adana (0.50), Gaziantep (0.39), Mersin (0.45) are above the average.



Graph 1. Socio-Economic Fragility Index Indicators of Provinces for 2015-2017

When the index averages of the provinces were examined for the 2015-2017 period, the first four provinces with the highest index value were Şırnak, Batman, Siirt and Mardin. It is seen that there is a clear difference between the value of Şırnak province and the values of other provinces (Graph 1). In addition, according to the graph, none of our provinces were included in the low index category while 26 of them were in the high index category. The remaining 55 provinces were in the middle level. Accordingly, 32% of our provinces were in the high index category, while 68% were in the middle index category. According to Graph 1. the index value of 12 provinces has an average of 0.50 and greater for the last period. Also, according to the table, most of our provinces were concentrated within the index value range of 0.31-0.40. In addition, 51 provinces are below the average index value (0.38), while 30 provinces are above the average index value.

Another note worthy point is that there are no provinces with index values of 0.20 and smaller.

Erzurum, Malatya, Kilis and Gaziantep provinces. In the western part, mostly yellow and green colors were concentrated. In addition, while the color tone of Istanbul and Izmir remained high, the color of Ankara was yellow with medium color.

Discussion

Considering the components that make up the Socio-Economic Fragility sub-index, the human poverty index consists of factors mostly related to economic conditions such as social inequality, the ratio of the unemployed to the total workforce, annual inflation of food prices and the ratio of service debt to gross income. Therefore, the variability of this index manifests itself depending on social and economic conditions. In addition, depending on these indices, the bad economic situation of people means that they will be affected more in case of a disaster. Besides, unemployment is an additional disadvantage for the population. The decrease in purchasing power due to high inflation is a negative economic situation for the population to reach resources.



Figure 1. 2015-2017 Period SFI (Social and Economic Fragility Index)

According to Figure 1, while the high tone of the eastern and southeastern provinces is evident in the 2015-2017 period, the middle yellow color is dominant in Elazığ, Tunceli,

When the sub-indicators of provinces with low index values were analyzed; the Human Poverty Index, the proportional dependence of the working age population,

the unemployment rate, the gross debt ratio of service debt, and the indices related to human degradation were remarkably low.

When we look at Graph 1, It is noteworthy that all of the 10 provinces with the highest SFI value were Eastern and Southeastern provinces. Among these cities, especially Van, Şanlıurfa and Diyarbakır are among large cities. Among the 10 provinces with the lowest index value, there were provinces of Blacksea region such as Amasya, Giresun, Artvin, Rize and Ordu, as well as the provinces of Central Anatolia such as Kırşehir, Çorum and Çankırı.

When the sub-indicators of Şanlıurfa were examined; the Human Poverty Index value was very high as 0.90, the index for income inequality measured using the Gini Index was again very high as 0.70, the unemployment rate is 0.54 and the annual inflation rate is 0.55. It is observed that the index related to the dependence of agriculture on gross growth is extremely high as 1.00. According to these values, these areas should be improved by developing policies regarding literacy rate, deprivation of health facilities and the rate of undernourished population, unemployment, income inequality and excessive dependence on agricultural growth.

When the sub-indicators for Diyarbakır were examined; the Human Poverty Index was very high at 0.80, the index for income inequality measured using the Gini Index was very high at 0.70, the unemployment-related index was at 0.54, the annual inflation of food prices was 0.55 and the index related to its dependence on net growth was 1.00. It is remarkable that the factors that increase the socio-economic vulnerability of Şanlıurfa and the factors that increase the vulnerability of Diyarbakır were almost equal in the same values. For this reason, the necessary studies and investments for the province of Şanlıurfa were valid in the province of Diyarbakır.

When sub-indicators were evaluated for Batman province; The Human Poverty Index was quite high at 0.86, the index for the dependency of the working age population was extremely high at 1.00, the index for unemployment rate was at the highest value of 1.00 and the index for the dependency of agriculture on Gross Growth was extremely

high value 1.00. Although, Batman had similar problems to other provinces, it was seen that there were serious deficiencies and problems especially related to literacy rate, insufficient nutrition under-five age, unemployment and proportional dependence of working age population.

When the sub-indicators were examined for Şırnak province which had the highest SFI value; it was remarkable that the values related to the working age proportional dependence, especially the Human Poverty Index, the index related to unemployment rate and the index related to the GDP growth dependency had the highest value of 1.00. In addition, it was observed that the index related to the gross ratio of services debt had a high value of 0.57. Accordingly, when the sub-factors constituting the Human Poverty Index were examined, for Şırnak province, the sub-index for the illiterate population was as high as 0.67, the sub-index for the population deprived of basic health facilities was as high as 1.00 and the index related to the insufficient nutrition under-five age had an extremely high value of 1.00. In the light of these data, there were serious problems for Şırnak in terms of unemployment, agricultural dependency, literacy rate, utilization of basic health facilities and insufficient nutrition under-five age. Investments and efforts to solve these problems should be put into practice as soon as possible.

Omar Darío Cardona and Jarge E. Hurtado (2000) conducted a study on seismic risk index. The study calculated the seismic risk index for 19 districts of Bogota, the capital of Colombia, with significant physical, economic and social differences and visualized the results by graphing and mapping. It is stated that the seismic risk of the city is high, but similar to our study, the comparative risk results of the regions vary significantly depending on social, economic and resistance differences³⁷.

Kalaycıoğlu et al. (2006) conducted a field study to investigate the main dimensions of socio-economic fragility in Eskişehir province. The main dimensions of socio-economic fragility used in the study; economic (poverty, housing ownership, income), demographic (dependent population, job status), social

(values and norms, social groups, age, gender, immigration), public infrastructure (social welfare, education, insurance, public expenditure), behavioral (individual coping strategies, solidarity, individual preparedness for earthquake). As a result of the study, while individual risk factors were determined for the neighborhoods of Eskişehir province, the poorest people were found to be the most vulnerable in general. In some areas, economic, social and cultural factors pose the main risks³⁸.

In a project prepared within the Istanbul Metropolitan Municipality (2014), an index was developed for the indicator system created to measure social vulnerability considering the earthquake hazard. Here, according to various studies in the literature, factors that increase vulnerability towards social fragility have been examined. In addition, a questionnaire form showing social fragility was developed in the study. The conceptual framework of this survey; The demographic structure of the household consists of disability and special treatment status, access to health services, educational status, economic status, mobility and social preparedness³⁹.

Conclusion

SFI is directly affected by the social and economic conditions of the regions, as it captures the fragility of regions in times of danger and crisis. For this reason, it is inevitable that regions or provinces will differ or increase according to their social and economic conditions. For example, the unemployed or dependent population in a province is exposed to the negative effects of this crisis more in the event of a crisis or disaster and may suffer more damage. For this reason, this method enables us to identify the weaknesses or strengths of regions or provinces in times of danger and crisis due to the components of the sub-factors. The identification of these weak and difficult aspects will provide an opportunity for a proactive risk management in crisis preparation stages.

The results of this method and the study show that the effects of factors such as poverty, income distribution and unemployment, combined with the effects

of other factors such as inflation, service burden on GDP, education and health, open the door to fragility. In fact, it is seen that provinces with high index values have higher unemployment, income inequality (this can be given as an example of Istanbul), and deprivation from basic health facilities. Therefore, it is clear that vulnerability to dangers and risks are directly related to these factors (unemployment, income inequality, poverty, inflation, lack of basic health care, education, etc.).

Improvements and subsidies to be made in these areas to provinces with deficiencies in the proposed areas will help to reduce the socio-economic fragility of these provinces against dangers and crises and will help them recover from their negative effects with the least damage.

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