Economic impact of the COVID-19 outbreak in Turkey: analysis of vulnerability and resilience of regions and diversely affected economic sectors

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Abstract
The COVID-19 outbreak has deeply affected the global economy of most countries and Turkey is no exception. However, the impacts of the outbreak differ on a regional basis, and both scientists and policymakers have neglected this regional differentiation. In an attempt to redress this situation, our study aimed to reveal the regional disparities related to the economic impacts of the outbreak and the dynamics that created this differentiation in Turkey. Our statistical analyses were carried out based on two different periods. The first period covered the first trimester when the outbreak began, and several shutdowns were implemented. The second period covered the second trimester when society began to open up again. The first trimester was termed the shock period, and the second trimester the recovery period. We developed a resilient–vulnerability index based on selected variables such as employment, energy consumption, exports, and the number of companies established and closed using a location quotient (LQ) analysis. While our index offers a picture of resilient and vulnerable regions, we also used this index as a dependent variable in our study. In the second stage, we focused on what kinds of dynamics gave rise to the resilience or vulnerability of a region. Our findings revealed that regions are economically affected by the outbreak at different levels. The regression analysis results showed that the innovation capacity and export levels of the regions predict regional resilience negatively, while firm size predicts positively. The recovery of regions also differed regionally. Our analyses show that Turkish regions with relatively larger economies recover more slowly, while regions with smaller economies recover more quickly.

Keywords COVID-19 · Economy · Regional resilience · Regional vulnerability · Turkey

JEL Classification O1 · O4

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1 Introduction

Humanity has been exposed to numerous crises. Even if these crises are based on non-economic factors such as wars, natural disasters, or outbreaks of disease, their effects have a profound effect on the economy. The COVID-19 virus has also caused a notable downturn in the economy. The outbreak and containment measures have plunged the global economy into a deep contraction, a notable occurrence within the historical period since World War II (Woolford 2021). The transformation of the virus into a global economic crisis is directly related to the flexible production system based on global production networks into which the world is integrated (Gibson et al. 2021). Supply chain disruptions associated with a high level of integration have brought global production activities to a standstill.

Crises have become a phenomenon that we have been exposed to more and more since the industrial revolution. So much so that with reference to the frequency of waves of crises, a conceptualization has also emerged, defined as Kontradiev Waves. The fact that crises occur in increasingly short periods and have global effects has also increased the need to write prescriptions for measures to be taken against the phenomenon. In this sense, the need for new conceptual frameworks has increased to understand the phenomenon and take precautions against crises. At this point, it can be stated that the concept of resilience is a conceptual umbrella produced to figure out this phenomenon (Martin and Sunley 2015). Resilience conceptualization has been studied in engineering, ecology, psychology, and economics. In recent years, it has been increasingly studied in regional economics studies, such that the focus of discussions on regional development policy has shifted from issues such as growth and competitiveness to the resilience of regional economies in the face of economic shocks (Klimanov et al. 2020). Indeed, various international organizations are increasingly suggesting the use of the concept of resilience instead of sustainability (Brinks and Ibert 2020).

Although the emergence of the concept of resilience can be traced back to the ecological crises that started in the 1970s, growing interest in economic research increased with the 2007–2008 economic crisis (Baycan and Pinto 2018). According to Martin (2012), the concept of resilience has four stages. These are resistance, recovery, re-orientation, and renewal. Here, resistance refers to the vulnerability or sensitivity of a regional economy to shock; recovery refers to the speed and extent of return to the old level after the experienced shock; re-orientation refers to faster growth and transformation than before the downturn through structural interventions; and renewal refers to the degree of the growth path that characterized the regional economy prior to the shock (Martin 2012: 11).

With the growing interest in explaining the causes and consequences of crises on regions, regional studies have progressively used the concept of resilience (Davies 2011; Bathelt et al. 2013; Eraydin 2013, 2016; Dijkstra et al. 2015; Crescenzi et al. 2016; Cuadrado-Roura et al. 2016; Martin et al. 2016; Doğruel et al. 2018; Brinks and Ibert 2020; Gong et al. 2020; Houston 2020; Kapitsinis 2020; Klimanov et al. 2020; Goschin and Constantin 2021; Tupy et al. 2020; Borsati et al. 2022; Kim et al. 2022; Li et al. 2022).
The outbreak continues to have profound effects in Turkey as well as all over the world. The first case of COVID-19 in Turkey was observed on March 11, 2020, the day before the World Health Organization declared a global pandemic. On the day following the first case, face-to-face education was suspended, and in the following days, public places such as shopping malls, restaurants, cafes, entertainment centers, and places of worship were closed, and a lockdown was imposed on people aged 65 and over and those under 18. On March 17, 2020, the first death due to COVID-19 occurred. On March 22, 2020, the flexible working model was adopted in the public sector, and on March 25, the economic support package was declared. For the first time, on April 3, 2020, a lockdown was imposed for 30 metropolitan cities plus the urban center of Zonguldak, together comprising the heart of the economy. On April 16, 2020, the private sector was prohibited from laying off workers for 3 months. All the measures carried out to control the outbreak have affected numerous areas of the economy, from industry to education, from agriculture to transportation, accommodation, food, beverage, and entertainment sectors. The slogan summarizing all these lockdowns was ‘Life Fits Into Home’. The lockdown period lasted roughly from mid-March 2020 to early June 2020. We consider this trimester as the first wave of shock. With the pandemic partially under control, some flexibility had been introduced to the existing lockdowns as of the first of June. The slogan of this period was the ‘New Normal’. Shopping malls, restaurants, cafes, entertainment centers, and places of worship were reopened in the New Normal with various precautions. This period, from the beginning of June 2020 to the end of August 2020, is considered the recovery period in this study. Indeed, many indicators show that these two periods are explicitly separated (see Figs. 1, 2, 3, 4, 5). The explicit separation of these two periods from each other, which is based on the indicators, is the justification for our differentiation of shock and recovery periods.

Although the outbreak gave rise to an economic downturn both in the world and in Turkey, as emphasized by Bailey et al. (2021), the spatial impact of the crisis has not been similar in all regions. As a matter of fact, the importance of the geographical dimension of the crisis cannot be overstated (Brinks and Ibert 2020). In this context, the regions are divided into three according to their response to economic shocks. These are shock-resistant, resilient, and non-resilient. The first refers to the shock failing to throw the region off its growth path, the second refers to regions that recover from the shock within 4 years, and the last refers to those regions that were unable to recover from the shock within 4 years (Hill et al. 2011: 3).

Based on the above, this study investigates the regional differentiation of the economic impact created by the COVID-19 pandemic in Turkey. From this point of view, this study aims to figure out how the regions react to the shock and recovery period and reveal the regional dynamics that ensure the differentiation of this response. The research therefore has two main aims. The first one is to determine both the resilient–vulnerable and recovery levels of the regions. The second is to explore the dynamics that make the region resilient–vulnerable and in recovery.

The next section of the study continues with a literature review on crisis, vulnerability, and resilience. In the third part, descriptive information about the sectoral impact of the crisis is presented. In the fourth section, the data and method of the
research are presented. In the subsequent section, the findings are presented. The study ends with a discussion and conclusion part.

2 Crisis, vulnerability, and resilience

The economic structure, competitiveness, innovation tendency, skills of the workforce, entrepreneurial culture, institutional forms, and economic governance arrangements of regions determine the response of the regional economy to the crises (Martin 2012). Indeed, the characteristics of the regions can determine the level of exposure to the crisis. Crises can affect countries, regions, sectors, or firms at different levels. Numerous studies dealing with the impact of crises on regions show that crises create different effects on place (Davies 2011; Simmie 2014; Dijkstra et al. 2015; Crescenzi et al. 2016; Faggian et al. 2018; Healy 2018; Sagan and Masik 2018; Sensier 2018; Klimanov et al. 2020; Goschin and Constantin 2021; Wang and Kang 2021). These studies focus on the reasons behind regions’ resilience and vulnerability to crises. On the other hand, they observe the dynamics that allow regions to recover or create new paths, although there is no definite prescription for the dynamics that provide resilience or create vulnerability.

Regional dynamics that make regions resilient or vulnerable may differ. For instance, Hudson (2010) considers integration into the global economy as one of the main reasons for vulnerability, while some others mention that making exportation and being a part of the international economy make regions more resilient (Healy 2018; Sagan and Masik 2018; Wink et al. 2018; Klimanov et al. 2020). Although export regions are defined as vulnerable to shocks, in some studies, they can recover more quickly (Hill et al. 2011; Varblane and Varblane 2018). On the other hand, it is stated that the presence of gatekeepers, referring to openness in a region, relieve isolation and may make the region more resilient (Boschma 2015). From this point of view, it is context dependent whether export and integration into the global economy are factors that make regions resilient or vulnerable.

Another factor that makes the regions resilient or vulnerable is based on the composition of the sectoral structure in the region (Kim et al. 2022). In this context, it is stated that the region’s sectoral structure has a related variety, both making the regions resilient and helping to overcome the crisis (Boschma 2015). As is known, related variety means that a region has a wide variety of related industries to enable cross-sectoral learning and new recombinations (Frenken et al. 2007). Therefore, the high level of related variety creates more opportunities for the industries in the region to learn from each other. Such a local environment is expected to facilitate resilience and recovery from the crisis (Boschma 2015). Indeed, it has been found that a region’s related variety increases its ability to absorb the impact of shock (Sedita et al. 2017; Cainelli et al. 2019a, b). It is noted that the related variety structure of the region performs the function of insurance against sector-specific shocks (Lee 2014). It is also emphasized that, despite all these advantages, a diversified structure may not guarantee a high level of resilience for the regional economies (Martin 2012). Here, the achievement can be realized by the fact that diversity creates overlaps and complementary dynamics. This, in turn, refers to the conceptualization
of related variety. So much so that the concept of related variety implies the existence of diversified areas that allow the use of complementarities between different industries. The resilience created by the associated diversity is provided by common competencies or cognitive proximity at the local level (Cainelli et al. 2019a). To take an example, it has been revealed that one of the most important reasons for the resilience of Poland’s Pomorski region is its diversified economic structure (Sagan and Masik 2018). However, it is also worth noting that if there are too many sectoral relations, when the problems experienced in one sector may affect other sectors, the recession is likely to spread out to the entire regional economy (Eraydın 2013). The regions in a specialized structure can make the region vulnerable (Healy 2018) or resilient according to its context (Martin 2012). In addition to sectoral diversity or specialization, the scale of the companies in the region is also important to share the risk that the region will face. In this context, having many small companies instead of a small number of large-scale companies also increases the resilience of regions against economic crises (Sagan and Masik 2018; Klimanov et al. 2020). On the other hand, the high level of employment in the public sector (Healy 2018) and dependence on government incentives make the region resilient (Zhikharevich et al. 2021).

In another respect, the level of crisis impact on high-tech regions is context dependent. While some studies reveal that regions with high technology are more affected by crises (Crescenzi et al. 2016), other studies emphasize that Turkish regions with high per capita patents and research and development expenditures, that is, regions with high innovation capabilities, are resilient (Christopherson et al. 2010; Wink et al. 2018). Conversely, it is also emphasized that the innovative structure of a region is important for the region to gain rapid momentum after the crisis. (Chapple and Lester 2010; Eraydın 2013; Crescenzi et al. 2016).

Another factor taken into account to determine the level of impact of the crisis is associated with the location of the regions. For instance, in the case of Singapore, despite being exposed to external shocks, getting rid of these shocks is associated with Singapore’s local advantage as a small island state. This case is conceptualized as the “Singapore Paradox” (Briguglio et al. 2009).

Although studies on this subject in Turkey are quite limited, the NUTS 2 level research conducted by Eraydın (2013) reveals that high exports, entrepreneurship rates, and specialization increase resilience to crisis. In contrast, regions with an economic structure based on a single sector and high technology are more affected by crisis (Eraydın 2013).

3 Analysis of vulnerability and resilience of regions and diversely affected economic sectors during the COVID-19 outbreak in Turkey

The COVID-19 outbreak has deeply affected Turkey and the rest of the world from an economic point of view. Many indicators make this clear. This section will reveal this effect based on the shock and recovery periods outlined above.

One of the most important indicators that can reveal this effect is the capacity utilization rates. Capacity utilization rates denote how much of the total production
capacity is used in a country, region, or enterprise. The decrease in total capacity utilization rates in Turkey in the first trimester reached 18% compared to the previous year. While the capacity utilization rates in the manufacturing of clothing production decreased to 54%, this decrease was 40% in furniture and around 33% in beverages. The sector that started to rise in this period was the manufacturing of computer, electronic and optical products. These figures indicate that the technology-intensive manufacturing sectors are the winners of the first shock wave.

There is a significant increase in capacity utilization rates in the second trimester. For instance, in the first trimester, the decline in capacity utilization rates in the manufacture of clothing products decreased to 54%, while these rates rose after June. It is worth noting that although there was an increase in many sectors during the second trimester, a decline in total capacity utilization rates continued compared to the previous year (Fig. 1).

The decrease in capacity utilization rates is also observed in many other indicators for the first trimester. As a matter of fact, from the point of view of energy consumption, there is also a significant decrease in the first trimester. Since March 2020, the decrease in energy consumption rate has reached 15%. Energy consumption started to increase in June with the beginning of the recovery period, as outlined above. During the recovery period, the increase in energy consumption reached 9.5% compared to the previous year (Fig. 2).

In parallel with the above indicators, exports have also experienced a sharp decline since March 2020. In the first trimester, the decrease in exports reached 43%.

1 The previous year refers to 2019, the year before the COVID-19 outbreak.
Although there was a significant decrease in total exports during the shock period (first trimester), all sectors were not affected by this at the same rate. The three sectors whose exports fell the most were the other manufacturing industries, the production of motor vehicles, and the manufacture of coke and refined petroleum products. The sector whose exports increased in the first trimester was the manufacture of basic pharmaceutical products and pharmaceutical materials. The increase in this sector reached 54%. In the second trimester, there was also a significant recovery in exports. Exports in June increased by 16% compared to the previous year. During the recovery period, the increase in the production of motor vehicles and other productions, where the greatest decline was observed during the shock period, was very rapid. The recovery in exports of coke and refined petroleum products, where the highest decline was observed in the first period, was slow in the second period (Fig. 3).

Considering the import, a dramatic decrease was observed in the first trimester. In this period, the decrease in imports reached 28%. The biggest decrease in imports was seen in the manufacture of coke and refined petroleum products with 73%. A 68% decrease followed it in the manufacture of leather and related products. The third sector, whose imports fell the most in the first trimester, was the production of motor vehicles. During the recovery period, the increase in imports was between 8 and 20%. In this period, the sector with the highest increase in imports was seen in the base metal industry. The rate of increase in the production of motor vehicles, which experienced a decrease in the shock period, reached 65% during the recovery period. This means the import of motor vehicles is the sector with the biggest recovery. Although imports in the manufacture of coke and refined petroleum products and leather and related products recovered, they remained negative compared to the previous year (Fig. 4).

The first shock wave of the pandemic was also reflected in the number of companies established and closed. In the first trimester, the number of companies established decreased by 56% compared to the previous year. The uncertainty experienced in the first trimester was also reflected in the number of closed businesses. The decrease in the number of businesses closed in the first period was around 3–12% compared to the previous year.
Fig. 3 Change in exports compared to the previous year (2019/2020). Source: https://evds2.tcmb.gov.tr/index.php?evds/serieMarket/collapse_21/6007/DataGroup/turkish/bie_kko2/

Fig. 4 Change in imports compared to the previous year (2019/2020). Source: https://evds2.tcmb.gov.tr/index.php?evds/serieMarket/collapse_21/6007/DataGroup/turkish/bie_kko2/
previous year. Since June, there has also been a significant increase in the number of established and closed businesses. In this period, between June and August, the rate of companies established was higher than those closed. This indicates that attempts were also made to turn the crisis into an opportunity. In this context, the number of companies established in June increased by 126% compared to the same month of the previous year. This increase was 46% and 80% in July and August, respectively. While the number of companies closed in June increased by 57% compared to the previous year, this rate was 11% in July and 21% in August (Fig. 5).

It has been observed that the rate of decline in the number of insured is lower than other indicators. In this context, the decline in registered employment in the first trimester was between 3 and 3.5%. However, it should be noted that the total labor losses are far beyond the official figures. There are two reasons why the change in employment losses was not so dramatic. The first is the prohibition of layoffs, and the second is that those dismissed are not truly reflected in the official figures due to the high level of informal employment. Despite this, as in other indicators, there was a recovery in employment in the second trimester.

### 3.1 Data and methodology

Various indicators are used in the literature to measure vulnerability and resilience. In this context, the most commonly used indicator to reveal whether a region is resilient to crisis is employment (Chapple and Lester 2010; Christopherson et al. 2010; Fingleton et al. 2012; Martin 2012; Martin et al. 2016; Faggian et al. 2018). On the other hand, the amount of exports (Healy 2018; Wink et al. 2018; Klimanov et al. 2020) and the number of businesses opened and closed (Eraydın 2013; Li et al. 2022) are also used to measure the crisis resilience level of regions. Undoubtedly,
| \(N\) | Variables and descriptions |
|---|---|
| **Dependent variable** |  |
| 1 | Employment | EMP | SGK | Resilience–vulnerability and recovery indices were formed by taking the average of the location coefficient obtained for five variables |
| 2 | Export | EXP | TUKSTAT |  |
| 3 | Energy consumption | EC | EPDK |  |
| 4 | Number of establishment company | NLC | TOBB |  |
| 5 | Number of liquidation company | NLC | TOBB |  |
| **Independent variables** |  |
| 1 | Innovation | INNOVPC | TPTO | Patents per capita (2019) |
| 2 | Export | EXPPC | TURSTAT | Export per capita (2019) |
| 3 | Public employment | PE | SGK | The ratio of public employment in the region to the total employment of the region (2019) |
| 4 | Firm size (50–249) | FS (50–249) | SGK | The proportion of companies employing 50–249 people among companies in the region (2019) |
| 5 | Firm size (250–499) | FS (250–499) | SGK | The proportion of companies employing 250–499 people among companies in the region (2019) |
| 6 | Firm size (500–749) | FS (500–249) | SGK | The proportion of companies employing 500–749 people among companies in the region (2019) |
| 7 | Above 65 years of age | 65+ | TURKSTAT | The ratio of the population over 65 years of age in the total population (2019) |
| 8 | Agriculture | AGR | TURKSTAT | The ratio of agriculture in GDP (2019) |
| 9 | Manufacturing | MANF | TURKSTAT | The ratio of the manufacturing industry to GDP (2019) |
| 10 | Construction | CONST | TURKSTAT | The ratio of construction in GDP (2019) |
| 11 | Services (consumer) | SERV | TURKSTAT | The ratio of consumer services in GDP (2019) |
| 12 | GDP | GDP | TURKSTAT | Share of the region in total GDP (2019) |
the existing characteristics of the regions can determine their resilience level. In this context, various indicators are used to assess regional resilience levels: innovation capacity of the region (Crescenzi et al. 2016; Christopherson et al. 2010; Wink et al. 2018; Chapple and Lester 2010; Eraydın 2013), openness level (Healy 2018; Wink et al. 2018; Klimanov et al. 2020), sectoral structure (Kim et al. 2022; Boschma 2015; Sedita et al. 2017; Cainelli et al. 2019a, b; Sagan and Masik 2018; Eraydın 2013), firm sizes in the region (Klimanov et al. 2020; Sagan and Masik 2018), and domination of public sector (Healy 2018). The dependent and independent variables used in this study were created from variables in the literature, mentioned above (See Table 1). Besides, as Martin and Sunley (2015) state, it should be emphasized that there is no generally accepted methodology in resilience studies. These indicators differ according to the scale of the studies and the framework in question.

Studies in the related literature mainly analyze the effects of crises over several years of data. However, in this study, the impact of the crisis will be evaluated through data for two separate trimester periods. The first trimester includes the period from March to May 2020, when shutdowns occurred nationwide. This period is intended to reveal the effect of the first shock created by the crisis. It therefore makes sense to try to determine resilience or vulnerability status of regions based on the data for the first trimester. The second 3-month period was between June and August 2020, described as the ‘New Normal’, when some openings were experienced. The analyses based on this period aim to reveal the recovery level of the regions.

In this context, data on employment, exports, energy consumption, and the number of businesses established-closed were used, taking into account the presence of monthly data and NUTS 3 level data. The data on the five variables mentioned were compared with the same month of the previous year to reveal the change. This created data set was included in the location quotient (LQ) analysis. Based on the location quotient values obtained, both the resilience–vulnerability index (based on the data for the LQ March–May 2020 period) and the recovery index (based on the LQ June–August 2020 period data) of the regions were created.

As a result of this method, two maps were produced. The first map was produced based on the LQ values of the March–May period. This map shows which regions were vulnerable to the first shock of the outbreak and which regions were resilient (Fig. 6). The second map was produced based on the LQ values for the June–August period (Fig. 7). This map reveals the level of recovery of the regions. An increase in the location quotient values indicates that the regions are resilient and the recovery speed was high, while a decrease indicates that the regions are vulnerable and the recovery rate was low. In this context, the calculation method for the location quotient values is as follows. The equation of energy consumption, export, and number of established businesses is the same given in the first equation below. But the equation for the closed businesses is different.\(^2\) By taking the average of the location quotient of five different data, the resilient–vulnerability and recovery index were formed.

\(^2\) A positive change in employment, energy consumption, exports, and the number of businesses established compared to previous years indicates a favorable condition, while a positive difference in the number of companies closed indicates a negative condition. To eliminate this problem, while the starting point in the first four variables was handled over the year before the pandemic, the starting point for the closed businesses variable was taken as the pandemic period.
LQ EMP = \left( \frac{\sum 2020_{NUTS3EMP}}{2020_{NUTS0EMP}} \right) / \left( \frac{\sum 2019_{NUTS3EMP}}{2019_{NUTS0EMP}} \right), \quad (1)

2020_{NUTS3EMP} = employmentinthelvel3regionintherelevantmonths-of2020,

\sum 2020_{NUTS0EMP} = totalemploymentinTurkeyintherelevantmonths-of2020,

2019_{NUTS3EMP} = employmentinthelvel3regionintherelevantmonths-of2019,

\sum 2019_{NUTS0EMP} = totalemploymentinTurkeyintherelevantmonths-of2019.

LQ NLC = \left( \frac{\sum 2019_{NUTS3NLC}}{2019_{NUTS0NLC}} \right) / \left( \frac{\sum 2020_{NUTS3NLC}}{2020_{NUTS0NLC}} \right), \quad (2)

2019_{NUTS3NLC} = numberofbusinessesclosedinthelvel3regionintherelevantmonths-of2019,
4 Results

4.1 Regional resilience/vulnerability during the shock period and contributing factors

Findings on the resilience/vulnerability index based on the data of the trimester of the outbreak, which we describe as the shock period, clearly reveal that the impact of the outbreak differs spatially (Fig. 6). Looking at the map in question, it is striking that the dark blue regions indicating resilience are mostly concentrated in the small and relatively underdeveloped regions in the east and southeast of Turkey. It is understood that the big industrial centers on the periphery of Istanbul, such as Kocaeli, Sakarya, Bursa, and Yalova in the Marmara Region, experienced the first 3-month shock period in a vulnerable way.

The regression analysis results performed to reveal the effect of 12 independent variables that make the regions resilient or that are thought to cause their vulnerability are as in Table 2. It is seen that all of the models established in this framework are meaningful. This significance level is 95% in the first, second, and third models, and 99% in the remaining models (see Table 2, F values). The adjusted $R^2$ values, which show how many of the independent variables explain the percent of the total change in the dependent variable, were the highest at 0.326 and the lowest at 0.277 in the established models (see Table 2). In this context, it can be stated that the strongest model is the 7th model ($R^2 = 0.326$). The regression analysis performed the VIF and Durbin–Watson values to reveal the dynamics that provide shock wave resistance and vulnerability are also among the reference values. In this context, the VIF values in the models were realized as a minimum of 1.002 and a maximum of 4.43. The Durbin–Watson value is 1.606. These values show that the models are statistically valid and reliable.

Looking at the details of the regression analysis, we found the innovation variable showing the innovativeness of the regions and the export per capita showing the openness of the regions were statistically significant in all models. While the innovation variable is significant at the 0.10 level in the first model, it is significant at the 0.05 level in all other models. On the other hand, the export variable has a high

\[ \sum 2019_{NUTS0NLC} = \text{total number of closed businesses in Turkey in the relevant months of 2019}, \]

\[ 2020_{NUTS3NLC} = \text{number of businesses closed in the level 3 region in the relevant months of 2020}, \]

\[ \sum 2020_{NUTS0NLC} = \text{total number of closed businesses in Turkey in the relevant months of 2020}. \]
### Table 2: Regression results for the shock period (March–May)

| Dependent variable: LQ (March–May) | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 | Model 7 | Model 8 | Model 9 | Model 10 |
|----------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|
| Constant                         | 0.949*** (3.940) | 0.944*** (4.013) | 1.002*** (6.998) | 0.938*** (8.636) | 0.945*** (8.768) | 0.870*** (11.744) | 0.858*** (11.820) | 0.917*** (15.824) | 0.891*** (18.030) | 0.922*** (22.239) |
| INNOVPC                          | −0.257* (-1.936) | −0.264** (-2.186) | −0.261** (-2.192) | −0.258** (-2.177) | −0.259** (-2.195) | −0.268** (-2.285) | −0.282** (-2.433) | −0.276** (-2.368) | −0.274** (-2.357) | −0.269** (-2.303) |
| EXPPC (March–May) 2019           | −0.474** (-2.756) | −0.479** (-2.891) | −0.482** (-2.946) | −0.463** (-2.888) | −0.388** (-3.224) | −0.391** (-3.260) | −0.392** (-3.271) | −0.402** (-3.343) | −0.430*** (-3.714) | −0.433*** (-3.735) |
| PE (%)                           | −0.121 (−0.657) | −0.113 (−0.657) | −0.124 (−0.742) | −0.119 (−0.717) |                  |                  |                  |                  |                  |                  |
| FS (50–249) %                    | 0.176 (0.855) | 0.181 (0.905) | 0.193 (0.988) | 0.251 (1.435) | 0.194 (1.251) | 0.198 (1.273) | 0.205 (1.326) |                  |                  |                  |
| FS (250–499) %                   | −0.280 (−1.486) | −0.277 (−1.499) | −0.279 (−1.524) | −0.281 (−1.545) | −0.266 (−1.479) | −0.217 (−1.263) | −0.233 (−1.364) | −0.134 (−0.867) |                  |                  |
| FS (500–749) %                   | 0.260 (1.440) | 0.256 (1.453) | 0.244 (1.433) | 0.238 (1.406) | 0.259 (1.561) | 0.211 (1.338) | 0.235 (1.515) | 0.296* (1.976) | 0.209* (1.882) | 0.209* (1.873) |
| 65 + (%)                         | −0.117 (−0.675) | −0.105 (−0.728) | −0.097 (−0.692) |                  |                  |                  |                  |                  |                  |                  |
| AGR                              | −0.176 (−0.902) | −0.179 (−0.935) | −0.211 (−1.321) | −0.209 (−1.316) | −0.202 (−1.280) | −0.107 (−0.878) |                  |                  |                  |                  |
| MANF                             | −0.142 (−0.592) | −0.139 (−0.590) | −0.180 (−0.923) | −0.186 (−0.960) | −0.183 (−0.950) |                  |                  |                  |                  |                  |
| CONST                            | 0.155 (0.918) | 0.154 (0.923) | 0.129 (0.889) | 0.132 (0.915) | 0.143 (1.003) | 0.213* (1.742) | 0.176 (1.540) | 0.147 (1.299) | 0.126 (1.143) |                  |
| SERV                             | 0.052 (0.329) | 0.047 (0.313) |                  |                  |                  |                  |                  |                  |                  |                  |
| GDP 2019                         | −0.025 (−0.130) |                  |                  |                  |                  |                  |                  |                  |                  |                  |
| N                               | 57 | 57 | 57 | 57 | 57 | 57 | 57 | 57 | 57 | 57 |
| Adjusted $R^2$                   | 0.277 | 0.293 | 0.307 | 0.315 | 0.321 | 0.323 | 0.326 | 0.316 | 0.319 | 0.315 |
| $F$                              | 2.790 [0.006] | 3.110 [0.003] | 3.479 [0.002] | 3.855 [0.001] | 4.316 [0.001] | 4.814 [0.000] | 5.513 [0.000] | 6.172 [0.000] | 7.563 [0.000] | 9.592 [0.000] |

Durbin–Watson is 1.606. None of the regressors was multicollinear—with a maximum VIF of 4.43 and a minimum of 1.002. Values in parentheses show the $t$ statistic. The values in square brackets indicate the $p$ value

***$p < 0.001$; **$p < 0.05$; *$p < 0.1$

Turkey has 81 NUTS 3 level. This number decreased to 57 because outliers were excluded
significance value of 0.001 in the ninth and tenth models. The significance level of exports in all models except the ninth and tenth models is at the level of 0.05. Both innovation and export variables predict the dependent variable negatively. In other words, regions with a high level of innovation and export per capita showed a more vulnerable structure (Table 2).

In the regression models and the innovation and export variables, the firm’s size (firms with 500–749 people) and construction activities also became significant predictors. In this context, firm size in the eighth, ninth, and tenth models and construction in the sixth model were significant and positive predictors at the 0.10 level (Table 2).

Based on these findings, in the first trimester, which we define as the first wave of the shock, the innovative nature of a region and the high amount of exports per capita made the region more vulnerable, while the growth of firm size in a region and the fact that the region operates in the construction sector made the region resilient. However, the fact that the $R^2$ values, which express the model’s predictive power, are not very high necessitates caution while commenting on the variables that predict resilience and vulnerability.

4.2 Resilient and vulnerable regions during the recovery period and their contributing factors

In June 2020, Turkey started a new period called ‘New Normal’. This period can be described as the recovery period in which most of the closures ended. According to the recovery index based on the data of this trimester covering June and August, the recovery after the outbreak also differed spatially (Fig. 7). The recovery index shows that the recovery is faster in the country’s small regions in the interior, east, and southeast. This indicates that regions that were vulnerable in the first period had difficulties in recovery.

The regression analysis results performed to reveal the effect of 12 independent variables, which are thought to ensure the recovery of the regions, are as in Table 3. It is seen that the first six models are not significant, but the next six models are significant. This significance level was 90% in the seventh and eighth models. The 9th, 10th, 11th, and 12th models are in the 95% confidence interval (see Table 3, $F$ values). This analysis was conducted to understand the recovery period, and the adjusted $R^2$ values were highest in the established models at 0.127 (see Table 3). The VIF and Durbin–Watson values in the regression analysis are also among the reference values in this analysis. In this context, the VIF values in the models are a minimum of 1.000 and a maximum of 4.43. The Durbin–Watson value is 1.731. These values also show that the models are statistically valid and reliable.

Looking at the details of the regression analysis, we found there are no significant variables in all of the established models. The share of provinces in GDP, which is the only significant variable in this analysis, was significant only in some models. In this framework, this variable, which shows the share of provinces in GDP

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5 For descriptive statistics, see Table 5 in appendix.
in the 9th, 10th, and 11th models, is significant at the level of 0.10 and at the level of 0.05 in the 12th model. The variable in question has a negative relationship with the dependent variable in all significant models (Table 3). From this point of view, it can be said that as the shares of provinces in GDP increase, their recovery slows down compared to other regions. In other words, the regions that are dominant in the Turkish economy have been able to recover more slowly from the effect of this process. Therefore, it can be said that small provinces, which do not have much economic leverage in the country, survived this process more easily.

However, the $R^2$ values in the regression analysis for the recovery period are lower than the $R^2$ values in the regression analysis for the shock period. These values also necessitate being cautious while interpreting the variables that predict recovery.

**5 Discussion**

The economic crisis caused by COVID-19 is fundamentally different from the Great Recession of 2008–2009 on a global scale. The crisis experienced in 2008–2009 hit the economy where the global economic integration process was at its peak.
Table 3  Regression results for the recovery period (June–August)

| Dependent variable: LQ (June–August) | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 | Model 7 | Model 8 | Model 9 | Model 10 | Model 11 | Model 12 |
|--------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Constant                             | 0.952*** (4.277) | 0.947*** (6.247) | 0.949*** (6.489) | 0.958*** (7.289) | 0.972*** (8.029) | 0.972*** (8.116) | 1.020*** (13.612) | 0.998*** (15.358) | 1.009*** (16.127) | 0.969*** (28.056) | 0.959*** (31.292) | 0.995*** (88.907) |
| INNOVPC                              | −0.048 (−0.304) | −0.048 (−0.307) | −0.048 (−0.309) | −0.046 (−0.303) | −0.041 (−0.271) | −0.046 (−0.309) | −0.044 (−0.271) | −0.046 (−0.303) | −0.041 (−0.271) | −0.046 (−0.309) | −0.044 (−0.271) | −0.046 (−0.303) |
| EXPPC (June–August)                  | −0.277 (−1.374) | −0.276 (−1.396) | −0.274 (−1.416) | −0.276 (−1.445) | −0.275 (−1.454) | −0.282 (−1.519) | −0.253 (−1.441) | −0.202 (−1.313) | −0.191 (−1.255) | −0.189 (−1.248) | −0.189 (−1.254) | −0.189 (−1.254) |
| PE (%)                               | −0.133 (−0.617) | −0.132 (−0.624) | −0.134 (−0.652) | −0.138 (−0.679) | −0.138 (−0.742) | −0.146 (−0.742) | −0.146 (−0.742) | −0.114 (−0.742) | −0.114 (−0.742) | −0.114 (−0.742) | −0.114 (−0.742) | −0.114 (−0.742) |
| FS (50–249) %                        | 0.118 (0.478) | 0.116 (0.487) | 0.121 (0.549) | 0.118 (0.542) | 0.113 (0.528) | 0.109 (0.515) | 0.109 (0.515) | 0.109 (0.515) | 0.109 (0.515) | 0.109 (0.515) | 0.109 (0.515) | 0.109 (0.515) |
| FS (250–499) %                       | 0.013 (0.059) | 0.013 (0.060) | 0.018 (0.069) | 0.018 (0.070) | 0.018 (0.070) | 0.018 (0.070) | 0.018 (0.070) | 0.018 (0.070) | 0.018 (0.070) | 0.018 (0.070) | 0.018 (0.070) | 0.018 (0.070) |
| FS (500–749) %                       | −0.201 (−0.924) | −0.199 (−0.956) | −0.193 (−1.066) | −0.189 (−1.067) | −0.189 (−1.080) | −0.189 (−1.110) | −0.192 (−1.102) | −0.130 (−0.962) | −0.113 (−0.858) | −0.084 (−0.666) | −0.113 (−0.858) | −0.113 (−0.858) |
| 65+ (%)                              | −0.094 (−0.456) | −0.096 (−0.486) | −0.097 (−0.496) | −0.098 (−0.510) | −0.098 (−0.514) | −0.107 (−0.557) | −0.153 (−0.760) | −0.111 (−0.762) | −0.111 (−0.762) | −0.111 (−0.762) | −0.111 (−0.762) | −0.111 (−0.762) |
| AGR                                  | 0.054 (0.232) | 0.058 (0.303) | 0.057 (0.301) | 0.054 (0.291) | 0.057 (0.301) | 0.054 (0.291) | 0.057 (0.301) | 0.054 (0.291) | 0.057 (0.301) | 0.054 (0.291) | 0.057 (0.301) | 0.054 (0.291) |
| MANF                                 | 0.156 (0.550) | 0.162 (0.674) | 0.157 (0.697) | 0.139 (0.742) | 0.103 (0.743) | 0.100 (0.730) | 0.094 (0.694) | 0.093 (0.690) | 0.094 (0.694) | 0.093 (0.690) | 0.094 (0.694) | 0.093 (0.690) |
| CONST                                | 0.022 (0.109) | 0.025 (0.146) | 0.025 (0.148) | 0.025 (0.148) | 0.025 (0.148) | 0.025 (0.148) | 0.025 (0.148) | 0.025 (0.148) | 0.025 (0.148) | 0.025 (0.148) | 0.025 (0.148) | 0.025 (0.148) |
| SERV                                 | −0.007 (−0.036) | −0.007 (−0.036) | −0.007 (−0.036) | −0.007 (−0.036) | −0.007 (−0.036) | −0.007 (−0.036) | −0.007 (−0.036) | −0.007 (−0.036) | −0.007 (−0.036) | −0.007 (−0.036) | −0.007 (−0.036) | −0.007 (−0.036) |
| GDP (2019)                            | −0.270 (−1.171) | −0.272 (−1.218) | −0.274 (−1.251) | −0.274 (−1.278) | −0.275 (−1.284) | −0.298 (−1.532) | −0.318 (−1.685) | −0.268 (−1.844) | −0.300* (−1.690) | −0.256* (−1.726) | −0.260* (−1.726) | −0.366** (−2.913) |
Durbin–Watson is 1.731
None of the regressors was multicollinear—with a maximum VIF of 4.43 and a minimum of 1.00
Values in parentheses show the $t$ statistic
The values in square brackets indicate the $p$ value

***$p < 0.001$; **$p < 0.05$; *$p < 0.1$
The impact of COVID-19 has been felt in all areas of life. This effect has led not only to negative, but also to some positive results. For example, although many sectors have suffered a great loss with the economic crisis triggered by COVID-19, some sectors, such as the pharmaceutical and chemical industry, have increased their power, as shown above. Hence, as Bailey et al. (2021) state, the winners and losers of each crisis are different. Socially, some new routines such as flexible working from home have also become a part of life. This situation exemplifies the functioning of Schumpeter’s conceptualization of creative destruction, which states that crises can create some positive results. As Martin and Sunley (2015) emphasize, major shocks can also serve as ‘creative destruction’ mechanisms in economic structures, institutional structures, infrastructure, and various regulatory mechanisms (Martin and Sunley 2015).

COVID-19 can be distinguished from other recent crises by several features. The most obvious of these is seen in the reaction of public policies to this crisis. While the public reaction to the Great Recession crisis of 2008–2009 was in the form of austerity, the reaction to the COVID-19 crisis has been marked by an unprecedented increase in public spending. In this context, the EU, the USA, and many countries of the world have announced bailout packages with varying degrees (Bailey et al. 2021). Although not as much as in developed countries, the public sector in Turkey tried to alleviate the impact of the crisis with various support mechanisms. According to IMF data, these supports are of two types in proportion to the countries’ GDP. The first is in the form of giving up additional expenditures and revenues made by the public against COVID-19, and the second is in the form of liquidity support. While waiver of additional expenses and revenues made by the public relative to GDP is 25.5% in the USA, 19.3% in the UK, 15.3% in Germany, and 9.6% in France, the world average is 10.2%. As for Turkey, this rate has become 3.5%. Turkey lags behind the world average in terms of additional expenditures made by the public and waiver of receivables. Considering the amount of liquidity support provided relative to GDP, it was 35.3% in Italy, 27.8% in Germany, 15.2% in France, 10.1% in South Korea, and 2.4% in the USA, while the average world rate was 6.2%. Turkey, on the other hand, positively differentiated from the world average by providing liquidity support of 9.6% of its GDP. Compared to GDP, the amount of public liquidity support in Turkey is higher than that of other types of support. While Turkey was behind the world average in terms of additional public expenditures, it provided a higher level of support than the world average in terms of liquidity support (IMF 2021). However, it should be emphasized that these kinds of support were not regional in character and so did not support vulnerable regions further.

6 Concluding remarks

Although attempts were made to mitigate the impact of the crisis with various aid packages, the economic impact of the crisis was felt at different levels both in terms of place and of different segments of the society. This causes the results of the crisis and the regions affected by it to differ. In this context, this research aims to reveal the regional impact of the economic crisis caused by the COVID-19
outbreak and to understand the dynamics that create regional differentiation. As a result of the analyses made, the response of the regions to the first shock and recovery period differed. In the first trimester, when the crisis started, Turkish innovative regions and regions with high openness levels were more vulnerable, while regions with large firm scale, which also happen to be prominent in the construction sector, became more resilient. The response of the regions also differed during the second trimester, called the recovery period, when the closures were stretched. In this period, it is observed that regions which are prominent in Turkey’s GDP recovered more slowly, while small regions recovered more rapidly.

Our findings reveal that regions which are articulated to the global economy are more vulnerable. This is compatible with studies showing that regions articulated to the global economy are more vulnerable to shocks (Hill et al. 2011; Eraydın 2013; Varblane and Varblane 2018). However, it contrasts with the literature arguing that resilience is based on the articulation of the international economy (Healy 2018; Sagan and Masik 2018; Wink et al. 2018; Klimanov et al. 2020). Our finding that innovative regions are more vulnerable contrasts with studies that revealed that innovative regions are more resilient (Chapple and Lester 2010; Clark et al. 2010; Eraydın 2016; Christopherson et al. 2010; Wink et al. 2018). However, this finding is consistent with the study of Crescenzi et al. (2016). Although it is stated that the small scale of the companies is important in terms of sharing the risk, which can increase the resilience of the regions (Sagan and Masik 2018; Klimanov et al. 2020), our findings reveal that the Turkish regions with large firm scale are more resilient. Our findings that the regions prominent in GDP recovered slowly are in line with Sensier’s (2018) findings that strong economic regions are not resilient.

While some of our research findings are compatible with the literature, some are in contradiction. This indicates that a definite recipe for ensuring the resilience of regions and preventing them from being exposed to vulnerability has not been revealed yet, and that the regional impact of the crisis is context dependent. However, it should be noted that the increase in such studies also provides an accumulation of knowledge that can form a basis for the necessary interventions to increase regional resilience. It should also be noted that this study covers only the first and second trimesters and may therefore be limited in terms of observing the holistic impact of the outbreak. Although this is considered a lacuna of this study, more observations and long-term investigation are needed to fill this gap.

Appendix

See Tables 4, 5 and 6.
### Table 4  Descriptive results for the shock period (March–May)

| Descriptive statistics | Mean       | Std. deviation | N  |
|------------------------|------------|----------------|----|
| LQ (March–May)         | 1.033479   | 0.1081605      | 57 |
| INNOVPC                | 6.054924   | 5.6236755      | 57 |
| PE                     | 15.204427  | 7.4605922      | 57 |
| FS (50–249)            | 1.622377   | 0.3912452      | 57 |
| FS (250–499)           | 0.167325   | 0.0641316      | 57 |
| FS (500–749)           | 0.044237   | 0.0301813      | 57 |
| 65+                    | 11.175128  | 2.7408333      | 57 |
| AGR                    | 13.4308137070 | 7.58978471922 | 57 |
| MANF                   | 14.2219705818 | 9.14400169144 | 57 |
| CONST                  | 4.571606486 | 1.9229735994  | 57 |
| Ln_SERV                | 1.2057     | 0.14194        | 57 |
| Ln_GDP                 | − 0.1812   | 0.47586        | 57 |
| Ln_EXPPC               | − 1.3045   | 0.55502        | 57 |

### Table 5  Descriptive results for the recovery period (June–August)

| Descriptive statistics | Mean       | Std. deviation | N  |
|------------------------|------------|----------------|----|
| LQ (June–August)       | 1.006439   | 0.0839608      | 57 |
| INNOVPC                | 6.054924   | 5.6236755      | 57 |
| PE                     | 15.204427  | 7.4605922      | 57 |
| FS (50–249)            | 1.622377   | 0.3912452      | 57 |
| FS (250–499)           | 0.167325   | 0.0641316      | 57 |
| FS (500–749)           | 0.044237   | 0.0301813      | 57 |
| 65+                    | 11.175128  | 2.7408333      | 57 |
| AGR                    | 13.4308137070 | 7.58978471922 | 57 |
| MANF                   | 14.2219705818 | 9.14400169144 | 57 |
| CONST                  | 4.571606486 | 1.9229735994  | 57 |
| Ln_SERV                | 1.2057     | 0.14194        | 57 |
| Ln_GDP                 | − 0.1812   | 0.47586        | 57 |
| Ln_EXPPC (Jun–August)  | − 1.3998   | 0.56654        | 57 |
Table 6  LQ values for the shock (March–May) and recovery period (June–August)

| No. | Provinces     | LQ (March–May) | LQ (June–August) |
|-----|---------------|----------------|------------------|
| 1   | ADANA         | 1.153357172    | 1.023400347      |
| 2   | ADIYAMAN      | 1.220398187    | 1.122714314      |
| 3   | AFYONKARAHİSAR| 1.160640832    | 1.027922504      |
| 4   | AĞRI          | 1.215561148    | 1.142892557      |
| 5   | AKŞARAY       | 1.005100437    | 1.089107663      |
| 6   | AMASYA        | 1.05047739     | 0.951416452      |
| 7   | ANKARA        | 0.933942377    | 0.938346391      |
| 8   | ANTALYA       | 0.975114622    | 0.90392067       |
| 9   | ARTVİN        | 1.155062678    | 1.176372532      |
| 10  | AYDIN         | 1.065292503    | 1.041046814      |
| 11  | BALIKESİR     | 1.061975438    | 1.105062565      |
| 12  | BARTIN        | 1.138157549    | 1.060330809      |
| 13  | BATMAN        | 1.097921845    | 0.99047622       |
| 14  | BİLEÇİK       | 1.129092759    | 1.133753912      |
| 15  | BİNGÖL        | 1.193616105    | 1.717366154      |
| 16  | BİTLİS        | 0.977595807    | 0.872458519      |
| 17  | BOLU          | 1.04692083     | 0.849251787      |
| 18  | BURDUR        | 0.87203545     | 0.983706118      |
| 19  | BURSA         | 0.84970789     | 0.892548284      |
| 20  | ÇANAKKALE     | 1.005202932    | 0.9853464        |
| 21  | ÇANKIRI       | 0.850600603    | 1.12474185       |
| 22  | ÇORUM         | 0.880425596    | 0.977718473      |
| 23  | DENİZLİ       | 0.949792152    | 0.98960564       |
| 24  | DİYARBAKIR    | 1.107539015    | 0.960029671      |
| 25  | DÜZCE         | 1.196731073    | 0.984733144      |
| 26  | EDİRNE        | 1.172780282    | 0.981485         |
| 27  | ELMİZİG       | 1.181873544    | 1.004114693      |
| 28  | ERZİNCAN      | 1.288686157    | 1.184959975      |
| 29  | ERZURUM       | 1.089360966    | 1.098609697      |
| 30  | ESKİŞEHİR     | 0.942352254    | 1.012945573      |
| 31  | GAZIANTEP     | 1.058131036    | 0.945103626      |
| 32  | GİRESUN       | 1.129653556    | 1.048463394      |
| 33  | GÜMÜŞHANE     | 1.493216574    | 0.942282678      |
| 34  | HAKKARİ       | 1.025192325    | 3.927411831      |
| 35  | HATAY         | 1.02948035     | 0.963754907      |
| 36  | İĞDIR         | 0.97487415     | 1.199764142      |
| 37  | ISPARTA       | 0.895971075    | 1.015528163      |
| 38  | İSTANBUL      | 1.001424363    | 0.871778281      |
| 39  | İZMİR          | 0.945118322    | 0.954050396      |
| 40  | KAHRAMANMARAŞ  | 0.989191096   | 1.024198624      |
| 41  | KARABÜK       | 1.033906203    | 1.181949608      |
| 42  | KARAMAN       | 1.256391801    | 0.97910586       |
Table 6 (continued)

| No. | Provinces     | LQ (March–May) | LQ (June–August) |
|-----|---------------|----------------|------------------|
| 43  | KASTAMONU     | 2.281265483    | 2.412504373      |
| 44  | KAYSERİ       | 1.07645419     | 1.127614085      |
| 45  | KIRIKKALE     | 1.021291278    | 0.997035233      |
| 46  | KIRKLARELİ    | 1.092130577    | 0.962981484      |
| 47  | KIRŞEHİR      | 0.962546269    | 0.956028135      |
| 48  | KİLIS         | 1.098826406    | 0.891449284      |
| 49  | KOCAELİ       | 0.886402366    | 0.957725528      |
| 50  | KONYA         | 1.066748969    | 1.087033107      |
| 51  | KÜTAHYA       | 1.065604582    | 1.348574744      |
| 52  | MALATYA       | 1.068312826    | 1.066637613      |
| 53  | MANISA        | 0.958325497    | 0.986638778      |
| 54  | MARDİN        | 1.58320752     | 1.099844089      |
| 55  | MERSIN        | 0.982698457    | 1.008963771      |
| 56  | MUĞLA         | 0.885712917    | 0.898002189      |
| 57  | NEVŞEHİR      | 0.918769636    | 1.005009413      |
| 58  | NIĞDE         | 1.134783558    | 1.054808826      |
| 59  | ORDU          | 1.074958713    | 0.902650658      |
| 60  | OSMANİYE       | 0.900019673    | 0.905543164      |
| 61  | RİZE          | 1.070331278    | 0.821628804      |
| 62  | SAKARYA       | 0.816816496    | 0.97650305       |
| 63  | SAMSUN        | 1.070658086    | 0.971011598      |
| 64  | SİİRT         | 1.446050911    | 1.036823696      |
| 65  | SİNOP         | 1.12320912     | 1.354103383      |
| 66  | SİVAS         | 0.958799569    | 0.995190727      |
| 67  | ŞANLIURFA     | 1.120867494    | 1.117052851      |
| 68  | ŞİRNAK        | 1.560946613    | 1.581462309      |
| 69  | TEKİRDAĞ      | 1.087355024    | 1.055633862      |
| 70  | TOKAT         | 1.082608614    | 1.111619506      |
| 71  | TRABZON       | 1.545806619    | 0.94445965       |
| 72  | TUNCELİ       | 1.277339049    | 1.704290694      |
| 73  | UŞAK          | 0.905717224    | 1.068122824      |
| 74  | VAN           | 0.828277177    | 0.869684977      |
| 75  | YALOVA        | 1.019124681    | 0.994846437      |
| 76  | YOZGAT        | 1.114403024    | 1.016291666      |
| 77  | ZONGULDAK     | 1.052109822    | 0.977496079      |

Declarations

Conflict of interest  The author(s) declare that they have no competing interests.
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