1 Introduction

The goal of this paper is to analyze and understand the spatial pattern of Chronic Obstructive Pulmonary Disease (COPD) in the provinces of Turkey. COPD is a progressive disease that makes it hard to breathe. It can cause coughing that produces large amounts of mucus (a slimy substance), wheezing, shortness of breath, chest tightness, and other symptoms[1]. Worldwide, COPD ranked as the sixth leading cause of death in 1990. It is projected to be the fourth leading cause of death worldwide by 2030 due to an increase in smoking rates and demographic changes in many countries[2]. For this reason, the insurance sector of the country may need that kind of analysis to make more precise pricings in insurance products. Especially in health and life insurance products morbidities like COPD may affect the life expectancy as much as the premiums. COPD prevalence may exhibit spatial autocorrelation due to spatial similarity of provinces. Hence understanding of spatial pattern of COPD prevalence may provide better actuarial decisions. In this research, the risk factors of COPD are considered to be smoking, demography, environmental factors and socioeconomic status of the provinces. The spatial pattern of these factors in Turkey as well as their correlation to COPD prevalence is explored.

2 Method of Analysis

The raw data of the morbidity (COPD) is collected from Social Security Institution (SGK) and the useful data is selected in this raw data. The data of the inde-
dependent variables are collected and derived from the Turkish Statistical Institute (TUIK) and Tobacco and Alcohol Market Regulatory Authority (TAPDK). First of all, COPD prevalence is grouped by provinces. Then, it needs to be decided which variables define prevalence of COPD. Age, gender, socio-economic status, urbanization, schooling rate, infant mortality, smoke sales and air quality may be some of the random variables which are categorized by provinces. With the principal component analysis, three main indexes (demographic, socio-economic and environmental) are constructed as independent variables and unit cigarette sales ratio is also decided to use in the analysis. After deciding the variables based on principle component analysis, visualization and exploratory analysis of the data is applied by using geographic information systems (GIS). In spatial data analysis, constructing spatial proximity matrices is quite important. These proximity matrices are used to evaluate Morans I values for understanding the spatial autocorrelation. Then, Ordinary Linear Regression, Spatial Regression and Geographically Weighted Regression Models are established and compared. Finally, as a result of those findings in the analysis some actuarial deductions about COPD prevalence are made, especially in pricing of health insurance in each province of Turkey, separately.

3 Results and Conclusions

COPD prevalence visualization of provinces in Turkey seems quite meaningful. For example, COPD prevalence in Zonguldak is very high since the coal industry is very active in this province. Demographic, socio-economic and environmental indexes support this result in this region too. Socio-economic index shows that in big cities like stanbul, Ankara, zmır, Eskiehir socio-economic status is very high with respect to other provinces. The socio-economic status in Adana, Bursa and Edirne seems high. Unlikely, the eastern and south-eastern part of Turkey seem to have the lowest socio-economic status as a result.

Demographic index shows that the west coast of Turkey have very high demographic characteristics. The median age and life expectancy in those provinces is higher than the eastern provinces of Turkey. Demographic index is reducing gradually from west to east.

Environmental Index shows that the air quality is very low in the provinces at the very east of Turkey. Also, the provinces in which the industrial regions are developed such as Afyonkarahisar, Zonguldak and Bursa seem to have low air quality. The north coast of Turkey has the highest environmental characteristics.

Unit Cigarette Sales ratio is very high in big cities and the west coast of Turkey. It is thought that in the eastern provinces people prone to smoke cigarettes, but the results are quite different. The main reason of this contradiction may be that; the illegal and illicit tobacco or smoke usage in the eastern part is getting higher as the taxes on cigarette sales increase.

As a result of this analysis, the parameters show spatial autocorrelation which means that; spatial models of COPD prevalence should be preferred when deciding
the pricing of some actuarial products such as health insurance. Generally, spatial correlation is ignored in this kind of analysis, but due to the high autocorrelation the results may indicate serious change.

From the actuarial perspective, the results of the analysis are used to determine a general health insurance premium pricing. Since the analysis could not have been made on the basis of individuals, the pricing is made according to some risk regions which is constructed by the help of spatial exploratory analysis. Risk premiums of health insurance differ regionally. It is not possible to make an individual health insurance premium, but it is possible to use these result in the calculations of some group health insurance which contains people from all ages.

References
