OECD Ülkelerinde Gelir Dağılımının Gelir Eşitsizliği İndeksleri ile Değerlendirilmesi*

Arş. Gör. Işın ÇETİN
Uludağ Üniversitesi İİBF
Ekonometri Bölümü
isin@uludag.edu.tr

Arş. Gör. Dr. Dilek MURAT
Uludağ Üniversitesi İİBF
Ekonometri Bölümü
dilekm@uludag.edu.tr

Özet
Gelir eşitsizliği, kaynakların toplum içerisinde bireyler açısından ne şekilde dağılım gösterdiğini ölçen bir göstergedir. Bu nedenle yüksek gelir eşitsizliği toplumda bireyler tarafından arzu edilmemektedir. Bazı insanlar da, gelir eşitsizliğinin ülkenin ekonomik gelişimi açısından olumsuz olacağını düşünmektedir. (OECD Raporu, 2015). Şili, Meksika ve Türkiye en yüksek gelir eşitsizliğine sahip ülkelerdir. Dili İngilizce olan OECD ülkelerinde gelir eşitsizliği, ya OECD ortalama seyrindedir ya da üzerindedir. Bu noktadan hareketle, çalışmanın amacı, OECD ülkelerinde gelir eşitsizliğini analiz etmektir. Bu amaçla, çalışmada gelir eşitsizliğine dair indeksler kullanılmıştır. Bu indeksler; GINI katsayısı, GNI (Toplam Milli Gelir), Atkinson İndeksi ve Desil Oranıdır. Çalışmada mekânsal ekonometrik teknikler kullanılmıştır. Çıktılar, GeoDa 1.8.8 paket programı ile elde edilmiştir. Analizden elde edilen sonuçlara göre, Türkiye, Şili ve Meksika'da indeksler en yüksek değerlere sahiptir. Yani OECD ülkeleri arasında en yüksek gelir eşitsizliğine sahip ülkeler bunlardır. Çalışmada, 2015 yılına ait veriler kullanılmış olup, bulgular GeoDa 1.8.8 paket programı yardımıyla elde edilmiştir.
***Anahtar Kelimeler**:* Gelir Eşitsizliği, GINI Katsayısı, Atkinson İndeks, Toplam Milli Gelir.

Evaluation of Income Distribution in OECD Countries with Income Inequality Indexes

Abstract
Income inequality is an indicator of how material resources are distributed across society. Some people consider high levels of income inequality are morally undesirable. Others focus on income inequality as bad for economic progress of country (OECD Report; 2015). Chile, Mexcio and Turkey had the highest income inequality. OECD Anglophone countries had levels of inequality around or above the OECD average. From this point of view, this study aims to analyze the income inequality for OECD countries. For this aim, we use some indexes to analyze inequality. These indexes are GINI Index, GNI, Atkinson Index and Decile Ratio.

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We use spatial econometric techniques to evaluate the differences in terms of inequality for OECD countries. Results are obtained from GeoDA 1.8.8 Software Package Programme. As a result of analysis, Turkey, Chile and Mexico have the lowest value in terms of income inequality indexes, this means that in these countries, income inequality have highest value among OECD countries. The datas of indexes are about 2015 and the results are obtained using GeoDa 1.8.8 Software Package Programme.

Keywords: Income inequality, GINI Index, Atkinson Index, Gross National Income.
JEL Classification Codes: C30, C31, D63

Introduction

The evidence provided by the literature demonstrated that high income inequality, measured by the GINI index, could have adverse effects on the pace and sustainability of economic growth (ILO, IMF, OECD & World Bank, 2015: 4). One study showed that shorter periods of growth and more breaks in growth were associated with a higher inequality and the correlation is significant (Berg & Ostry, 2011: 4).

Distribution of the national income has been a topic of strong political and economic debate for a long period of time. Policymakers with a focus on development are usually focused on the distribution of the benefits of that growth, not only the in economic growth itself, especially to the poor. In fact, in the 1970's, one of the mottos of development policy was "growth with equity" (Kusnic & Davanzo, 1980: 1).

On the top of the global policy agenda leads the increasing income inequality, which reflects its malign social and political effects, highlighted by questions about the consistency of extreme inequality with democratic authority, in addition to its economic impact. While it is a fact that work and innovation should be rewarded with positive incentives, on the other hand, redical inequality would destabilize growth by reducing access to health and education, causing political and economic instability, reducing investments as a result and preventing the social consensus needed to adjust when major shocks are experienced, among others (Ostry et al.; 2014).

In OECD countries between mid-1980s and late 2000s, increases in household disposable income were not parallel to the gains in per capita GDP and this gap was particularly significant in households with low income, implying that the growth was due to increasing inequality. This was consistent with several research reporting that income inequality has widened in the majority of OECD countries during the last three decades, and that this trend was true across a wide range of income measures. The present study aims to summarize key trends in income inequality, with a focus on real household disposable income gains in different points of the income distribution. Then, it continues to discuss the potential impact of policies that aim to enhance growth on these developments and provides preliminary evidence on the contribution of growing inequality on long-term GDP (OECD, 2015: 3).

1. Literature Review

In the literature, there are lots of empirical study about income inequality. IMF, OECD and World Bank have yearly reports about income inequality and poverty. These reports give us important information about countries' profile.

Gastwirth (1972), his basic idea is to obtain upper and lower bounds to the GINI index from data which are grouped in intervals and the mean income in each interval is known. His paper shows that the GINI index can be accurately estimated without fitting curves to data whenever the data is grouped properly. Finally he saw that the effect of including negative incomes was much greater on IRS data than on the Census data.

Krueger and Perri (2005) used data from Consumer Expenditure Survey and evaluated that in the context of a calibrated general equilibrium production economy, whether this set up, or alternatively a standard incomplete markets model can account for the documented stylized consumption inequality facts from the U.S. data.

Rowlingson (2011) examines in his report, whether or not there is a link between income inequality and health and social problems, who might be most affected by income inequality and other possible impacts of income inequality, for example on the economy.

Pede et al. (2012) revisit the inequality-growth relationship using data at the sub-national (provincal)level in the Phillippines over the period 1991-2000. Results indicate that inequality Geographically Weighted Regression esitmates show that the magnitude of the inequality effect is not stable across regions.

Corak (2013) implies in his study, the demographic diversity between the high-income countries, and their underlying values, imply that it may well be impossible and indeed not even desirable, to change the degree of mobility in countries like the United Kingdom or the United States into the rates observed in Denmark.

Moser & Schnetzer (2014) investşgate the nexus regional income levels and inequality. They present a novel small-scale inequality database for Austrian municipalities to address this question. They find distinct regional clusters of both high average wages and high earnings inequality in Austria.

2. Aim, Data and Methodology

The present study aims to analyze income inequality in OECD countries, using the inequality indexes. In the literature, there are several measurement techniques utilized to determine income equality/inequality. Since income inequality is considered as poverty, poverty indicators could also be used to analyze income inequality. In this study, we used mainly four income inequality indexes. These were; Gini coefficient, Gross National Index, Decile Ratio and Atkinson Index. There are previous studies on these indicators, but several provide only basic statistical results. OECD, European Union and World Bank published reports on this topic. These are yearly, sometimes monthly analyses on the countries' situation around the world and their past performances. In the light of these information, in this study, we utilized descriptive statistics and histogram charts initially to have a priori information on the current situation in these countries. Then, we used spatial statistical techniques to determine the spatial interaction between OECD countries and their spatial homogeneity/heterogeneity. Finally, we were able to conclude which countries were similar or not in terms of income inequality indicators. We used 2015 data for all OECD countries. The results were obtained using Stata 13.0 MP and GeoDa 1.8.8 software programs.

3. Inequality and Income Distribution

Inequality measurement is a topic where the meaning of the terms could be the subject of a long debate. This is not problem of taxonomy for the purpose of taxonomy. In fact, inequality measurement endeavors to make sense of income distribution comparisons based on ethical principles, interesting mathematical constructs or simple intuition (Cowell, 1998: 1).

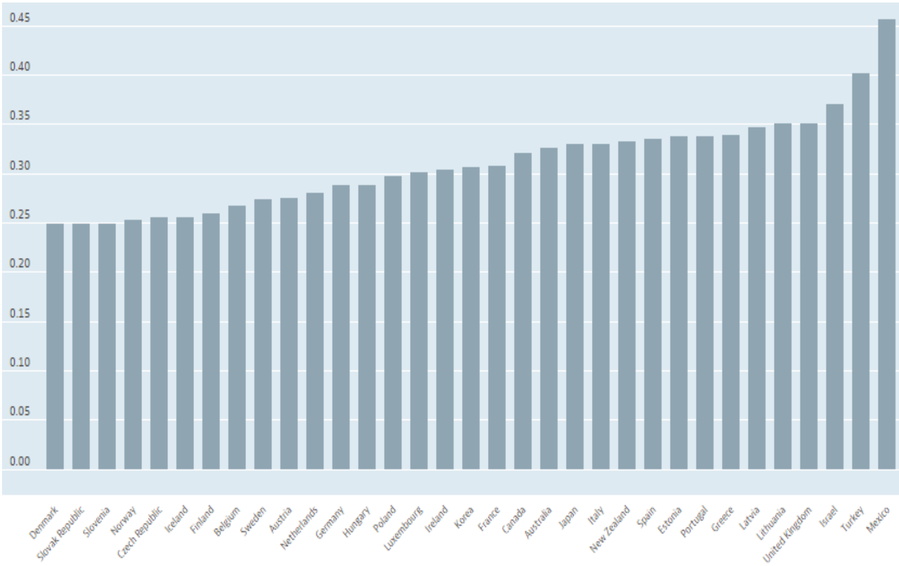
If a social welfare function expresses the aversion of a society in inequality, then it is the natural starting point of inferring inequality measures. Suppose that the function is homogenous in the first degree. Using this property, the mean income can be written as:

$$W(x) = \mu\left(\frac{x_1}{\mu}, \dots, \frac{x_n}{\mu}\right)$$

Then, normalize V(.) so that $V(1, \ldots, 1) = 1$. If there is an aversion for inequality, the normalized function reaches its maximum at 1 and thus, total welfare cannot be greater than μ. So, welfare function can be rewritten as:

$$W(x) = \mu(1 - I)$$

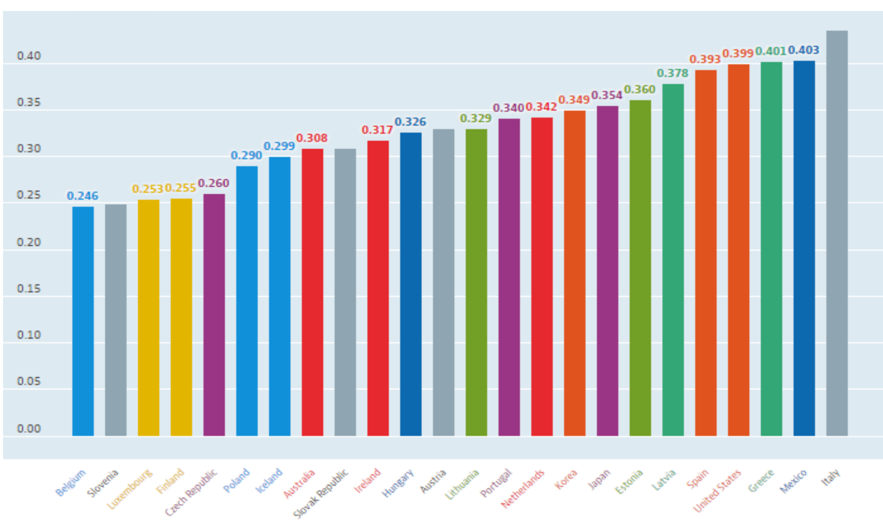
where I cannot be greater than 1. Then I is interpreted as an inequality measure and μI represents the cost of inequality. Welfare increases with μ, resulting in a welfare increase and an increase in inequality. It is essential to note that total welfare is measured by a mix between μ and I, and not only by one minus the degree of inequality I. If the poor get a little poorer, and the rich richer, this is a Pareto improvement. And welfare is greater provided that μ has risen more than I. The principle of transfers, on the contrary, leaves μ unchanged, but decreases I. There is thus a balance to maintain between these two important criteria: Pareto principle and the principle of transfers.



Graph 1: Income Inequality for OECD Countries

Source: OECD, https://data.oecd.org/inequality/incomeinequality.htm#indicator-chart

As can be seen in Graph 1, some countries have higher income inequality than the other OECD countries. This is for 2015 and as can be seen clearly that Mexico has the highest level of inequality and Denmark has the lowest. Turkey has really high income inequality, following Mexico.

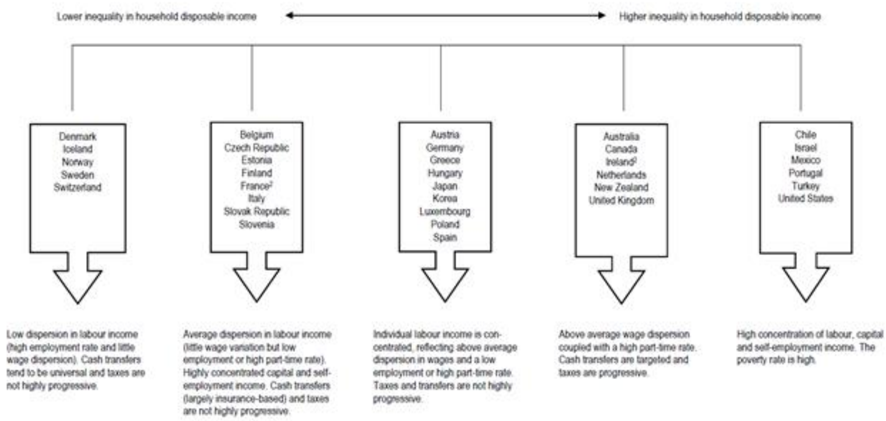


Graph 2: Poverty Chart for OECD Countries

Source: OECD, https://data.oecd.org/inequality/poverty-gap.htm#indicator-chart

Graph 2 indicates the poverty gap in OECD countries. The poverty graph is similar to the income inequality graph. Italy and Mexico are classified as the poorest, Belgium is the richest country in 2015.

Using these two graphs, OECD classified the countries in terms of income inequality and household income. The classification results could be shown as follows:



Graph 3: Poverty Chart for OECD Countries

Source: OECD Report, 2015.

4. LISA and BILISA Map

LISA Cluster maps show regions with significant local Moran statistics, classified in four groups of spatial correlation (high-high, low-low, high-low and low-high) (Annoni & Kozovska, 2010: 23). In LISA map, spatial clusters are highlighted with bright colors. High-high regions are in red. Hence, positive associations arise from own and neighboring high values of the attribute variable. Low-low regions are colored in blue. Here, positive spatial autocorrelation emerges from own and neighboring low values of the related variable. The two following requirements are satisfied by LISA:

a. The extent of significant spatial clustering of similar values around the observation are given by LISA based on each observation;
b. The sum of LISAs for all observations is proportional to a global indicator of spatial association (Anselin, 1995: 2).

5. Spatial Statistics

Commonly statistical research is limited to descriptive studies such as exploratory analysis and induction, and the development of generalizations on a determined population based on a sample drawn from that population. Map oriented studies were concentrated on data description and induction, examining the statistical literature for ideas on extraction of maximum information from georeferenced data. Essentially, spatial statistics could be considered a specific research area. Traditional statistical theory is based on the models about assumed independent observations (GIS).

Before 1960s, only a modest number of literature was developed in geography about perhaps the most challenging spatial question: how is one to account for the correlation in spatially distributed variables in an unbiased way? The fundamental ideas concerning the measurement of and testing for spatial autocorrelation were spawned in geography by Robinson (1956) and Thomas (1960), who saw the difficulties in dealing with dependent unequally sized units. Through their work and of others, the modifiable areal unit problem was addressed and spatial residuals from regression were evaluated. It was during this period that statisticians Moran (1948) and Geary (1954) developed their measures of spatial autocorrelation. Building on the work of Moran (1948) and Krishna Iyer (1949), Dacey (1965) addressed the issue of the possible association among contiguous spatial units. These joined count statistics led to the work of Cliff and Ord, whose monograph “Spatial Autocorrelation” (1973) opened the door to a new era in spatial analysis.

Spatial dependence could be included in two distinct ways in a standard linear regression model: as a spatially lagged dependent variable, functioning as an additional regressor, or in the error structure. This is considered as directly related to a spatial model and thus, a substantive spatial dependence (Anselin, 1988: 11). Estimation of the spatial regression models are based on an iterative procedure maximizing the likelihood (LeSage, 1997: 87).

The foundation of Gini coefficient is the Lorenz curve framework. As a tool, Lorenz curve reflects the income distributions as proposed by Lorenz (1905). It demonstrates which proportion of total income is earned by a given percentage of the population (Lorenzo & Paolo, 2005: 2). Lorenz Curve is obtained as follows:

$$L\left(\frac{k}{P}\right) = \frac{\sum_{i=1}^{k} y_i}{Y}$$

where;

$k = 1, \dots, n$ is the position of each individual in the income distribution,

$i = 1, \dots, k$ is the position of each individual in the income distribution,

P = total number of individuals in the distribution

y_i is the income of the i^{th} individual in the distribution

$\sum_{i=1}^{k} y_i$ is the cumulated income up to the k^{th} individual.

Lorenz Curve can be shown as:

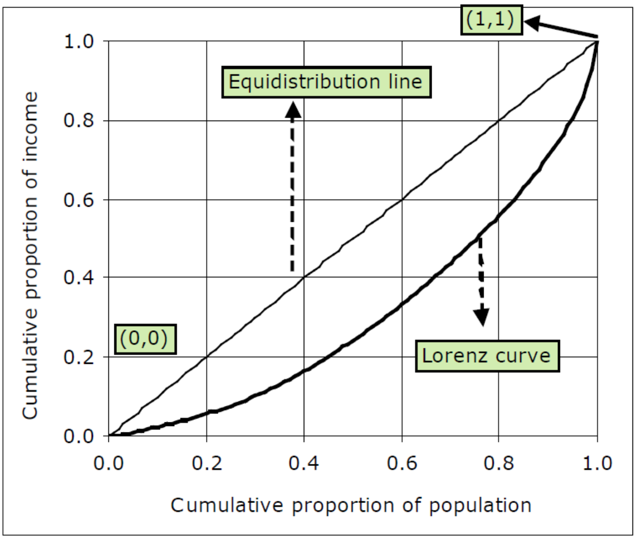


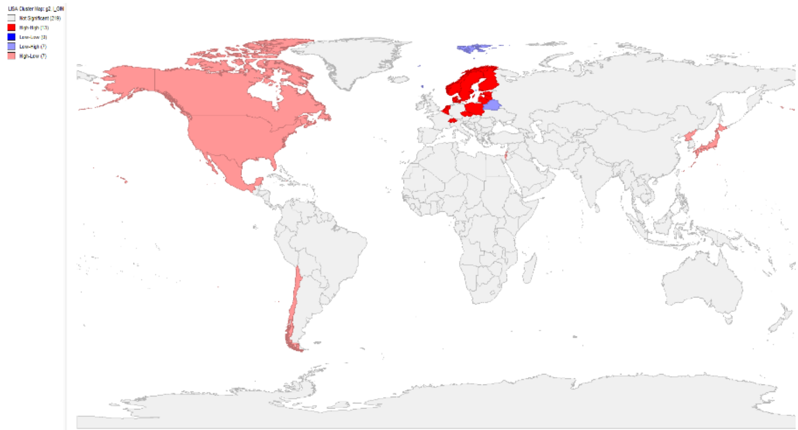
Figure 1: Lorenz Curve

Figure 1 illustrates the shape of a typical Lorenz Curve. As can be seen in the graph, the curve starts from coordinates (0, 0), as a zero fraction of the population owns a zero fraction of the income. Lorenz Curve records cumulative proportions, thus the total population owns the total income. Hence, the end point coordinates of the Lorenz curve are (1,1). If the income was equally distributed in a population, it would result in a given ratio of the population would have the identical ratio of the total income (Lorenzo & Paolo, 2005: 3).

In a perfectly equal society, the "poorest" 25% of the population would earn 25% of the total income, the "poorest" 50% of the population would earn 50% of the total income and the Lorenz Curve would follow the path of the 45° line of equality. As inequality increases, the Lorenz curve starts deviating from the quality line where the "poorest" 25% of the population could earn 10% of the total income and the "poorest" 50% of the population may earn 20% of the total income and so on (Maio, 2007: 851). Furthermore, the main flaw of the Gini coefficient as an income distribution measure is its inability to differentiate between different types of inequalities. Lorenz curves might indicate different patterns of income distribution, intersecting with each other, but they all result in similar Gini coefficient values (Atkinson, 1975: 189). The Gini coefficient is calculated from un-ordered size data as the "relative mean difference", i.e., the mean difference between every possible pair of individuals as follows:

$$\text{Gini} = \frac{1}{2n^2\bar{y}} \sum_{i=1}^{n} \sum_{j=1}^{n} |y_i - y_j|$$

In the present study, we uses this coefficient to determine the spatial interaction between OECD countries. Furthermore, we classified the countries in terms of income equality/inequality using this coefficient. The spatial diagram analysis could be given as follows:



Map 1: GINI Coefficient

This map is a Cluster Map and statistically significant at 5% significance level. There are four colors in this map where each color reflects a different spatial effect. The results obtained in the Cluster Map could be given similarly as:

High-high area (Dark red colored countries)	Norway, Sweden, Finland, Denmark, Poland, Czech Republic, Switzerland, Netherlands
Low-Low area (Dark blue colored countries)	-
Low-High area (Light blue colored countries)	Svalbard, Belarus
High-low area (Light red colored countries)	Canada, United States, Chile, Japan, Korea, Israel, Mexico

The countries in the high-high area have lower Gini coefficients than the other countries (means low income inequality) and there is a spatial interaction among them. These countries show spatial homogeneity. Similarly, the countries in high-low area have higher Gini coefficients (means high income inequality). These countries also demonstrate spatial homogeneity.

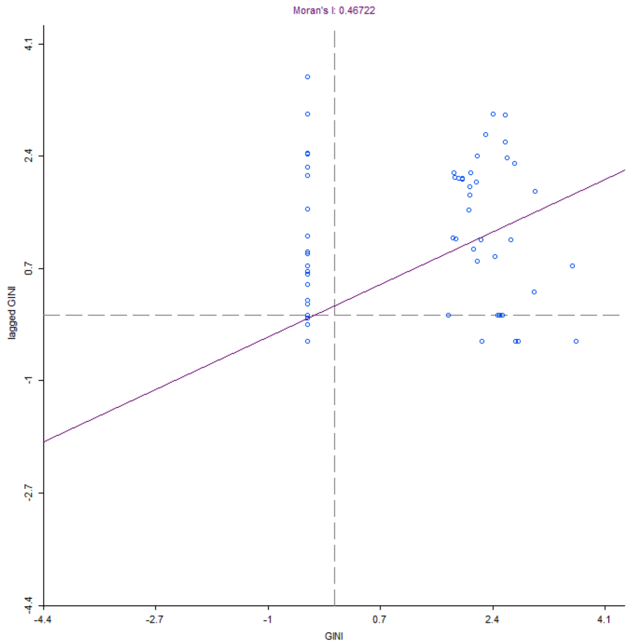
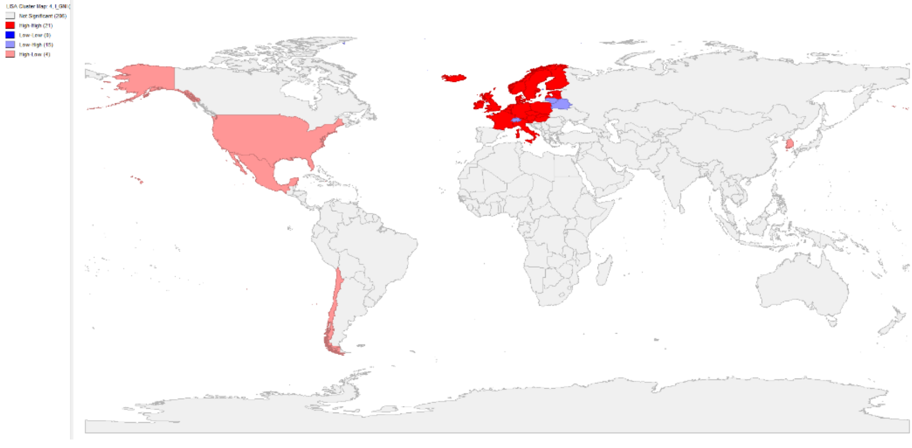


Figure 2: Moran's I Diagram of GINI

The map shows the homogeneity/heterogeneity of OECD countries. For spatial analysis, there are two main results obtained from the software. First one is the Cluster Map, second one is Moran's I diagram. We expected Moran's I value to be high. For Gini coefficient, this value was calculated as 0.4677 and because of a positive value, we could argue that there is a spatial autocorrelation among OECD countries. Also this value means that there is a positive spatial correlation between OECD countries.



Map 2: GNI (Gross National Income)

Map 2 is a Cluster Map and statistically significant at 5% significance level. The results obtained from Cluster Map of GNI can be given as:

High-high area (Dark red colored countries)	Norway, Sweden, Finland, Denmark, Estonia, Latvia, Poland, Czech Republic, Slovakia, Hungary, Italy, France, United Kingdom, United States, Belgium, Netherlands, Iceland, Austria, Ireland
Low-Low area (Dark blue colored countries)	-
Low-High area (Light blue colored countries)	Belarus, Lithuania, Switzerland
High-low area (Light red colored countries)	United States, Canada, Chile, Korea, Mexico

The countries in the high-high area, have lower GNI than the other countries (means low income inequality) and there is a spatial interaction among them. These countries show spatial homogeneity. The countries in the high-low area have higher Gross National Index (means high income inequality).

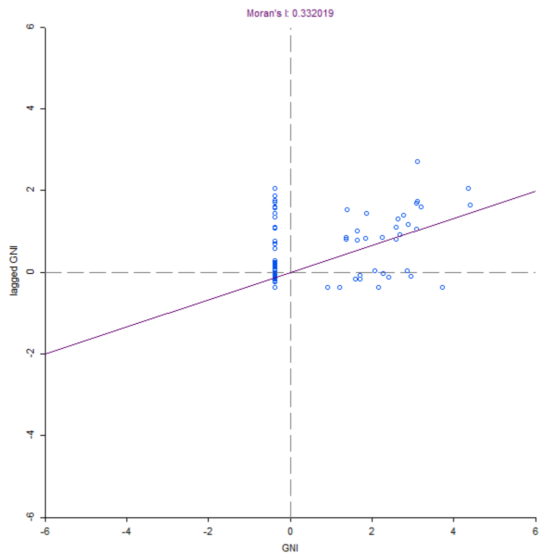
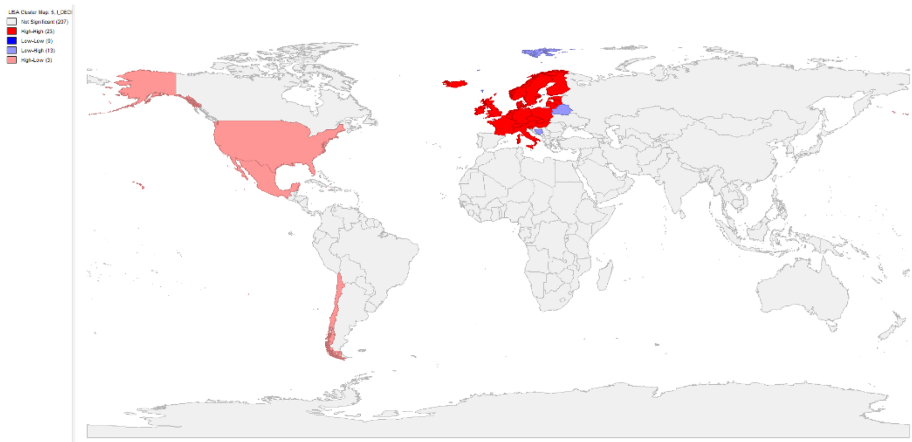


Figure 3: Moran’s I Diagram of GNI

The map demonstrates the homogeneity/heterogeneity of OECD countries. For Gross National Index, this value was calculated as 0.332 and because it has a positive value, we could argue that there is a spatial autocorrelation among OECD countries. Also this value means that there is a positive spatial correlation between OECD countries.

An effective way to examine income inequality is to calculate decile ratios. The calculation is conducted, for example, by dividing the income earned by the richest 10% of households by the income earned by the poorest 10% of households. Decile ratios were used by Gold et al. (2001) Gold et al. (2001) studied income inequality and teen birth rates in the US and Lobmayer and Wilkinson studied income inequality and mortality in 14 countries. An important advantage of this measure is that it makes sensitivity analyses possible (Maio, 2007: 851).



Map 3: Decile Ratios

Map 3 is a Cluster Map and statistically significant at 5% significance level. The results obtained from GNI Cluster Map can be given as follows:

High-high area (Dark red colored countries)	Norway, Sweden, Finland, Estonia, Latvia, Lithuania, Poland, Germany, Czech Republic, Austria, Hungary, Slovenia, Italy, Switzerland, France, United Kingdom, Iceland, Ireland
Low-Low area (Dark blue colored countries)	-
Low-High area (Light blue colored countries)	Svalbard, Belarus, Bosnia and Herzegovina
High-low area (Light red colored countries)	United States, Mexico, Chile

The countries in the high-high area, have lower Decile Ratios than the other countries (means low income inequality) and there is a spatial interaction among them. These countries show spatial homogeneity. The countries in the high-low area have higher Decile Ratios (means high income inequality).

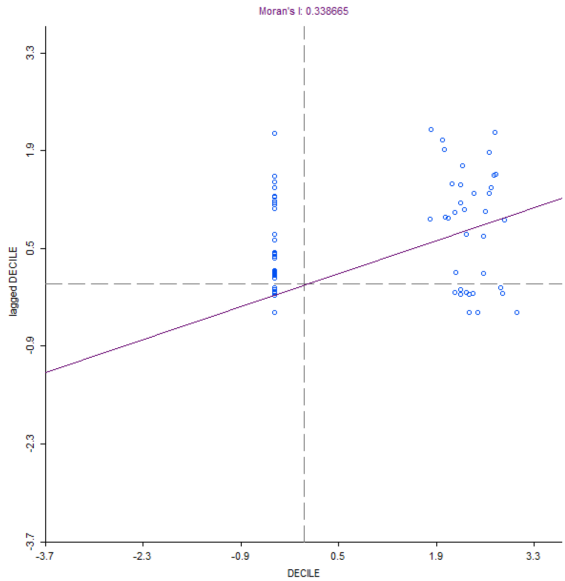
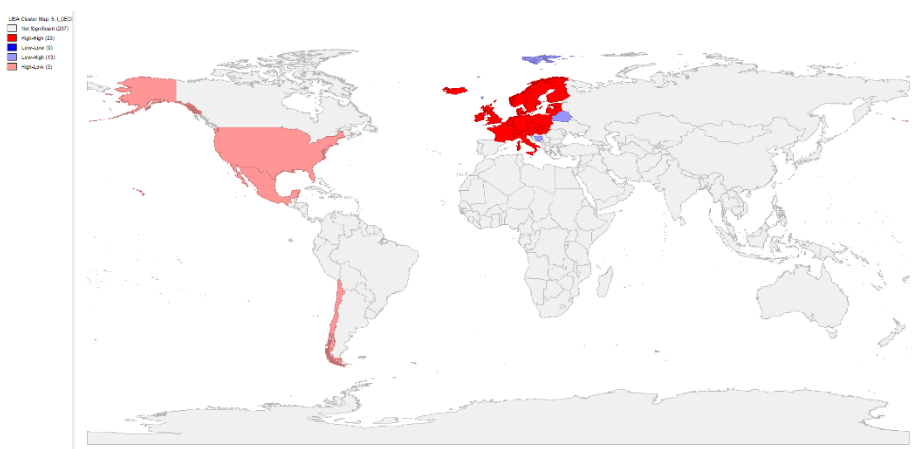


Figure 4: Moran’s I Diagram of Decile Ratio

The map shows the homogeneity/heterogeneity of OECD countries. For Decile ratio, this value was calculated as 0.3387 and since it has a positive value, we could argue that there is a spatial autocorrelation among OECD countries. Also this value means that there is a positive spatial correlation based on Decile ratio between OECD countries.



Map 4: Atkinson Index

Map 4 is a Cluster Map and statistically significant at 1% significance level. The results obtained from Cluster Map of Atkinson index can be given as follows:

High-high area (Dark red colored countries)	Norway, Sweden, Finland, Estonia, Latvia, Lithuania, Poland, Germany, Czech Republic, Austria, Hungary, Slovenia, Italy, Switzerland, France, United Kingdom, Iceland, Ireland
Low-Low area (Dark blue colored countries)	-
Low-High area (Light blue colored countries)	Svalbard, Belarus, Bosnia and Herzegovina
High-low area (Light red colored countries)	United States, Mexico, Chile

The countries in the high-high area have lower Atkinson Index than the other countries (means low income inequality) and there is a spatial interaction among them. These countries show spatial homogeneity. The countries in the high-low area have higher Atkinson Index (means high income inequality).

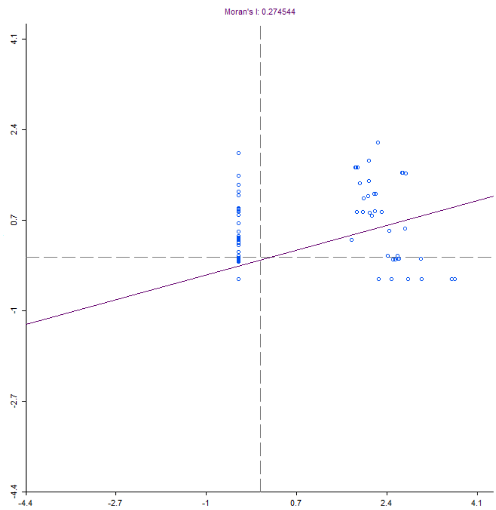


Figure 5: Moran's I Diagram of Atkinson Index

The map shows the homogeneity/heterogeneity of OECD countries. For Atkinson Index, this value was calculated as 0.2745 and since it has a positive value, we could argue that, there is a spatial autocorrelation among OECD countries. Also this value means there is a positive spatial correlation between OECD countries in terms of Atkinson Index.

Table 1: Country Similarity Comparison

	Countries with Low Income Inequality		Countries with High Income Inequality	
	LISA Map	**Coefficient**	**LISA Map**	**Coefficient**
Countries with High Homogenity	Norway, Sweden, Finland	0,954	Turkey, Chile, Mexico	0,974
Countries with Low Homogenity	Switzerland, Bosnia and Herzegovia	0,120	-	0,865

As can be seen in Table 1, some OECD countries have spatial similarity/dissimilarity. Norway, Finland and Sweden have low income inequality and these countries show spatial homogenity. This means that, these countries are similar in terms of income equality. On the other hand, Turkey, Chile and Mexico have high income inequality and these countries are similar in terms of income inequality.

Result

Income inequality is an important subject for all countries around the world. An excessively equal income distribution can be bad for economic efficiency. For example, the experience of socialist countries, where deliberately low inequality deprived people of the incentives needed for their active participation in economic activities. On the other hand, excessive inequality adversely affects people's quality of life, leading to a higher incidence of poverty and so impending progress in health and education and contributing to crime (World Bank, 2015).

The increase in income inequality is evident not just in a widening gap between the top and bottom income deciles, but also in the GINI coefficient, a broader measure of inequality. In OECD countries in the mid-1980s, the GINI measure stood at 0.29; by 2011/2012, it had increased by 3 points to 0.32. The evidence that the trend increases in income inequality have dragged down growth in many OECD countries has significant policy consequences. In particular, it challenges the view that policy makers necessarily have to address the trade-off between promoting growth and addressing inequality (OECD, 2015). In many OECD countries, income inequality has increased in past decades. In some countries, top earners have captured a large share of the

For the last decade, countries made some arrangements to minimize the income inequality. But unfourtunately, these attempts could not be enough. So currently, income inequality is really important and sometimes causes big economic problems. This situation is our starting point.

In this study, we analyze the equality of income for OECD countries. For this aim, we use spatial statistical techniques, LISA Maps, and classify the countries into four groups. These groups are defined as high-high, high-low, low-high and low-low area in spatial analysis. We use GeoDa 1.8.8 Software Programme. Datas are obtained from OECD official site.

As a result of the study, we use four basic income inequality indicators, GINI coefficient, GNI, Atkinson Index and Decile ratio. We use spatial statistical techniques, LISA Map, to evaluate the OECD countries' income inequality profile and similiraties/dissimilarities among OECD. According to results obtained from GINI coefficient; the income inequality in Norway, Sweden, Finland, Denmark, Poland, Czech Republic, Switzerland and Netherlands is low, in Canada, United States, Chile, Japan, Korea, Israel and Mexico, income inequality is higher than other countries and these countries also have spatial interaction and homogenity. For other indexes, the results are similar with GINI coefficient. Finally, the spatial homogenity coefficient is calculated. For Norway, Sweden and Finland, this coefficient is 0,954, means there is strong spatial homogenity and these countries are the best in terms of income equality. For Switzerland and Bosnia and Herzegovia the spatial homogenity coefficient is 0,120 means, there is low spatial homogenity and low spatial interaction. For Turkey, Chile and Mexico, spatial coefficient is 0,974 means there is high spatial interaction and homogenity, but in these countries, income inequality is higher than the other OECD countries.

As a general result, equality of income have currently importance for policy makers. So if the countries similarity/dissimilarity is taken into account, efficient results can be obtained for the economies. So, on this view, trade-off among OECD countries is really important. Trade-off can affect and increase GDP level, so inequality can decrease.

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