

# Geographical and Visual Investigations behind Populism Trends in the European Union

Alberto Ruiz Benitez de Lugo Hernandez - City, University of London

## 1. MOTIVATION AND DOMAIN DESCRIPTION

**P**OPULISM in Europe has been on the rise the last decade. The Financial Crisis (2008), Sovereign Debt Crisis (2010) and Refugee Crisis have encouraged an atmosphere of anti-european inclinations, commonly known as **Euroscepticism**. Beside this, an undeniable increase in nationalism has flooded over the entire European Union, including Switzerland and Norway, no matter political wing or population levels.

The nature of this phenomenon is heterogeneous and worthy to study because this scenario is not ordinary, as Missiroli (2011) [14] says, *"The rise and decline of populist forces and the spread of anti-EU rhetoric have not always gone hand-in-hand"*. Therefore, this situation should contain patterns that can be analyzed using both computational and visualization techniques. Then, the motivation of this project is the geographical study of the populism over the European Union using visualization methods and computational techniques, such as Clustering.

## 2. RESEARCH QUESTIONS AND DATA

For this project, Populism is understood as anti-capitalism, anti-globalization and euroscepticism political perspectives. It is important to set this assumption due how abstract this term is. The procedure to represent whether a political party is populist or not is using a self-made continuous indicator given by the percentage of the populism representation in the parliament. In other words, the amount of senators (parliamentarians) that the political parties cataloged as populist have obtained in the elections. The research questions around this analysis are:

- Has the populism increased its levels in Europe since the nineties? if so, has it followed a logic geographical distribution by areas?
- Are the new political parties, usually post-2008 parties, the reason of populism increase?
- Is the political wing an important feature while studying populism distribution?
- May the European countries be grouped according to populism levels?

In order to answer this questions, a complete new dataset has been created using historical EU elections database [1] and further political information (Political ideology) from official European Institutions [2]. This ideology information comes from the European Parliament, where every political party must select a biggest umbrella party to join in, showing their ideological inclinations.

Therefore, to pursue this research question the raw data has been transformed, structured and cleaned. The obtained dataset is composed of discrete (*year, number of senators, population, total number of senators*), continuous (*senator distribution, votes percentage*) and categorical data (*country names, party names, political wing, populism, new party*), all in a proper and organized tabular structure - 11 columns (features) and 1759 rows (observations).

## 3. TASKS AND APPROACH

**3.1 Set a continuous populism dimension to develop further analysis and notice whether its level has increase or not during the nineties in Europe**

The populism indicator needs to be generalized. Therefore, *"senator distribution"* feature is obtained using python transformations (pandas library) to display the representation in parliament of populist political parties as percentage in the European Union (including Norway and Switzerland).

**3.2 Analyze populism spatial distribution in Europe using computational cartograms techniques**

This continuous populist dimension allows us to analyze the spatial variations of populism using cartographic techniques, as applied in Bouts, 2015 [4]. The software package used to this task is ScapeToad [18], an open-source tool to develop cartograms based on statistical variables (mass or density). To reach this goal, a shapefile has been developed associating the populism dimension to shapefile polygons using the QGIS software tool. Then, a simple choropleth map and a populism based cartogram are displayed to compare.

**3.3 Analyze using gradient density colour 2D maps whether new political parties are usually populist or not**

A straightforward approach to analyze the country populism contribution from new political parties, is a simple count of how many of them are populist. For this task, Tableau software have been used to display high-dimensional spatial data into two dimensions. In order to identify spatial patterns, as done in Moosavi, 2017 [15]. Then, geographically-weighted coloured maps are plotted according to new party-populism density.

**3.4 Identify wing political distributions using heatmaps, particularly in new political parties (post 2008)**

The political wing distribution is evaluated using Tableau software, this categorical data is plotted as heatmaps to analyze the density of each wing per country, as average. This technique is extensively applied, good examples are seen in Ferreira, 2013 [10] and Zhao, 2014 [21].

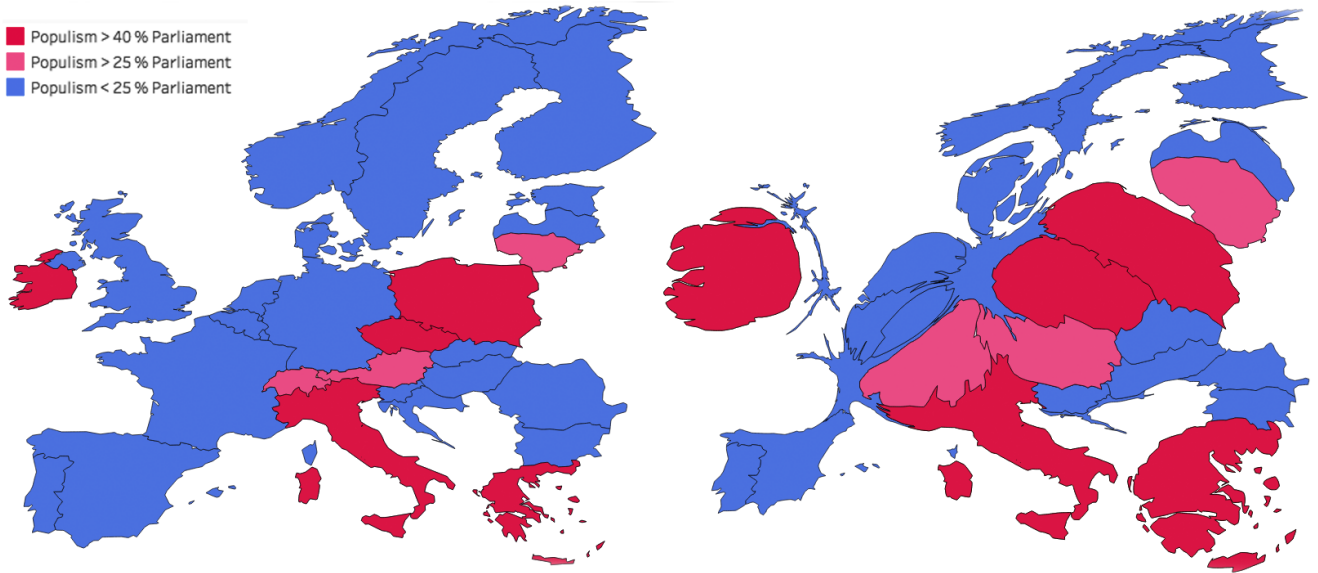


Fig 1. Populism distribution in Europe (Max levels reached) from 1990 to 2016. Left-to-right respectively, regular coloured EU map and coloured EU cartogram faceted with Maximum populism levels. Source: Prepared, ScapeToad [5] and QGIS.

### 3.5 Explore populism associations between countries using Scatter plots and computational Clustering methods

Finally, the last task is the allocation of groups between the countries according to shared patterns. The software used to this task are Python (SciPy library, Hierarchical Clustering) and Tableau (Scatter plots and K-means Clustering). Examples of these techniques are respectively available in Seo, 2002 [17] and Zhou, 2009 [22].

## 4. ANALYTICAL STEPS

### 4.1 Set a continuous populism dimension

The entire project is based on the assumption of populism increase in the European Union, including Norway and Switzerland. Therefore the variable "senator distribution", is plotted to guarantee this fact, Fig 2.

The procedure to obtain this metric is selecting the populism representation per year, then create an average value for all the European countries. According to Fig 2, this increase in populism level turns to be true. Because, the Parliament representation (average) of the European populism per year has a positive trend.

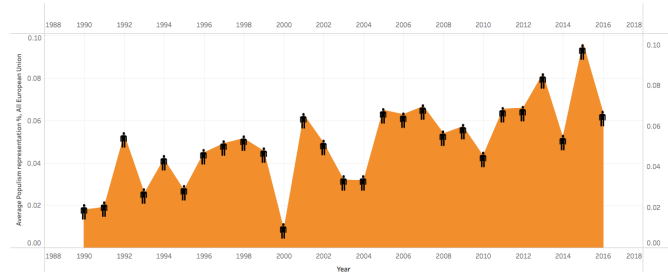


Fig 2. Populism parliament representation (average) of European countries 1990-2016. Source: Prepared, Tableau.

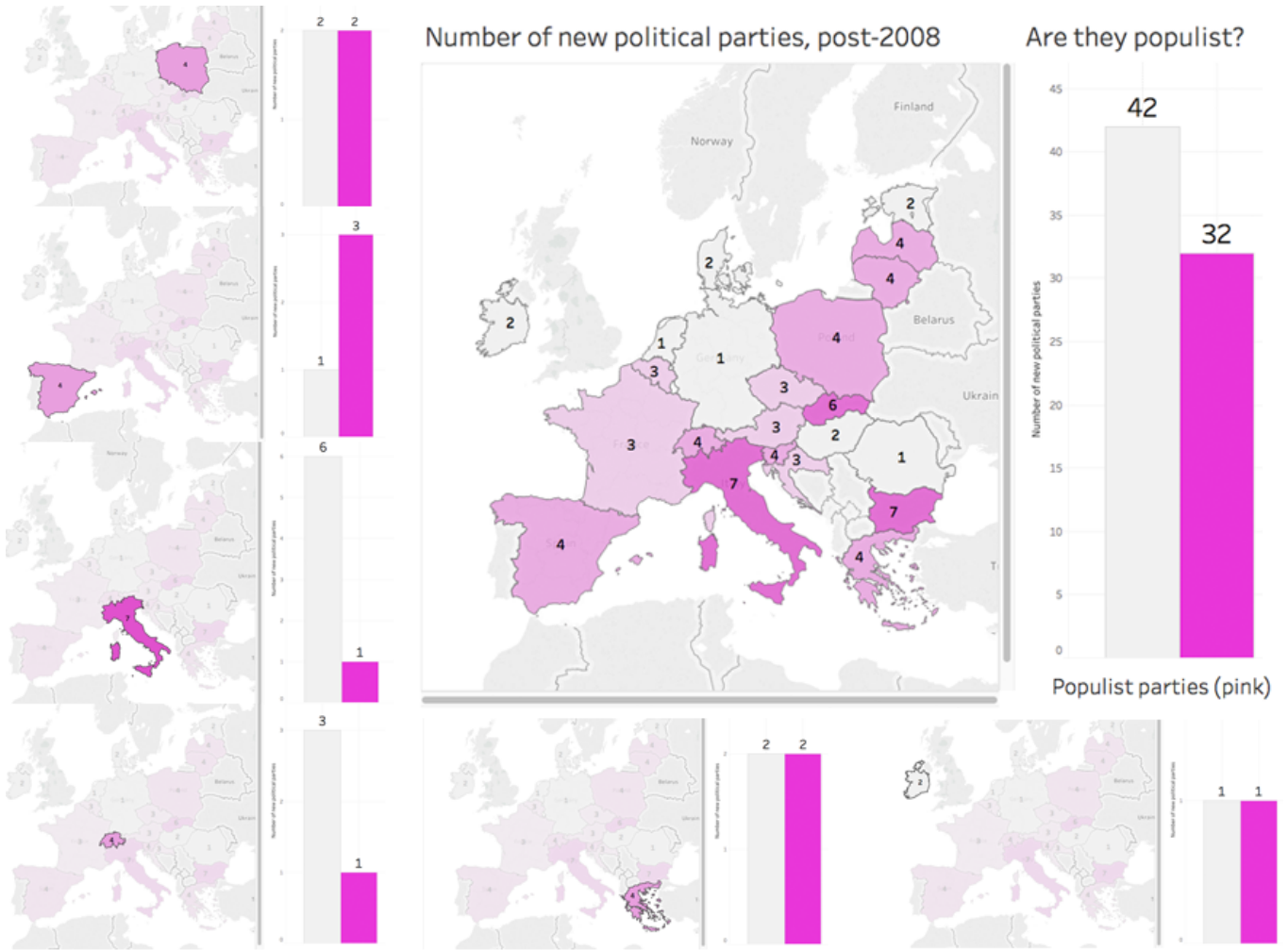
### 4.2 Populism distribution (Max levels) using cartograms techniques

There are many approaches to show populism distribution in Europe, but according to given results the best metric is the **maximum populism level reached per country**, Fig 1. Obtained through the "senator distribution" feature analyzed in 4.1 section. In other words, the maximum populist level ever reach by country since 1990.

The developing process to obtain the cartogram, Fig 1, was using the ScapeToad tool [18]. Which provides a cartogram from an original shapefile with measures associated to their polygons (mass or density). The original file was obtained from Eurostat [9] and modified using QGIS tool, assigning the corresponding max populism values to each country polygon. Furthermore, the colour grouping assignment corresponds to a cluster solution obtained in 4.5 section, Fig 7.

This approach is perfect to visualize populism percentage per country and make comparisons between them. Mainly, because this computational method avoids high distortions that could lead to difficulties while reading the map. As Gastner 2004 [12] says, "Many methods for making cartograms have been proposed, some of them are extremely complex, but all suffer either from this lack of readability or from other pathologies, like overlapping regions or strong dependence on the choice of coordinate axes". The decision to choose the maximum populism value instead others, such as the average, was based on its extreme nature, which makes the map easier to read due to high difference between the polygons values.

Therefore, this has been the stopping criteria in this method. Because it allows to evaluate how much populism a country has respect another, with a simple glance.



## Political Wing Distribution

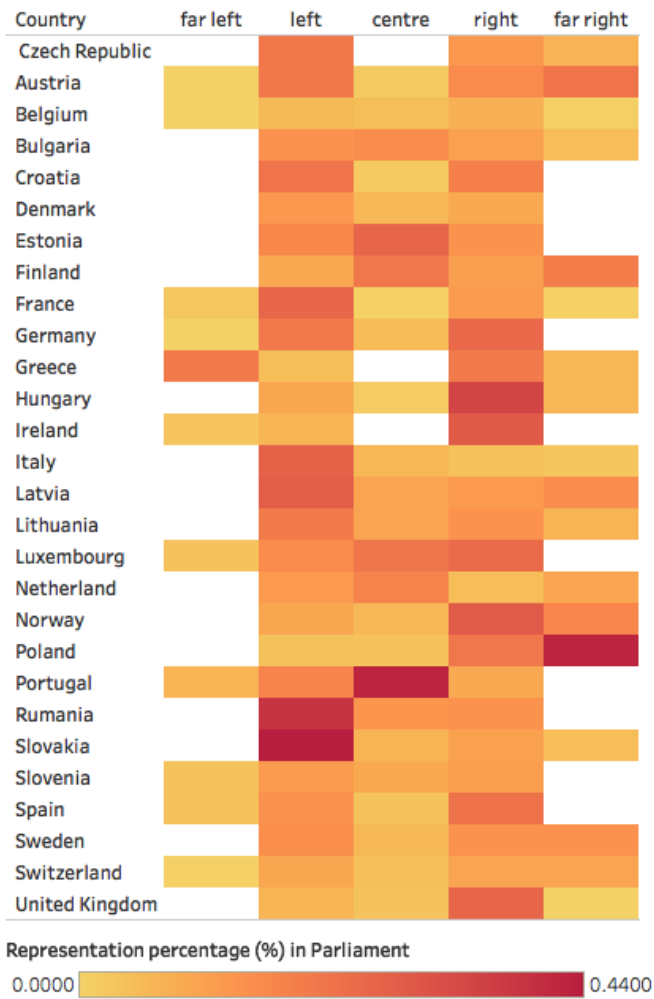


Fig 4. Political wing distribution per country. The Darker the square is, the higher the representation in parliament. Source: Prepared, Tableau.

This visualization techniques allows the reader to understand how the political wing spectrum is structured in Europe. A remarkable fact is the normalization, because on average, the wing distribution rests on central values commonly known as traditional values: right, centre and left. Although, there are also some outliers regarding far-wing perspectives in Poland, skewed to the far-right and Greece skewed the far-left.

In the same way, this distribution can be analyzed regarding the new populist parties created after 2008's financial crisis, Fig 5. On the contrary, this results are not normalized and the distribution is clearly skewed to the right wing, especially to right and far-right perspectives.

Moreover, the number of countries shown is lower because not all the European countries had new political parties, as seen in the 4.3 section.

## Political wing distribution (New populist parties, post-2008)

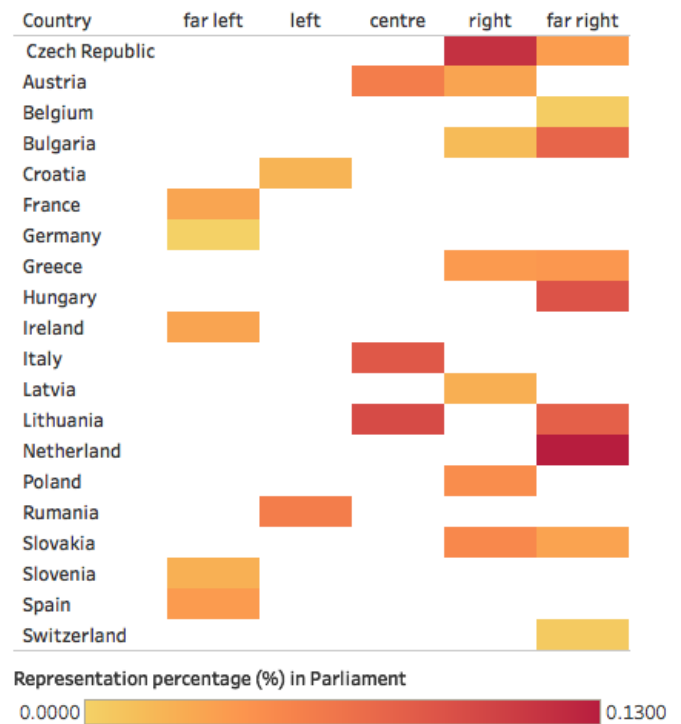


Fig 5. Political wing distribution per country, new political parties after 2008. The Darker the square is, the higher the representation in parliament. Source: Prepared, Tableau.

### 4.5 Build country groups using computational Clustering methods based on Scatter plots

Structured data in groups may lead to further understanding of the populism issue in Europe. Therefore, the data has been displayed using scatter plots to analyze its distribution according to population, maximum and average populism values. Then, two clustering methods have been use to group the countries, hierarchical clustering (python, SciPy) [17] and K-mean clustering (Tableau, built-in clustering) [22]. Estonia have no populist parties, hence no cluster was assigned.

The procedure to get this scatter plot have been transforming the data, obtaining the max populism values ever reached per country and generating an average populism value in the study period, 1990-2016. According the results given, the k-mean clustering have been chosen to set the groups, Fig 6. Both algorithms are partition-based clustering [3], but k-mean has gave more reasonable results [5] according to the stopping criteria, which is the Max populism level reached, Fig 7.

In the same way, the populism level have been compared with population amount in order to get deeper understanding of the problem and provide another group structure, Fig 8. To obtain these clusters, the last available population data has been added. The method to classify also has been k-mean clustering in Tableau, due to better results and stopping criteria, which is the population size, Fig 9.

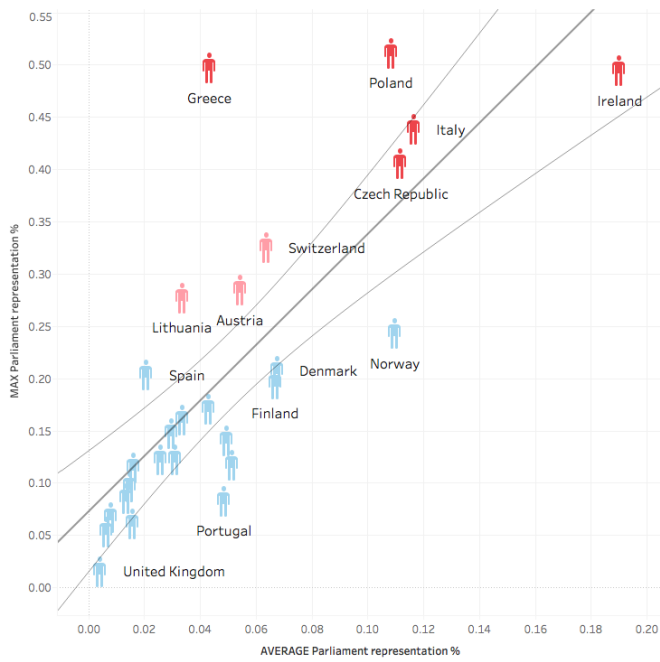


Fig 6. Populism parliament representation, average (X axis) and maximum values (Y axis). Source: Prepared, Tableau.

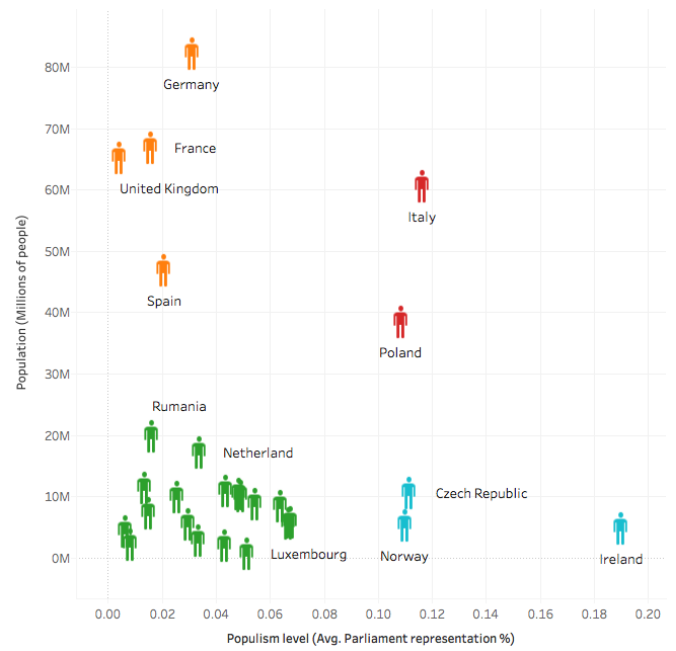


Fig 8. Populism (X axis) and Population (Y Axis) distribution. Source: Prepared, Tableau.

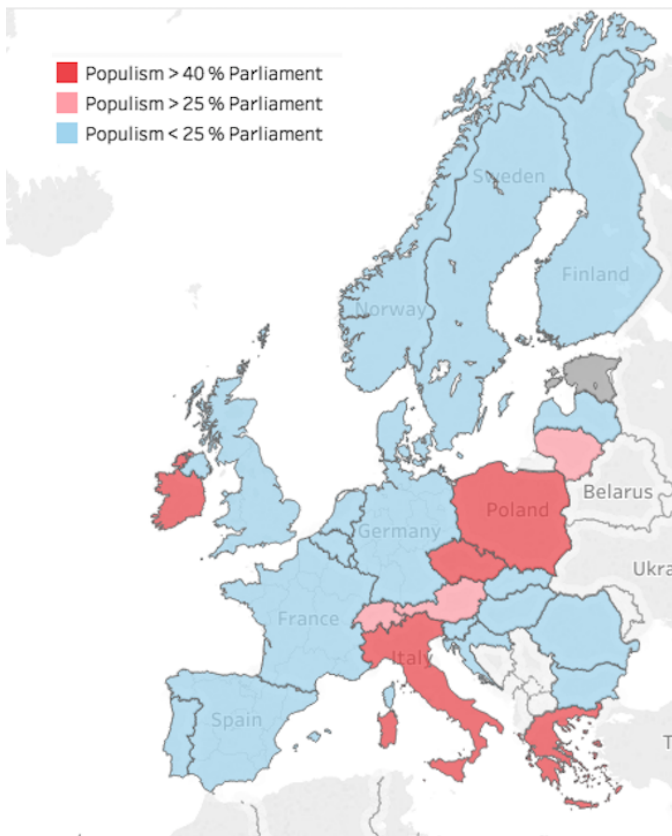


Fig 7. Max Populism representation Clustering. Source: Prepared, Tableau.

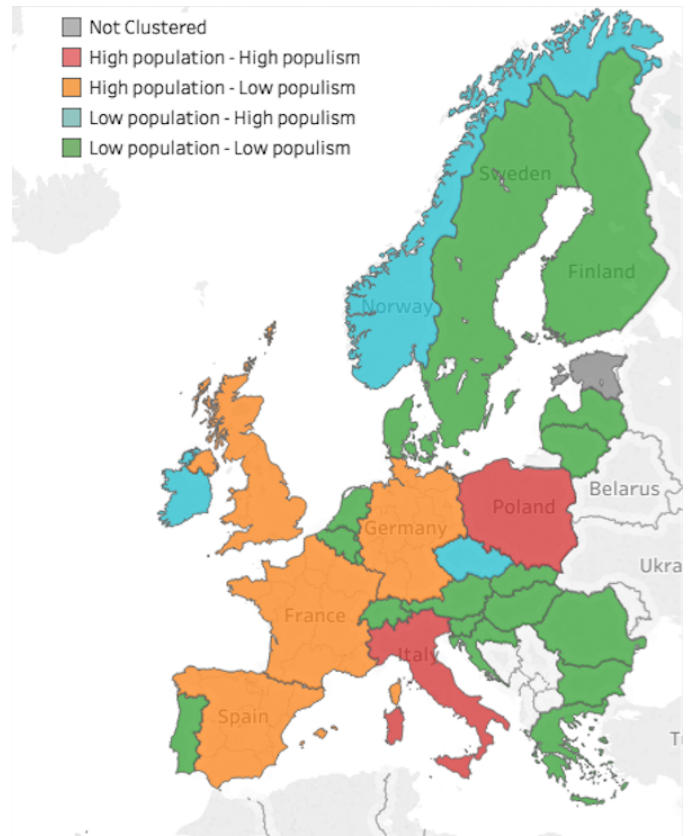


Fig 9. Populism - population Clustering. Source: Prepared, Tableau.



## 5. FINDINGS

The populism levels in Europe have raised since 1990 as seen in Fig 1. Thus, the first part of the starting research question is solved. However, according to given results, the distribution of this populism only follows a logic geographical distribution in eastern Europe, where many countries (Poland, Czech Republic, Latvia) have higher populist levels. The rest are independent cases where particular social-economic factors have stumbled their political stability. Apart from Estonia, which has no populism representation.

Secondly, the participation in populism of new political parties created after 2008 is low but significant. The number of these parties that are populist (32) are below than the non-populist (42). However, the electoral results of these parties are overwhelming, reaching high percentages of parliament representation. Then, regarding the second research question, the new parties are not encouraging the populism increase directly, but they have sufficient importance in this matter. Furthermore, their geographical distribution focus on southern European countries, whereas northern countries already had this kind of political parties, but with low or insignificant representation according to data and Fig 3.

Next, the political wing, Fig 4, represents a balanced structured between right and left as average, with low participation of far-wing parties among the countries. Although, there are exceptions, such as Poland, Greece or Austria. Unfortunately, this distribution is not balanced regarding new political parties, as seen in Fig 5, which is skewed to the right. Therefore, right and far-right wings are wide expanded between post 2008 political parties. This structure explains many behaviors in Europe regarding immigration and refugees [11]. Hence, the third research question is answered, because the political wing distribution is a good feature to study populism, but is more representative applied to new post 2008 parties.

Finally, there are a linear relation between the maximum and average level of populism, as seen in Fig 6, which provides a clear distinction of populism levels in three groups. Besides, the level of population is also an important factor to take into account while analyzing. Because populism usually depends of country integration [7], and this might vary depending of the population size. Fig 8, shows four different groups of countries in Europe. Thus, the last research question is solved, because countries can be grouped by populism patterns.

## 6. CRITICAL REFLECTION

The findings obtained from the chosen methods and techniques provide useful information about recent events in Europe. The raise of populism has caused important tensions within the EU, first with 2008 Financial Crisis, then the Debt Crisis in 2010 and finally the Refugee Crisis nowadays. According to the results given, this scenario does not follow a clear geographic distribution, but follows social-economic factors that are particular in each country.

The most important areas affected by populism can be analyzed in Fig 1, where the size of each country is related to the maximum populism level reached. This allows the reader to make comparisons, for instance the Ireland-UK case is quite evident. The UK has lower levels of populism mainly represented by UKIP, whereas Ireland has a higher level due to the Unionism issue [20]. In the same way, the higher levels in Poland are explained by the increase of far-right and anti-immigration policies [11][13], similarly Czech Republic, Austria, Switzerland and Latvia have followed this trend, pointing immigration as the source of their problems. On the other hand, the increase of far-left wing in Greece has been encouraged during the financial and debt crisis [19]. Meanwhile, the Italian case is based on political disputes grouped in coalitions, the most well known is called the Northern League [6].

Therefore, populism looks like a reaction founded on changes in western way of life that globalization has modified forever, rather than a cyclic effect. Hence, this project can lead to further investigations in this research field where these characteristics could be analyzed based on the findings obtained in this paper.

Furthermore, the visualizations techniques applied in this work provide a powerful framework to catch up the populism characteristics easily. Because all the techniques applied seek a simplification of high-dimensional and complex data into simple representation.

For instance, the political wing distribution has been studied per country using Heat Maps, Fig 4 and Fig 5. Which allows the reader to understand how the political wing spectrum is structured in Europe. The first remarkable detail is the normalization, as said in section 4.4, the wing distribution rests on central values commonly known as traditional values: right, centre and left. Meanwhile, there are some outliers regarding far-wing perspectives in Poland, skewed to far-right and Greece skewed to far-left. This can be extremely useful to understand some patterns and cultural behaviors in future investigations.

In the same way, scatter plots were extremely useful to pursue further analysis. In fact, this visualization method pointed to better performance while answering the research questions. Particularly while k-mean clustering was implemented, Fig 8. The scatter plot showed four clear groups that helped to decide the number of centroids while using the algorithm. Moreover, this algorithm was selected over the hierarchical clustering thanks to Breithreutz [5], who says "*Partitioning methods require that the number of clusters to be found is statically set, and incorrect choice of this value can lead to serious noise sensitivity*". Because in this particular case, population, the number of groups were known in advance.

Moreover, the visualization techniques have been very helpful while answering the second research question, showing a common pattern regarding the most populist countries (Greece, Italy, Ireland and Poland). Which apparently have a balanced distributions in new parties created after 2008, Fig 3. In other words, these countries usually have the same amount of populism and non-populism new political parties created.

Finally, all these visualization techniques and computational methods can be used in further knowledge areas. Especially the cartogram method obtained in Fig 1, which enable a simple representation of density features that can be used to compare and evaluate attributes in other areas. Such as public expenditure, health systems or military spending within European countries or any other field. Similarly, Heat Maps might be used to represent further categorical information of any kind like public spending distribution by sectors such as infrastructure, health, pensions, unemployment among others. The good characteristic of these visualization techniques is that many of them depends on data type, thus they are easily exportable to any field which share its data type. The same happens with the computational clustering methods, as long as the data may be represented in two dimensions, the clustering methods may be applied on every research field that use this kind of information.

To sum up, the visualization methods and techniques developed in this project not only provide a wide and clear understanding of the populism in Europe. But also, they can be exported to further research areas where geographical and visual techniques are needed. No matter the field, as long as they share the same data type.

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