**STAT 112 – DATA Visualization with Tableu Project**

**Rabia Görünmez**

**Statistic – METU**

**Ankara, Türkiye**

**rabia.gorunmez@metu.edu.tr**

**INTRODUCTION**

This project was designed to analyze the relationships between economic, environmental and social indicators across different countries. The data was visualized using Tableau and the links between variables such as carbon emissions, energy consumption, per capita income, total tax rates and ease of doing business were examined. The aim is to understand the dynamics between countries' sustainable development, economic growth and environmental impacts.

The data includes annual statistics, economic indicators and environmental factors from various countries. This analysis provides important insights for understanding how economic growth can be balanced with environmental sustainability.

**DATA PREPROCESSİNG**

Data Source and Cleaning Process:

1. Missing Data Detection and Adjustment: When the data were analyzed, missing information such as energy consumption and tax rate were found in some countries. These missing values were handled by mean-filling or by excluding missing countries.

2. Standardization: Data at different scales were normalized to facilitate comparison. For example, variables such as per capita income and carbon emissions were put on a logarithmic scale.

3. Combining Data Sources:

Data were obtained from different datasets, such as carbon emissions (CO2), energy consumption, total tax rate, CPI, MSRP, and merged. **A white background with lines and letters

Description automatically generated**

Figure 2: Relationship tax rates and tax revenues

4. Data Validation: The data was checked with data source merging and cleaning tools in Tableau to detect discrepancies before graphical analysis.

**EXPLORATORY DATA ANALYSIS**

The project includes five research questions, each aimed at uncovering different aspects of car sales.

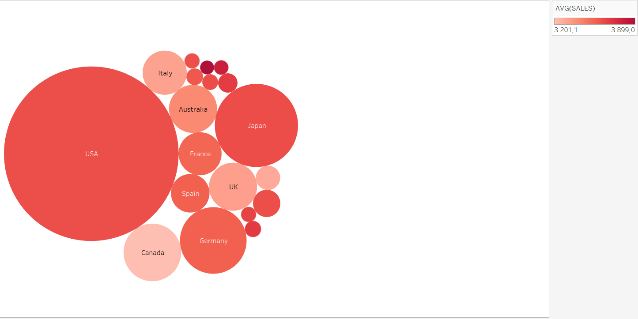


Figure 1:Relationship between sales and CO2 emission

**1)Is there a strong relationship between sales and CO2 emission levels?**

The graph is effective for examining trade off between economic growths and environmental cost. It shows that there is a strong relationship between sales and CO2 emissions. Countries that have high sales rates, generally, have high CO2 emissions levels. On the other hand, this corelation is not linear. While the US is economically strong, it poses risks to environmental sustainability. While countries such as Japan and Germany are notable for their high sales and CO2 emissions, sustainability policies such as the transition to renewable energy could reduce their environmental impact.

**2)Do countries with high tax rates also have high tax revenues?**

This graph relates countries' tax revenues (as a percentage of GDP) to their total tax rates (as a percentage of profits). Each point represents a country and visualizes the relationship between these two variables. It is also a powerful tool for analyzing differences in countries' tax policies, as there is generally a positive relationship between tax revenues and the total tax rate. However, this relationship is not linear and some countries fall outside this general trend.

**3) How reducing CO2 emissions can affect life expectancy in the long term?**

The graph, every countries CO2 emissions with treemap area size and life exceptancy with color intensity are compared. USA is an example for high CO2 emission does not reduces life exceptancy. Another different example is Norway that has low emissions and high life exceptancy. Some countries that have low CO2 emissions life expectancy has remained high overall.

**4) if sales remain stable, does this indicate that the market has reached saturation?**

**A screenshot of a graph

Description automatically generated**

**A screenshot of a computer screen

Description automatically generated**

Figure 3: Relationship between CO2 emission and life expectancy

Figure 4: Relationship between total tax rate and sales

The graph compares to sales performance by years and average total tax rate. Bars represent sales volumes, while bubbles visualize total tax rates. Average sales remained stable at 2018, 2019, and 2020 ,which can mean economic slowdown or that the market has reached saturation. The pandemic in

2020 did not cause a decrease in sales. This may indicate that the products analyzed were independent of the pandemic impact. Although there was no increase or decrease in taxes, there was also no significant change in sales volume. This may indicate that the impact of tax rates on sales is limited.

**5)** **In countries where CPI is higher than MSRP, will the buying power of consumers be affected?**

**A screenshot of a graph

Description automatically generated**

Figure 5: Relationship between CPI and MSRP

The graph compared to CPI and MSRP across different countries. Blue stick shows average CPI, and red stick shows average MSRP. In the US, the difference between CPI and MSRP is quite significant. This difference indicates that consumer prices are higher than production costs. High consumer prices can be associated with a strong economic market and high purchasing power. Similarly in the UK, the CPI is above the MSRP. However, the difference is smaller compared to the US. This may indicate that consumer prices are more balanced in the UK.In Norway, the difference between CPI and MSRP is quite low. This may indicate that product prices in the country are generally cost-oriented and not subject to excessive price increases.

**Conclusion**

As a result of the analyses and visualizations, important findings on the economic, environmental and social dynamics between countries have been obtained. The results from each analysis clearly illustrate the complex relationships between countries' economic policies, environmental sensitivities and social investments.The analysis shows that large economies generally produce higher carbon emissions. In particular, countries such as the United States exhibit a clear advantage in terms of both sales revenues and carbon emissions. This suggests that in large economies, environmental costs are a by-product of economic growth. However, countries such as Germany, Japan and France are highly competitive in terms of economic income despite having moderate carbon emissions. These countries may have adopted more sustainable policies to limit their environmental impact.

Interestingly, countries with low carbon emissions (e.g. Scandinavian countries) also have low sales revenues. This may indicate the potential for environmental sensitivity to constrain economic activity, or it may indicate that economic activity is concentrated in more niche areas in countries targeting low carbon emissions. In this context, it is understood that reducing carbon emissions does not have to completely limit economic growth, but needs to be balanced with appropriate policies.The relationship between tax rates and ease of doing business is not as linear as expected. For example, countries such as the United Kingdom and Canada, in addition to having low tax rates, also rank high in the ease of doing business ranking. This suggests that low tax rates create a favorable atmosphere for entrepreneurs. However, the low ease of doing business rankings despite high tax rates in countries such as France and Italy suggest that not only tax rates but also other factors such as bureaucracy, legal processes and infrastructure play a critical role.

Moreover, the fact that some developing countries have low levels of ease of doing business despite low overall tax rates suggests that infrastructure deficiencies, legal irregularities and underdeveloped financial systems have a negative impact on the business environment. This finding emphasizes the need for developing countries to undertake comprehensive reforms to simplify regulations and improve the business environment, not only through tax cuts.The results of the study show how economic growth, environmental sustainability and social policies are interrelated and the importance of achieving a balance between these elements. Although there is a strong link between carbon emissions and economic growth, it has been observed that countries aiming for sustainable development can remain economically competitive by reducing their environmental impact. Tax policies, ease of doing business and infrastructure reforms are found to have a direct impact on a country's entrepreneurial environment. This finding is particularly instructive for developing countries.

Dashboard Link: https://public.tableau.com/app/profile/rabia.g.r.nmez/viz/newtab2\_17336595141210/Dashboard3?publish=yes