

Global Coffee Trade EDA

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Introduction:

Coffee is one of the most consumed products worldwide, being the second most traded product in the world, after oil. The price of coffee fluctuates every year due to the high demand of this product both from countries that consume it domestically as well as from countries that import it due to climatic conditions that do not allow its harvest.

Due to the threats that climate change presents in the production of coffee, the cultivation of this product becomes a process full of uncertainty full of challenges for coffee production.

This project seeks to make an exploratory analysis of historical data on the world coffee trade, analyzing sectors such as production, exportation, importation, and domestic consumption with the objective of finding patterns in which possible factors can be identified that will help to have a better control in terms of climatic affectations in the cultivation of coffee.

Results:

Despite changes over the years in coffee production due to climatic conditions, pests, diseases and fungi; production has maintained a positive trend from 1990-2020 (Fig. 1), the lowest median was in the 2014/25 production being one of the reasons the prolonged drought and high temperatures in Minas Gerais and Sao Paulo (about 80% of Arabica production in Brazil) that negatively affected the development of coffee beans, taking into account that Brazil is the largest producer of coffee worldwide (Fig. 2).

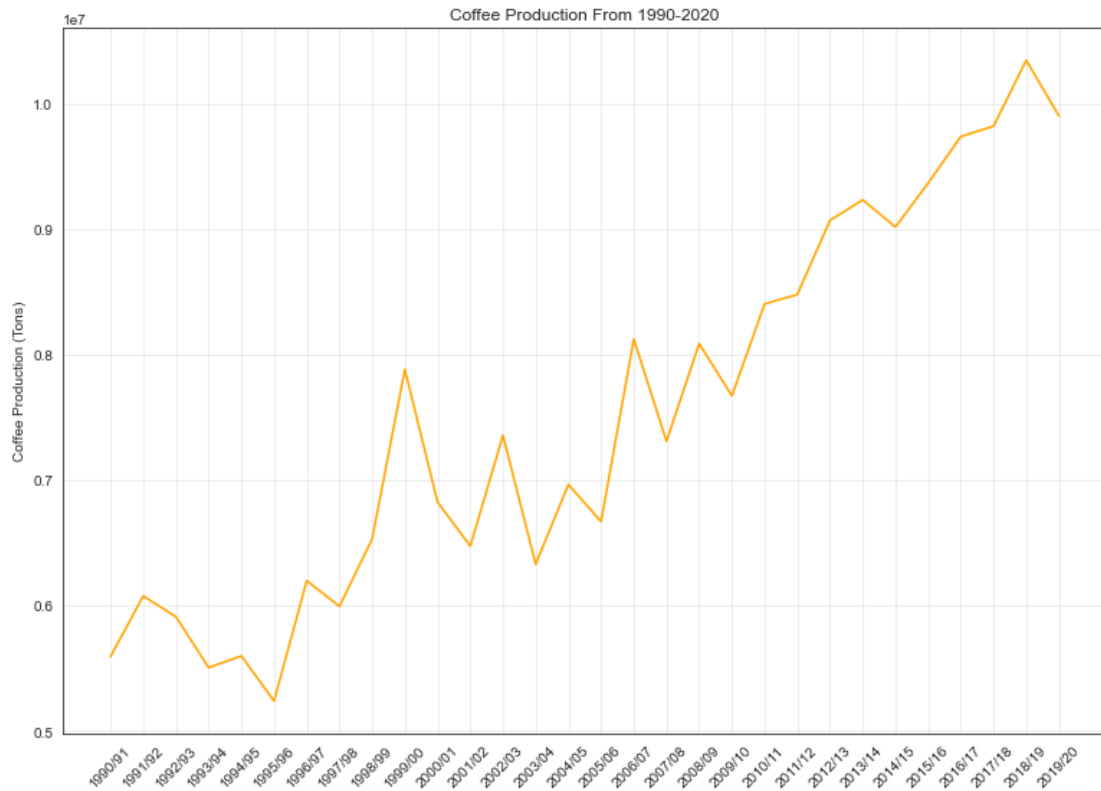


Figure 1: Coffee Production From 1990-2020

Brazil, being the largest producer, represents 33.26% of world production from 1990-2020 with Arabica and Robusta coffee crops, being part of the 32.73% of countries that produce both types of coffee (Fig. 3), while Uganda, which represents the tenth place in the top 10 coffee producers (Fig. 2), only represents 2.62% of world production from 1990-2020, being also part of the 32.73% that cultivate Arabica and Robusta (Fig. 3).

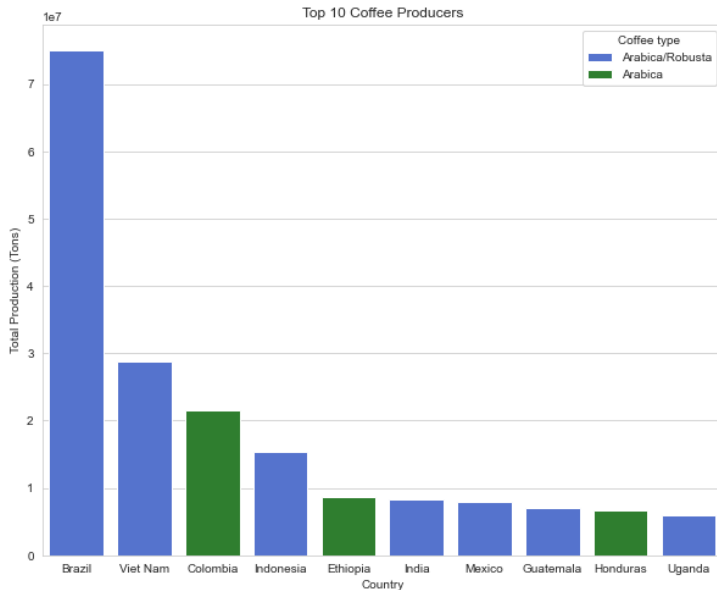


Figure 2: Top 10 Coffee Producers

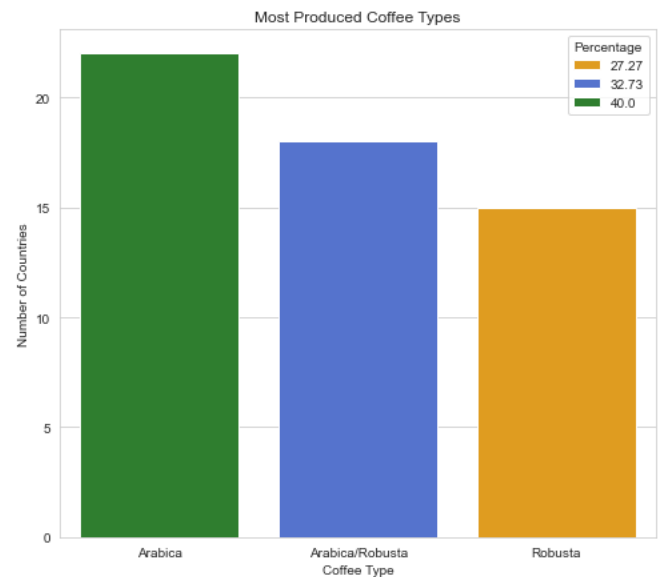


Figure 3: Most Produced Coffee Types

It is worth mentioning that on average Uganda is the country with the highest percentage of domestic consumption of its total coffee production, being 95.24% (Fig. 4), in comparison Brazil would be consuming 62.39% of its total production (Fig. 4) and exporting the remaining 37.61% (33807709.056 Tons) which makes it the largest exporter worldwide.

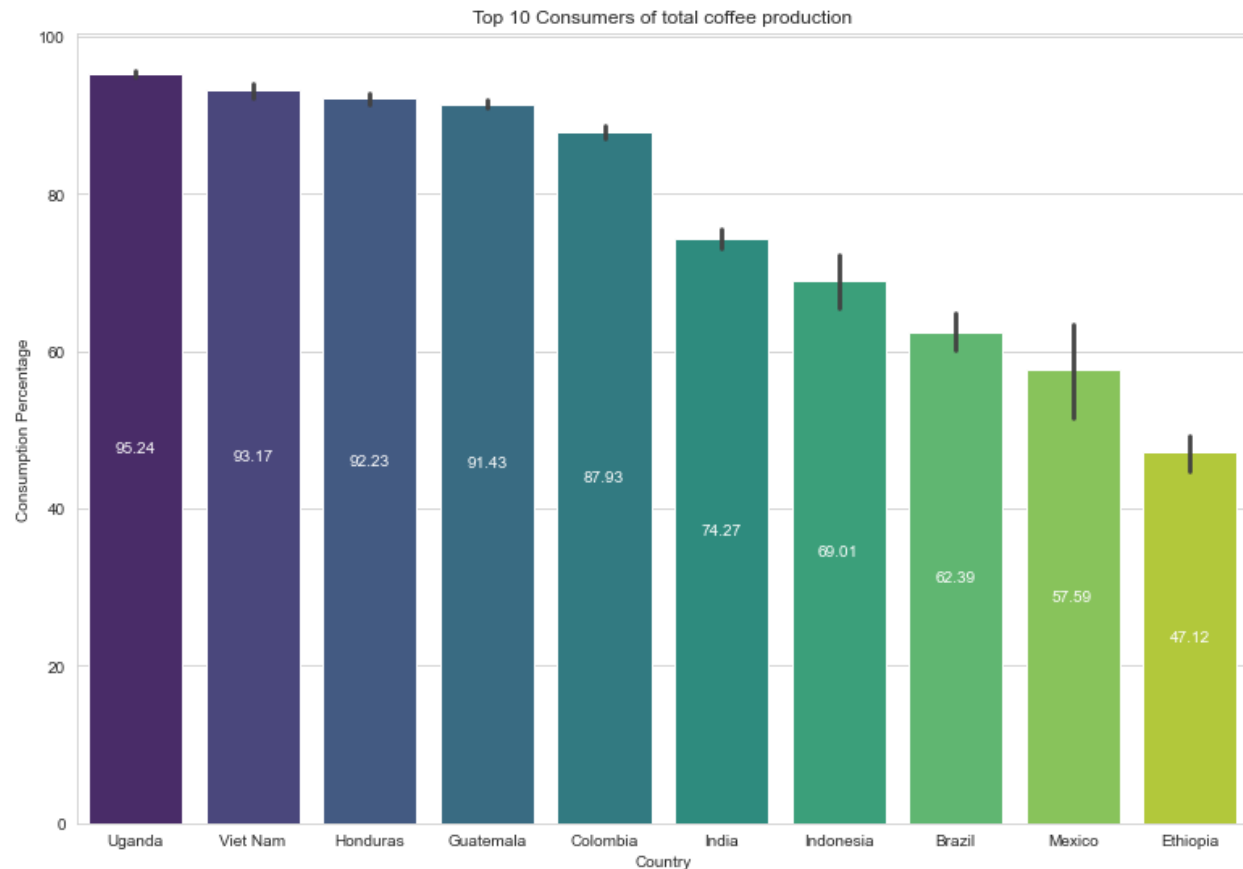
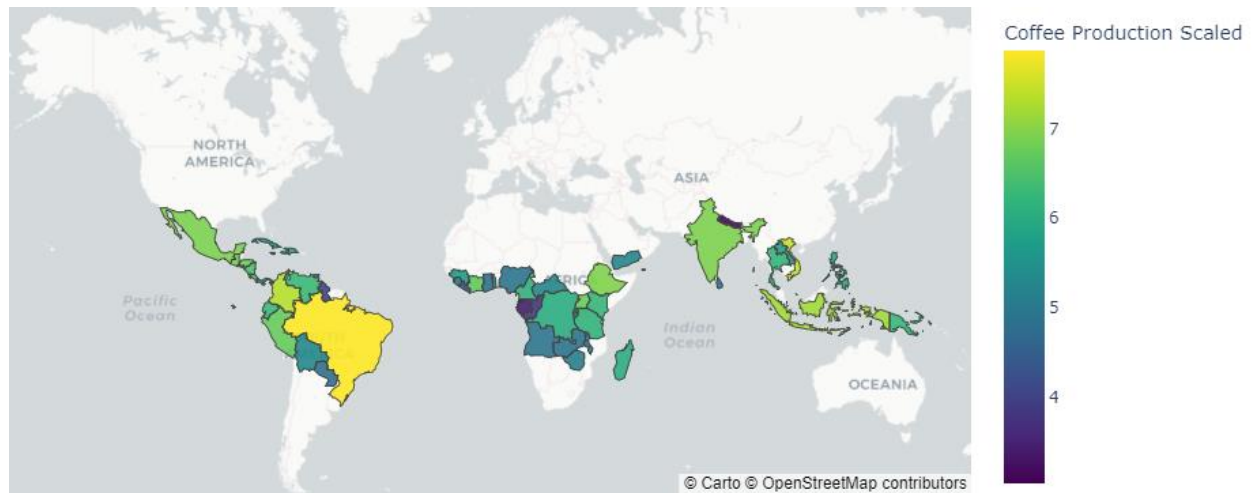


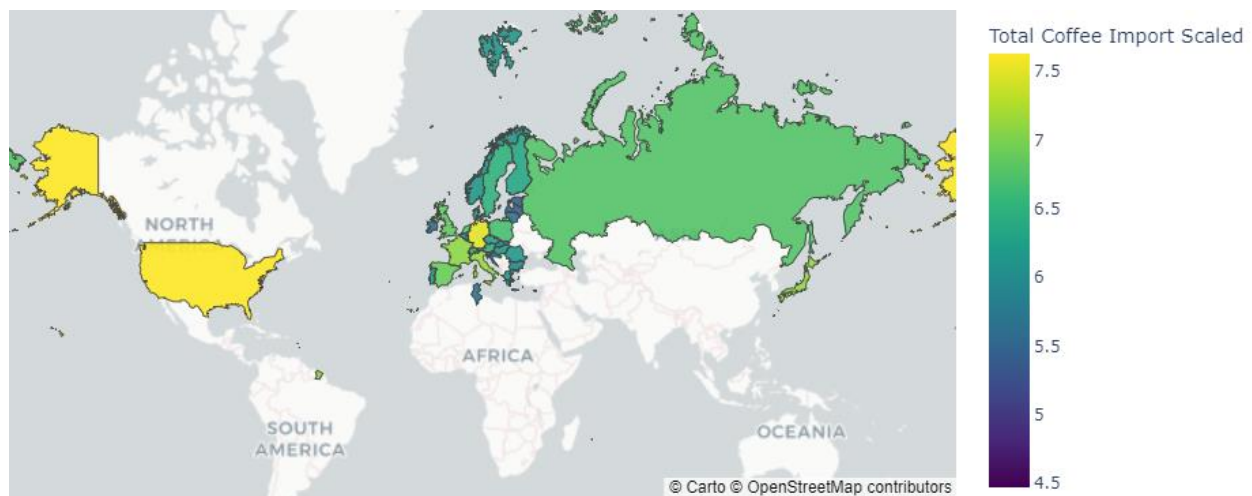
Figure 2: Top 10 consumers of total coffee production

Considering the geographical position of the coffee producing countries (Map 1), a tendency is observed regarding their latitudes, which implies the importance of climatic factors such as temperature with a median of 24.58°C, with Nepal being the only country out of range with a temperature of 8.1°C, which could be one of the influential factors in its low coffee production of only 84.75 Tons per year.

There is an obvious difference in terms of the geographical position of importing countries and producing countries, where a tendency towards the north with much lower temperatures is observed, which complicates the cultivation of coffee in their territories and therefore they resort to coffee imports (Map 2).



Map 1: Coffee Production Scaled



Map 2: Total Coffee Import Scaled

The idea was to use temperature and precipitation data with the objective of finding groupings of coffee cultivation types through K Means Clustering to identify climatically suitable areas for the cultivation of a specific type of coffee or if it is possible to cultivate more than one in the area.

After correlating the temperature and precipitation data a value of 0.28 was obtained indicating that they vary together but have a weak association.

In the model 3 groupings were used considering the 3 situations that could be found in coffee cultivation; the results were not as expected because they do not show a clear differentiation between the climatic factors chosen and the types of coffee (Fig. 5).

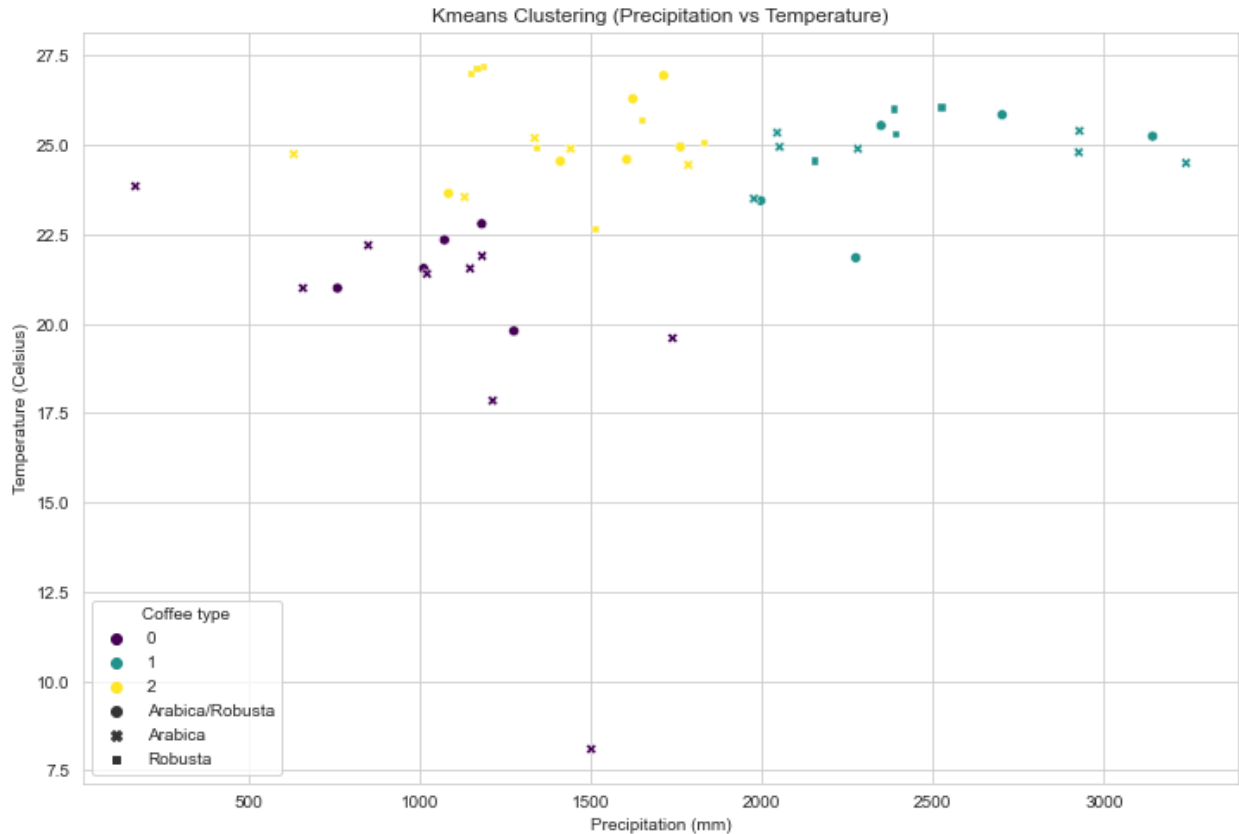


Figure 3: Kmeans Clustering (Precipitation vs Temperature)

Discussion:

Although there was no strong relationship between temperature and precipitation, it has been proven that these are essential factors in coffee cultivation and it would be of great interest to add other climatic and geological factors that together with these could help to create suitability models that allow the identification of the best zones for coffee cultivation.

Conclusions:

Brazil has been the largest producer and exporter of coffee worldwide, with data that indicate a positive trend in the future but that could be affected by climate change problems.

There is a clear importance in the geographical position in terms of coffee cultivation that can be observed with the producing countries and the location of the importing countries.