

Data Analysis Poultry Exportation



Data Analyst Course - Project 5
Michael Orange

Mission

A company in the food industry specialized in Chicken Meat is looking at expanding worldwide. All countries are considered.

Their production is based in France.

The mission is to provide the company with data ensuring it will collaborate with the most promising export market countries.





Data preparation

Data Exploration

Clustering and Principal Component Analysis

Analysis and Recommendations

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Data Preparation

Source datasets

Data are collected from The Food and Agriculture Organization Corporate Statistical Database (FAOSTAT). The FAOSTAT website disseminates statistical data collected and maintained by the Food and Agriculture Organization (FAO).

- Analysis is based on data from 2017 (most recent complete dataset in 2020).
- Data from 2013 are used to measure a 4 years evolution.



Indicators

 variables for PCA
 additional variables

'country'

country'food_supply_kcalcapitaday'
'protein_supply_gcapitaday'*Calories per capita per day
Proteins per capita per day*

'protein_animal_over_protein'

% of Proteins Animals'pop_thousand'
'pop_growth'*Population (in thousand)
Population growth*'gdp_percapita_usd'
'gdp_growth'*GDP per capita (USD)
GDP per capita growth*

'euro_union'

Belonging to EU

'political_stability_index'

Political Stability Index'dom_supply_poultry_tons'
'export_poultry_tons'
'import_poultry_tons'
'prod_poultry_tons'

'net_import_poultry_tons'

'net_import_poultry_over_domsupply'
'import_poultry_over_domsupply'
'prod_poultry_over_domsupply''growth_domsupply_poultry'
'growth_import_poultry'

'Protein_poultry_gcapitaday'

'import_french_chicken_tons'

*Domestic Supply Poultry (tons)
Export Poultry (tons)
Import Poultry (tons)
Production Poultry (tons)**Net importations Poultry
(Importations - Exports)**Net importations / Dom Supply
Importations / Dom Supply
Productions / Dom Supply
(Poultry)**Growth Dom Supply Poultry
Growth Imports Poultry**Protein Poultry per capita g per day**Importations of chicken from France*

Imputations

Taiwan **GDP per capita** is missing in the FAOSTAT dataset. Imputation with data collected from the International Monetary Fund (IMF).

Political Stability Index data are missing in the FAOSTAT dataset for 'French Polynesia', 'Namibia' and 'New Caledonia'.

- Imputation for the 2 French territories (French Polynesia and New Caledonia) with France's index.
- Imputation for Namibia with United Arab Emirates' index - the political stability index of the UAE is the closest of Namibia in 2017 (source: World Bank)

Poultry definition

Poultry are domesticated avian species that can be raised for eggs, meat and/or feathers.

The term "poultry" covers a wide range of birds, from indigenous and commercial breeds of chickens to Muscovy ducks, mallard ducks, turkeys, guinea fowl, geese, quail, pigeons, ostriches and pheasants.

In 2017, chickens accounted for 92 percent of the world's poultry population, followed by ducks (5 percent), and turkeys (2 percent).

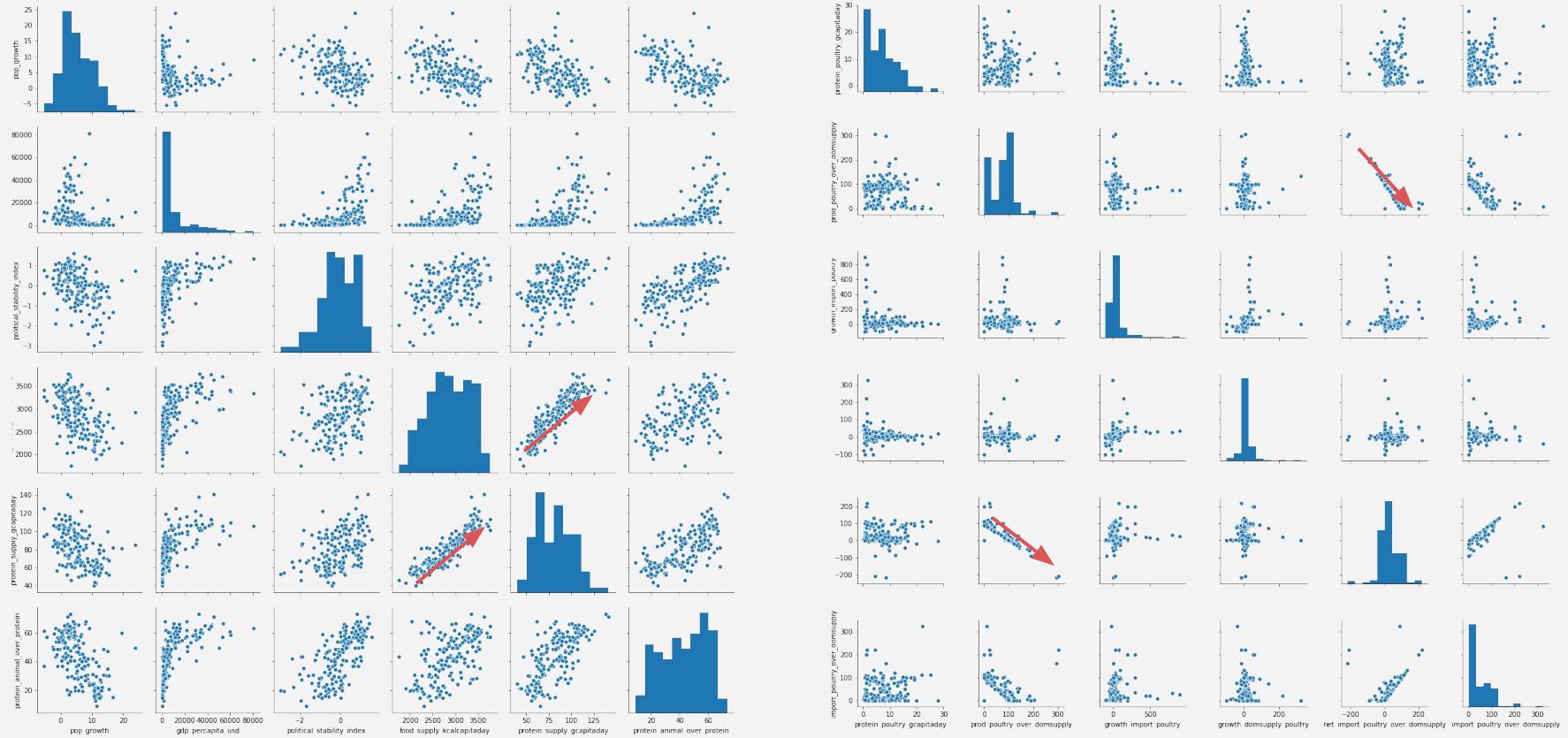
- Chickens = 89 percent of world poultry meat production. Rest comes from turkeys(5%), ducks (4%), geese and guinea (2%) and others.
- Chickens provide 92 percent of world egg production.

There is no granular data about chicken meat exclusively in our dataset but the data for the category 'Poultry' gives a fair indicator of the chicken market in each country.

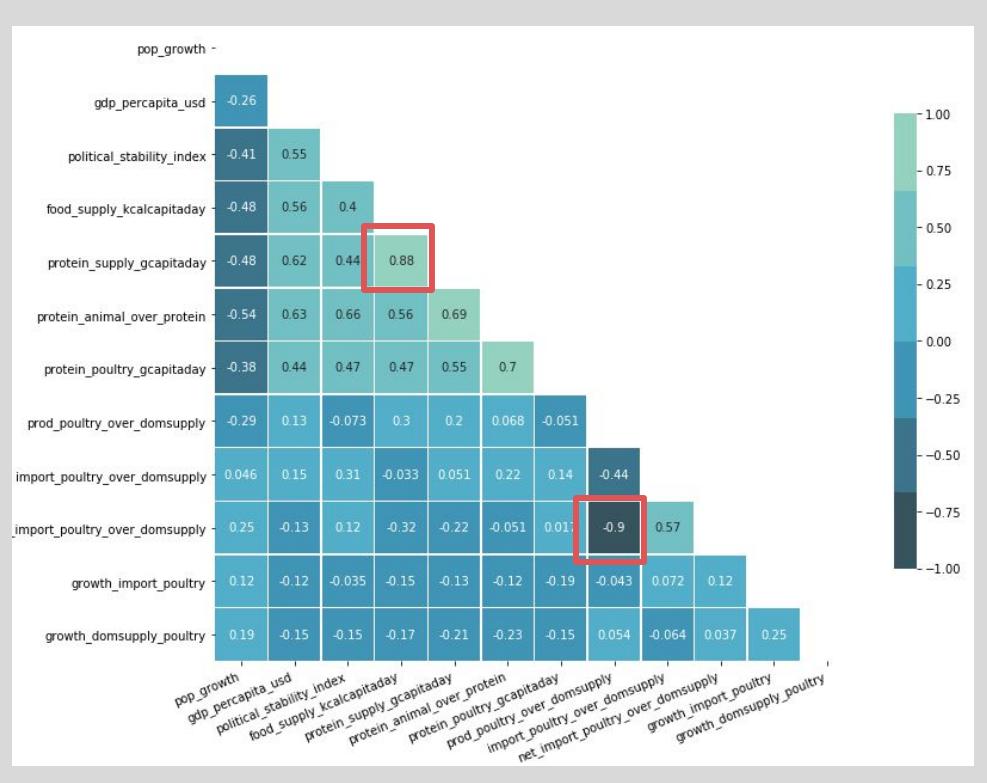


Data Exploration

Pair Plot

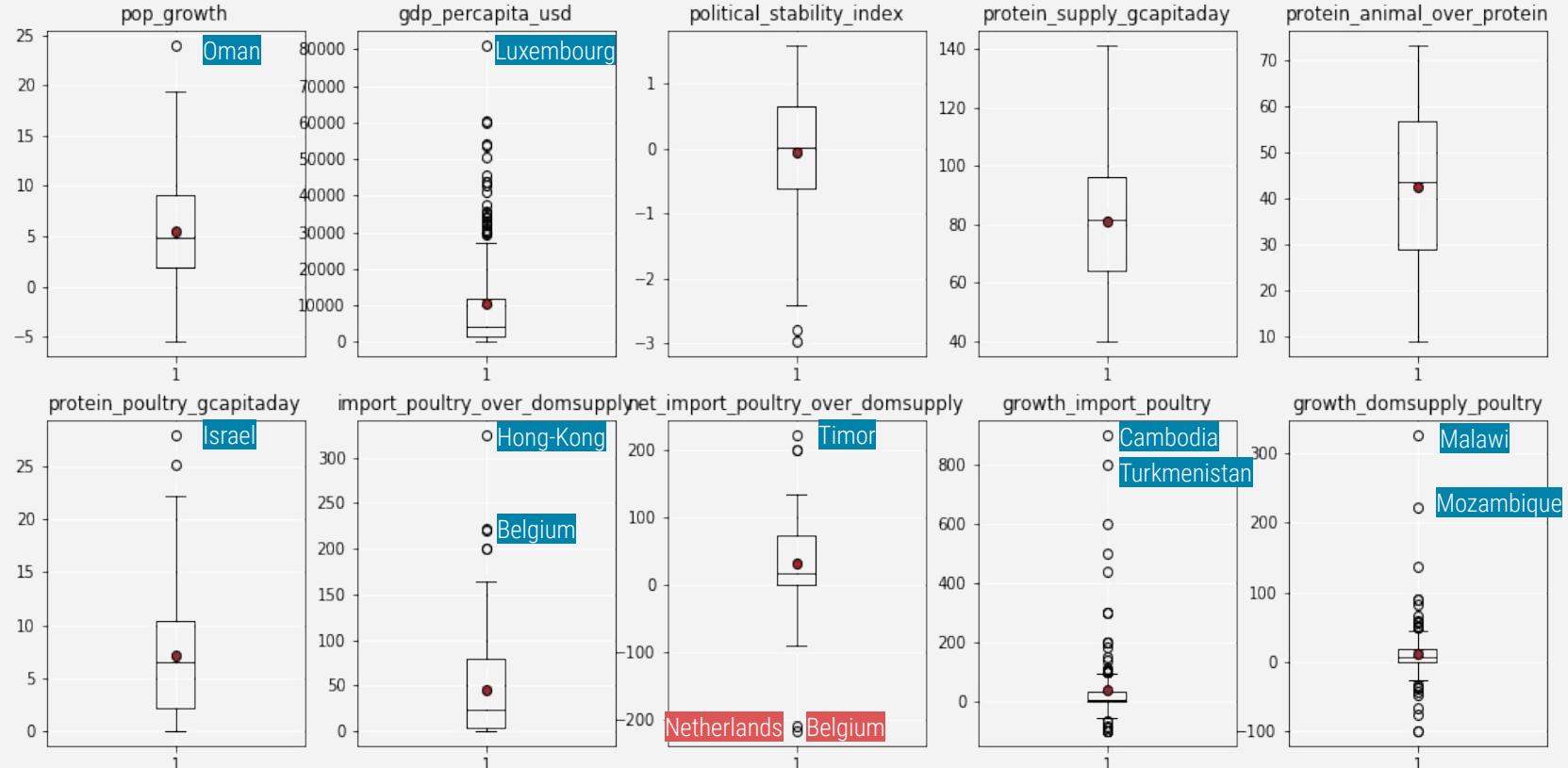


Correlation Matrix



- Strong positive correlation (0.88) between 'protein supply (g per capita)' and 'food supply (kcal per capita)': **'food supply' removed from PCA variables.** Higher is the average quantity of Proteins per capita in a country, higher is the average quantity of calories per capita.
- Strong negative correlation (-0.9) between 'production poultry over domestic supply' and 'net imports poultry over domestic supply': **'production poultry over domestic supply' removed from PCA variables.** Higher is the Poultry local production, lower are the Poultry net imports.

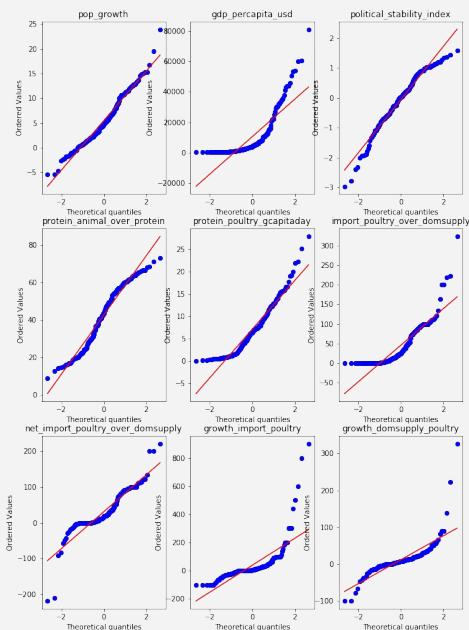
Outliers



Not gaussian-like distribution

Some of our variables do not have a Gaussian-like distribution

PCA performs better when numerical variables have a Gaussian distribution



Box-Cox transformation applied - for the variables strictly positives.

Yeo-Johnson transformation applied - for the variables with negatives values.



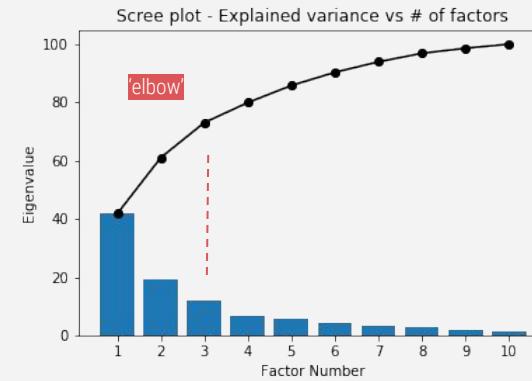
Clustering and Principal Component Analysis

Preparation for PCA

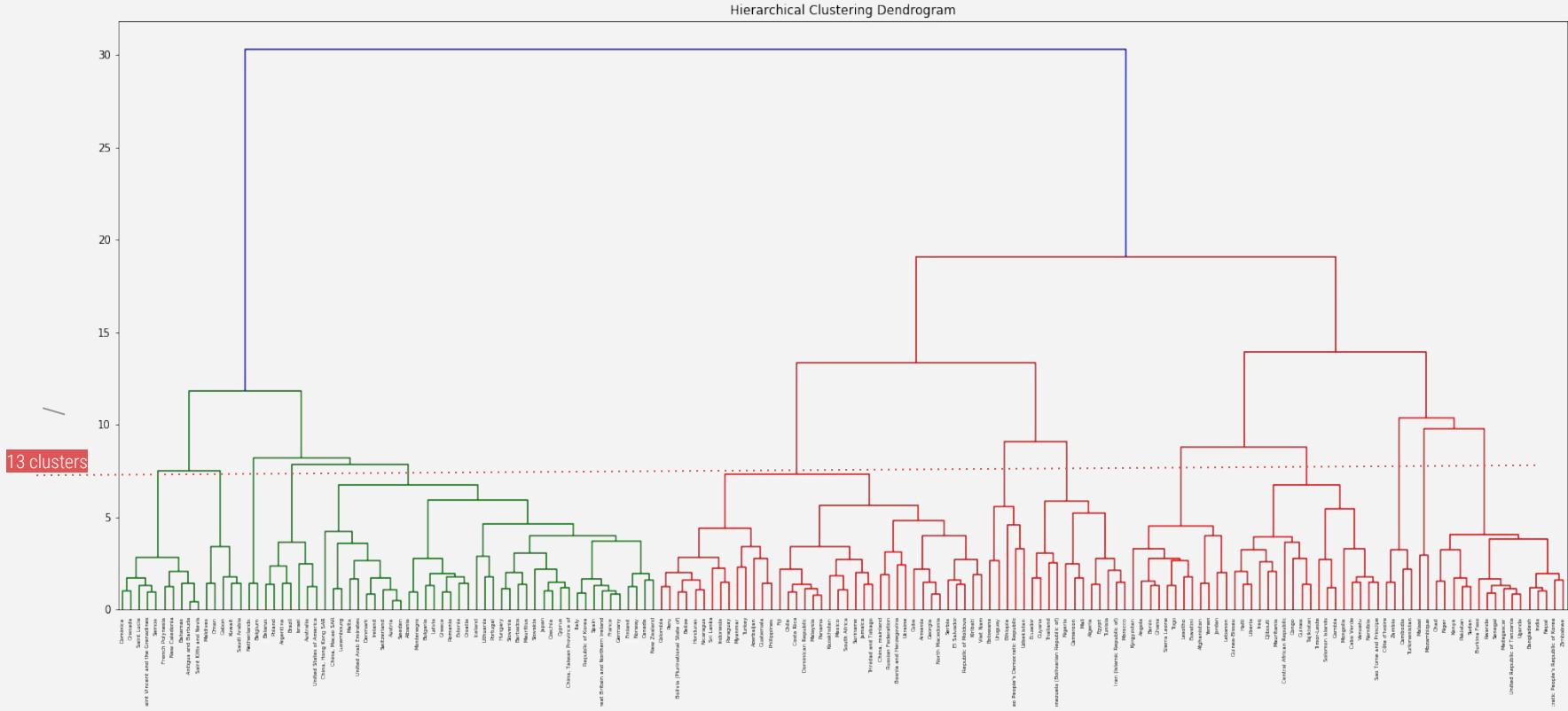
Mean centering - subtracting variable measured mean from each data value so that its empirical mean (average) is zero

Variance standardization to 1 - after the mean centering, dividing 'centered' data by standard deviation.

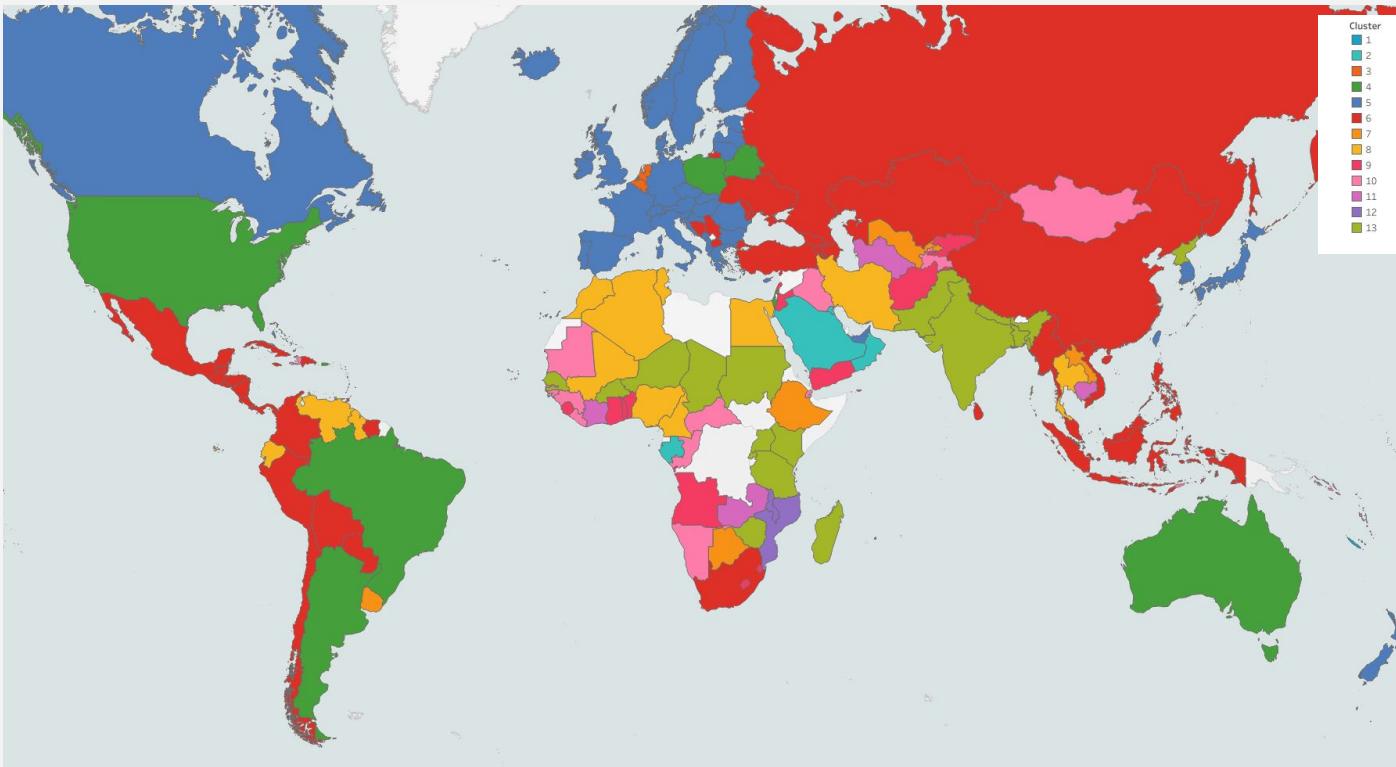
3 components are selected
(capturing approx. 80% of the variance)



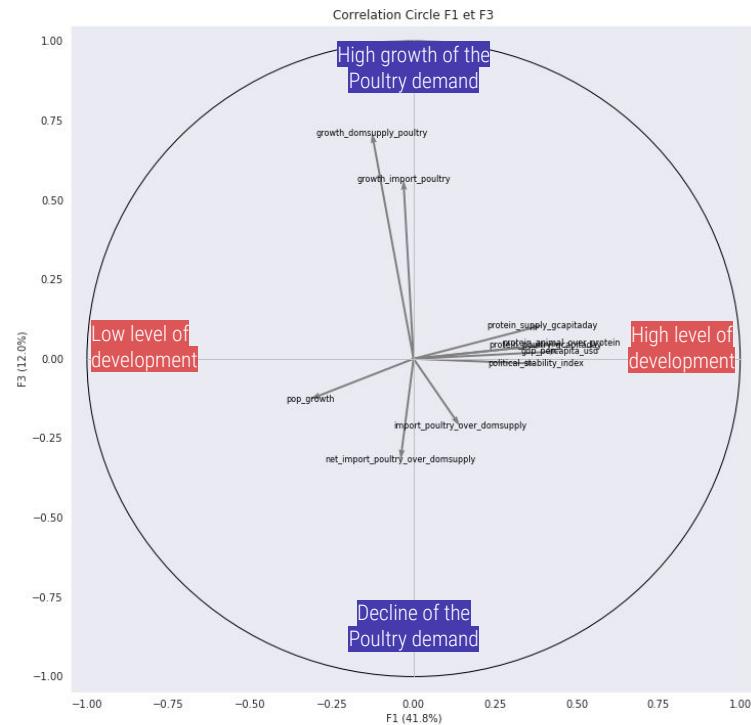
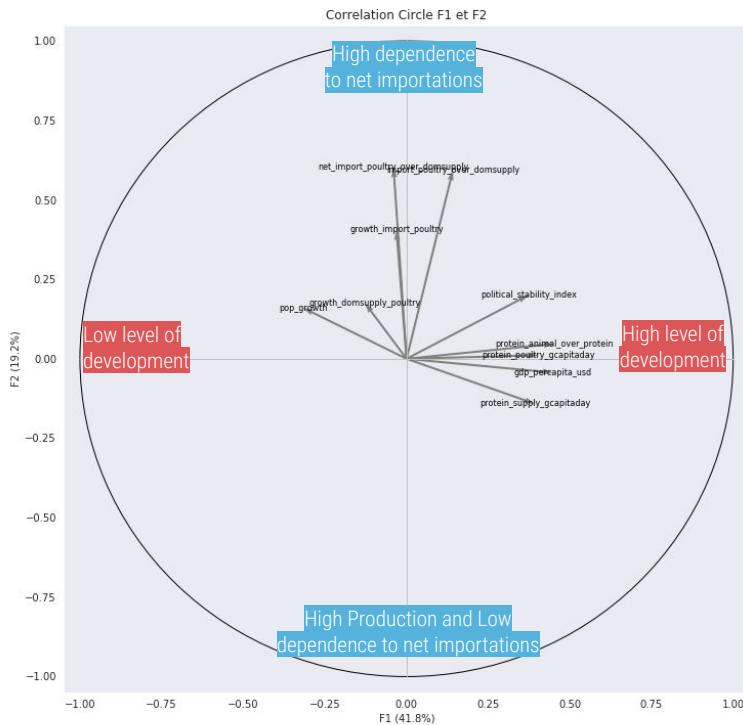
Dendrogram



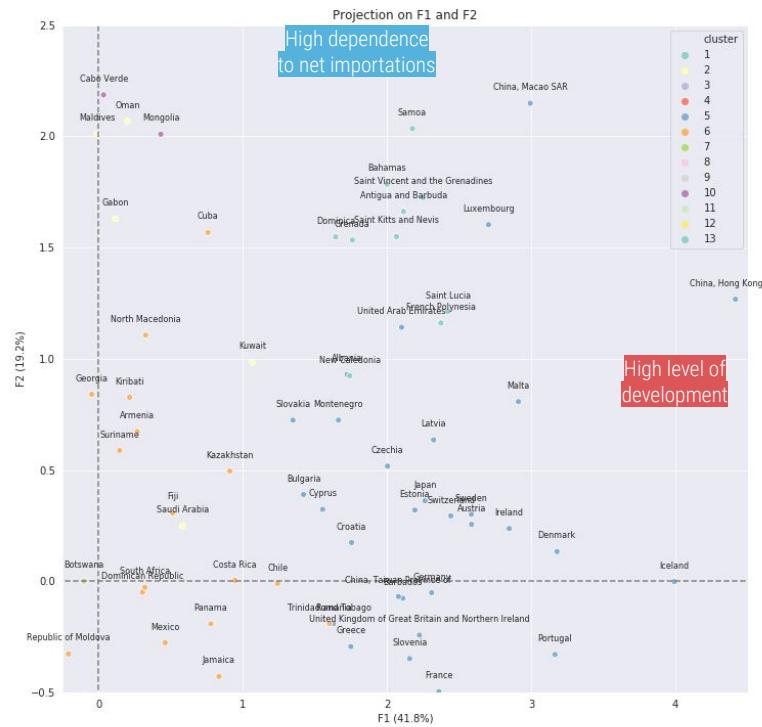
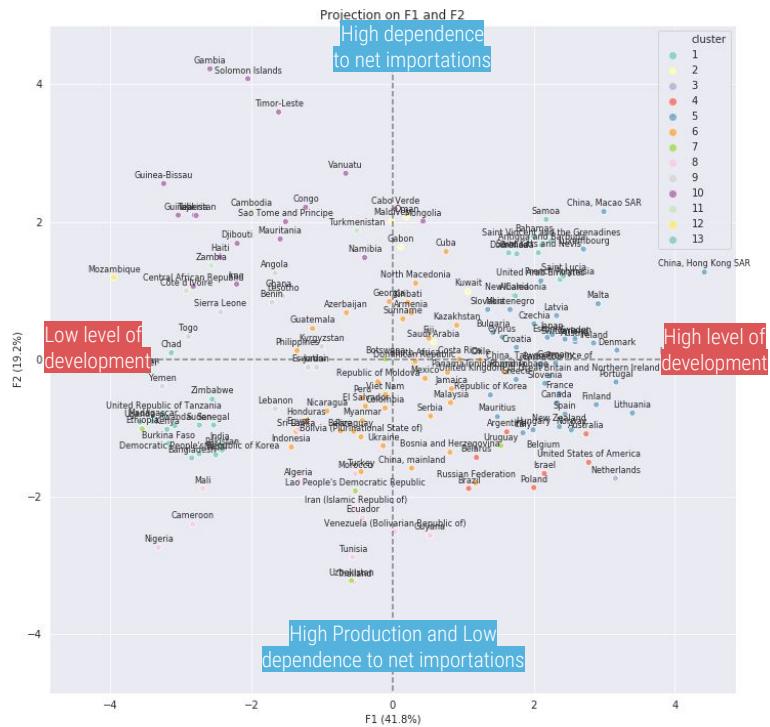
Clusters



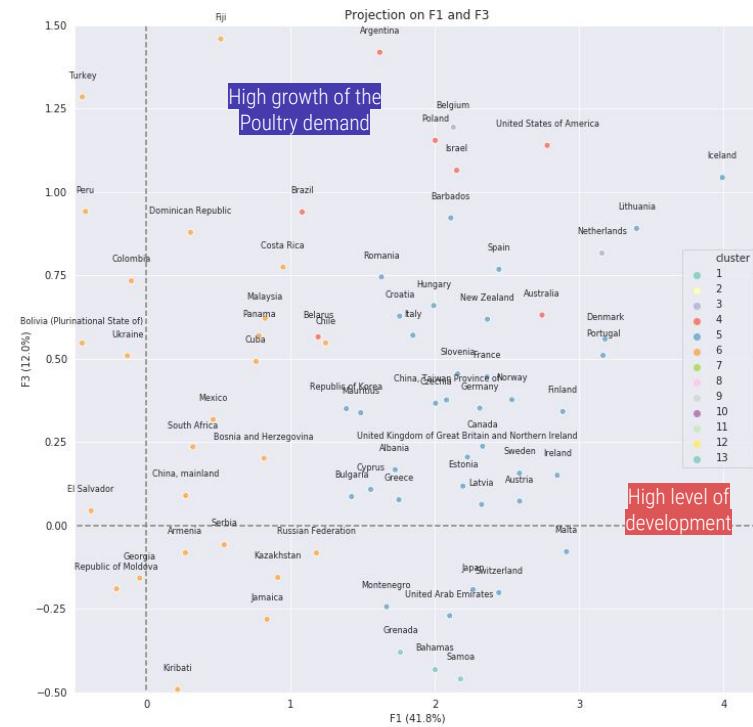
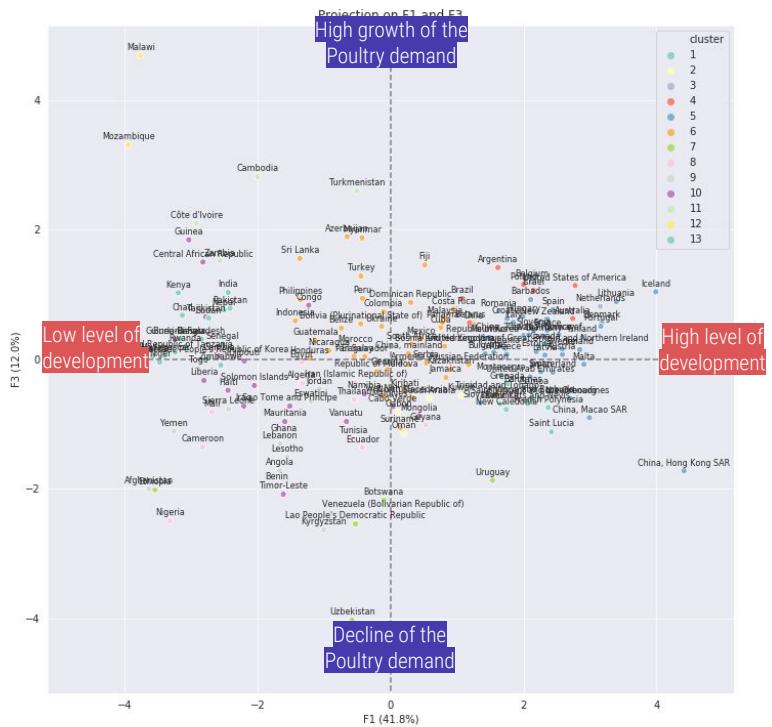
Correlation Circles



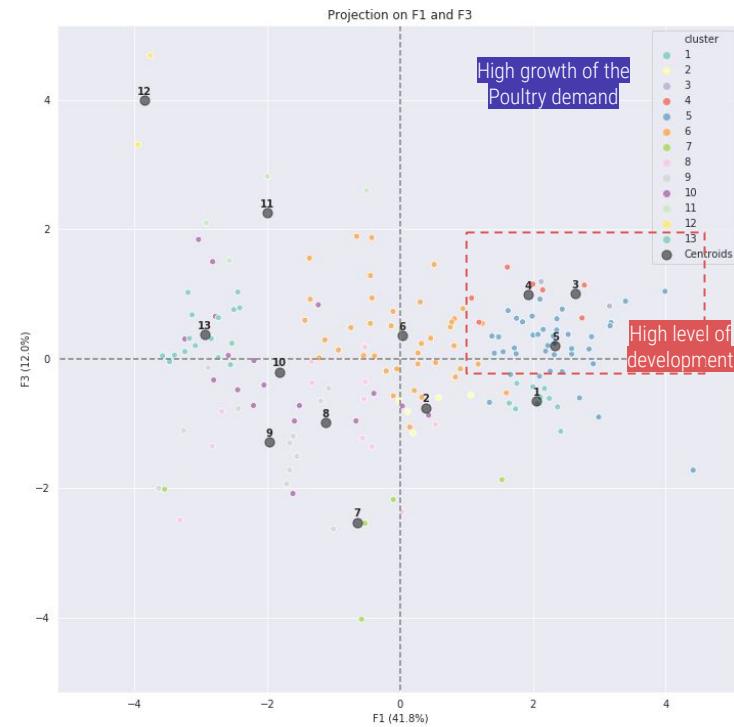
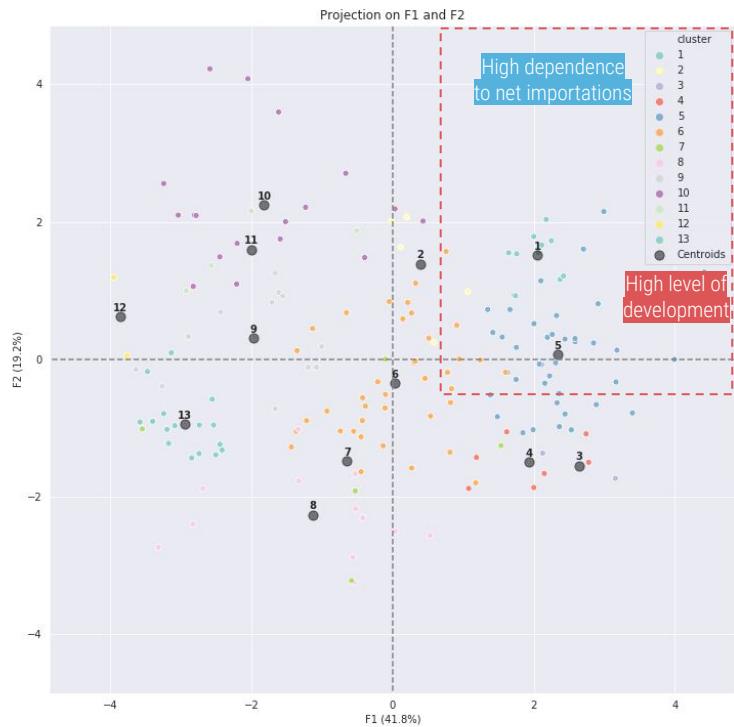
Projection on F1 and F2



Projection on F1 and F3



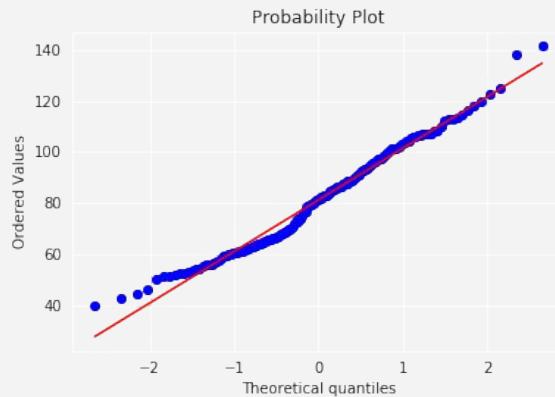
Cluster 5 is the preferred cluster



Statistical tests

Testing distribution

With a p-value > 1% (shapiro test), we cannot reject the hypothesis of Normality for the variable **"protein_supply_gcapitaday"**. It is also confirmed by the henri line.



Comparison between Cluster 5 and Cluster 10

■ **Test for Equality of Variances** - bartlett's test for equal variances. Using a significance level of 5%, we cannot reject the null hypothesis for cluster 5 compared to cluster 10. Cluster 5 and Cluster 10 have an equivalent variance at this level of significance.

■ **Two-Sample t-Test for Equal Means** - T-test for the means of two independent samples. Using a significance level of 5%, we can reject the null hypothesis. Countries in Cluster 5 and 10 do not have the same level of proteins per capita.



Analysis

Market observations

The Poultry market is a strong competitive market.

The international Poultry market, whose growth is being powered by emerging countries, is focusing on cost rather than quality.

Cost is the strategic variable for success in most of the geographies.



In poultry production, **French farms** are more numerous and also smaller than the ones from the main producers (Brazil, USA, Thailand, China, Poland, etc.).

French poultry farms have a smaller capacity because of the importance of quality and origin labels (Red Label, organic, Appellation d'Origine Contrôlée). With farm sizes which don't allow for large economies of scale, and with labour costs above some of its competitors, the French Poultry sector is facing challenges on exports.

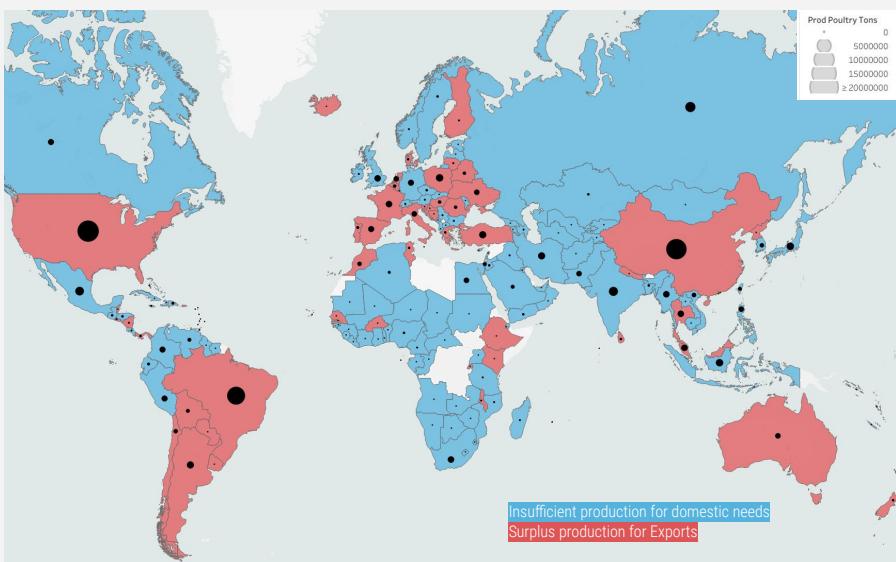
With a "gourmet" image and high quality products, it is recommended for a French Poultry producer **to explore export markets with a clientele ready to pay for premium products.** Countries with a higher level of development are preferred.

For French poultry producers, **exportation to EU** countries is facilitated in terms of regulations, standards and import tariffs.

3 giant producers

Almost half of the Poultry production is located in 3 countries: USA (18%), China (15%) and Brazil (12%).

Poland is the main producer in Europe.

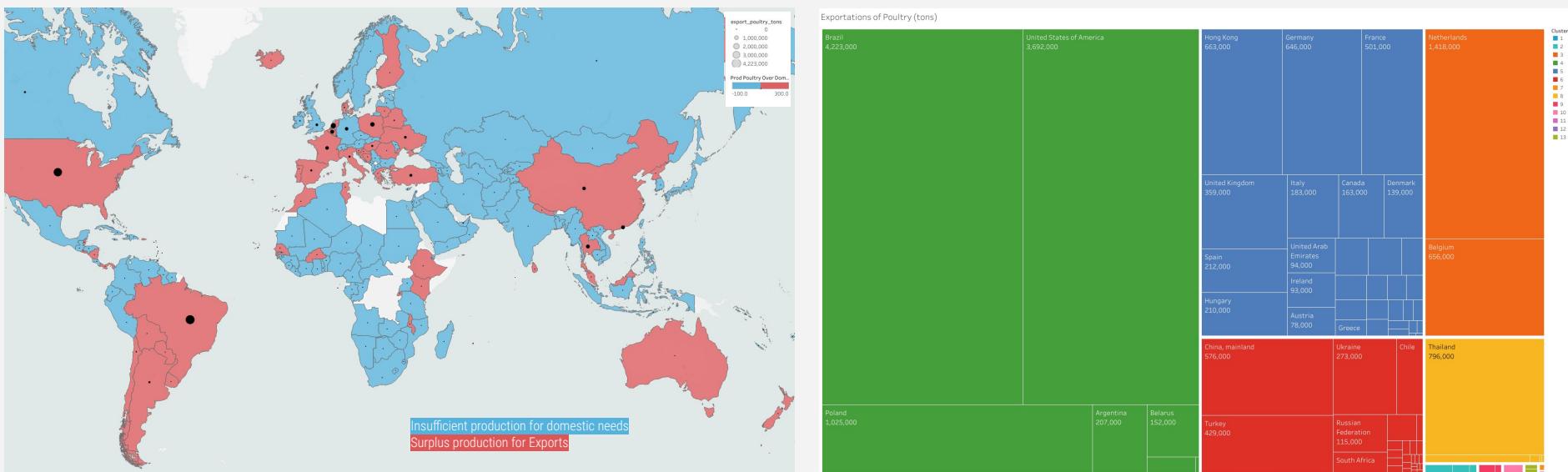


45% of exports from the USA and Brazil

2 countries are exporting almost half of the Poultry: USA (24%) and Brazil (21%).

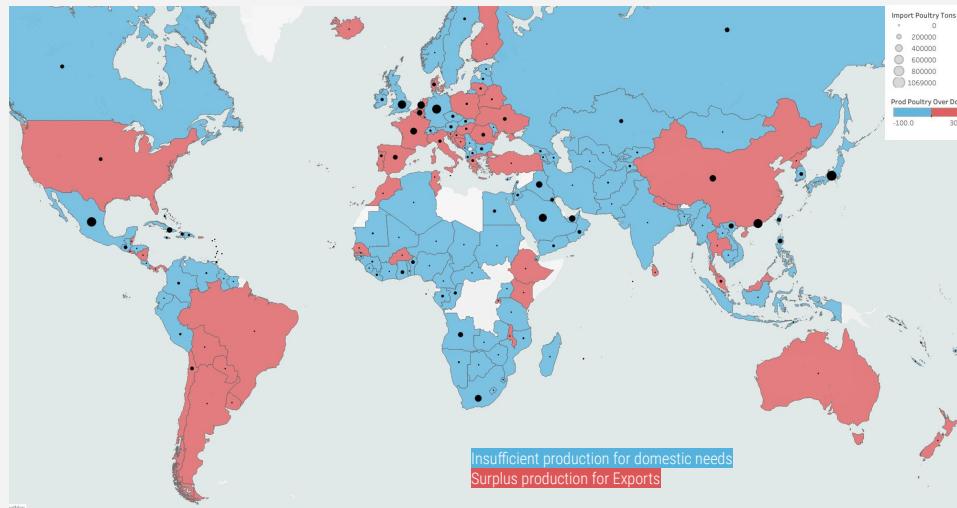
Netherlands and Belgium are relying on large poultry raw imports in order to re-export semi-processed poultry meat.

China (along with Hong-Kong), Poland and Thailand are also key exporters.



3 countries out of 4 rely on importations

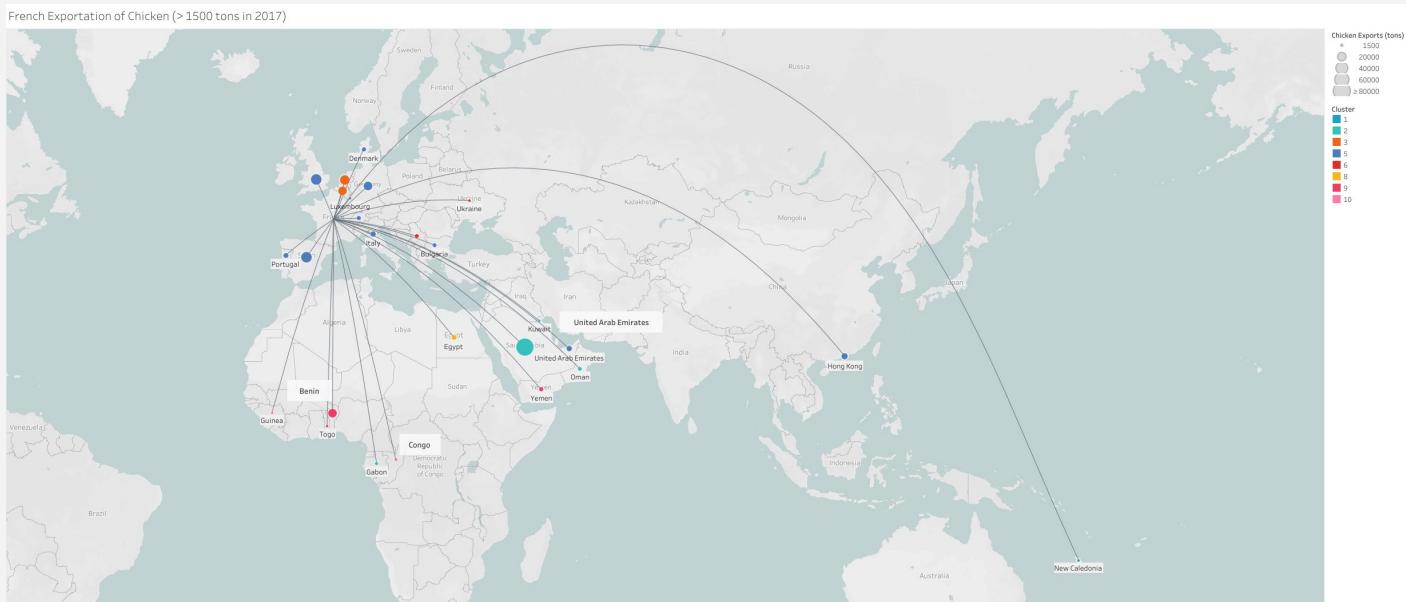
With a local production not meeting their domestic demand, **127 countries are importing Poultry** (net importations). Japan, Mexico and Saudi Arabia are the countries the most dependent on Poultry importations for their domestic market.



French Exports of Chicken

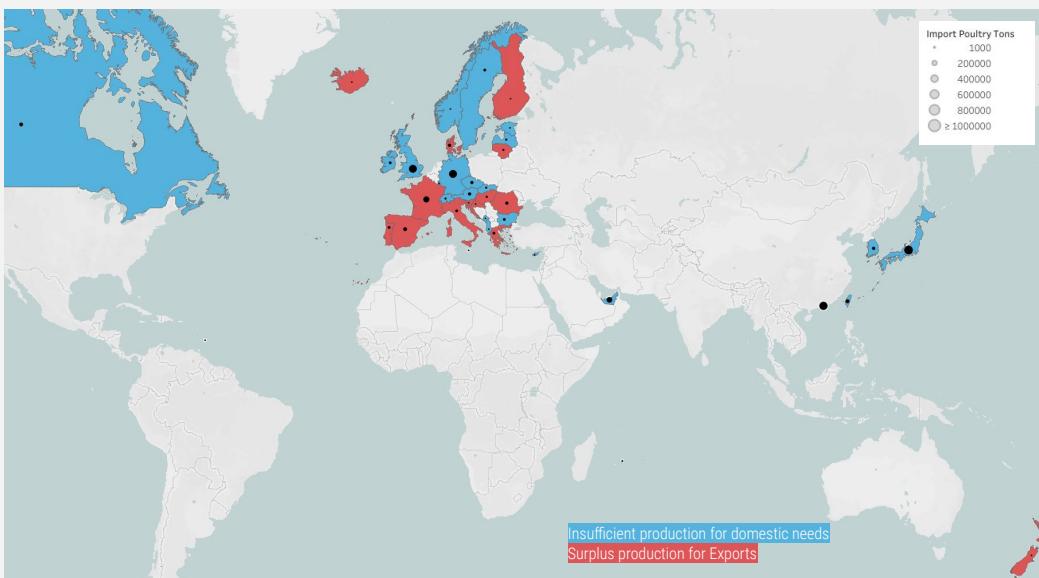
The main importer of French Chicken is by far **Saudi Arabia** (3x more than the other largest importers). Other main importers are Spain, United Kingdom, Germany, Netherlands.

A strong localization to Europe, Africa and Middle-East is observed (only 1 country in Asia and no countries in Americas).



Export to high-income developed countries

Recommendation Cluster 5 is the recommended cluster with the best country attributes regarding the level of development, net importations and growth of the local demand for Poultry products.



Selection within Cluster 5

Borders with France:

Requirements: Poultry net import > 10 000 tons, poultry domestic supply stable or in growth, poultry production capacity < 90%, positive growth of the domestic supply.
Selection: **Luxembourg, Switzerland, Germany**

Within EU:

Requirements: Poultry net import > 30 000 tons, poultry importation growth > 2%, poultry production capacity < 90%, gdp per capita > 15 000.
Selection: **Sweden, Austria, Czechia**

Outside EU:

Requirements: Poultry net import > 150 000 tons, poultry importation growth > 15%, poultry production capacity < 90%, GDP per capita > 15 000.
Selection: **United Arab Emirates, Taiwan**

Export to high-income developed countries

Luxembourg

While their importations are limited, Luxembourg is selected due to the very close distance from France, their belonging to EU, their high GDP per capita and their strong dependence to Poultry importations (0 local production).

Switzerland

Switzerland is not part of the EU and there is a small decline of poultry importations. However Switzerland remains an attractive export opportunity for a french producer due to the close distance from France, their high GDP per capita, the significant size of their Poultry importations due to an insufficient production and bilateral trade agreements between France and Switzerland.

Germany Austria Sweden

All indicators are positive. Significant volume of poultry importations, significant growth, production rate not able to meet the needs, high GDP per capita, population growth, part of EU, etc.

United Arab Emirates

Presents an interesting business opportunity with a significant volume of importations, a significant growth of both importations and domestic supply and a high GDP per capita. In addition, the UAE are highly dependant on importations due to a very low production (under 15%).

Czechia

Selected due to their belonging to the EU and a significant growth of their Poultry internal demand (22 %) leading to a significant growth of their imports. However importations from Poland (with a lower-cost and geographically closer) are a threat due to the Czechia relatively low GDP per capita.

Taiwan Not selected

Distant from France, Taiwan is an interesting option due to a high level of development, a significant volume of Poultry importations combined with a strong growth of the importations. However Taiwan has complex relationship with China and strong political ties with the USA. That dependence is observed on the quantity of chicken imported from the USA superior to 90% of their importations.

Why not the top importers

Japan

First market worldwide in terms of importations, Japan is not included in the selection due to a decline of their internal domestic supply (faster than their population decline) combined with a very strong increase of their Poultry production (+51%). While their demand is decreasing, their production capacity is increasing (now exceeding 90%). Their production could meet in the future their internal demand.

Mexico

With 972 000 tons of importations and a 14% increase of their imports, Mexico is a great export market for Poultry. However due to a low GDP per capita and the proximity to the 2 giant producers (USA and Brazil), Mexico is not an ideal option for a French producer.

Saudi Arabia

First export market for French poultry producers, Saudi Arabia has a low production and a high volume of importations but their poultry imports declined severely (-18%). And Ukraine became in 2018 the second largest supplier (instead of France). However in 2019, Saudi has established a ban for 5 Ukrainian suppliers (after a field inspection) which could be a market opportunity for French suppliers in the near future. To be added on the watchlist.

Hong Kong

There is a strong decline of poultry importations (-24%) and market supply (-38%). However these numbers could be biased. Hong-Kong is the main road for imports/exports to/from China. Specialists have difficulties to differentiate data (Hong Kong vs China).

Recommendations

Conclusion

European Union



Germany, Luxembourg, Sweden, Austria, Czechia

- total Population : 112,616,150 inhabitants
- total Poultry market size : 2,359,000 tons (domestic supply)
- total Poultry importations : 1,163,000 tons
- a high GDP per capita of 41,467 USD (average).

A large poultry export market, with a rich population, highly developed infrastructure, close or relatively close from France and procedures facilitated by their belonging to the European Union.

International

Switzerland, United Arab Emirates

- total Population : 41,617,553 inhabitants
- total Poultry market size : 1,330,000 tons (domestic supply)
- total Poultry importations : 645,000 tons
- a high GDP per capita of 46,976 USD (average).





THANK YOU!

Do you have any questions?

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