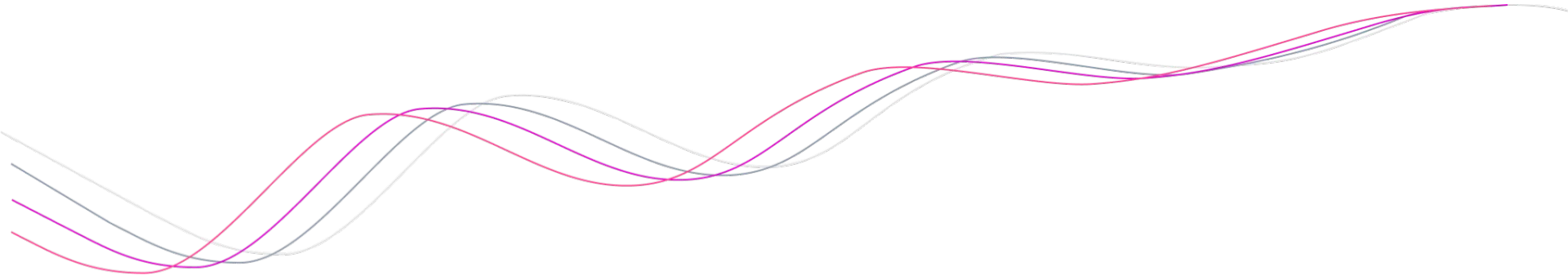
French Fiscal Data Analysis



Anamaria Loznianu

Merci, France! 🇫🇷

A heartfelt thank you to France for meticulously collecting and openly sharing your tax data! 📊

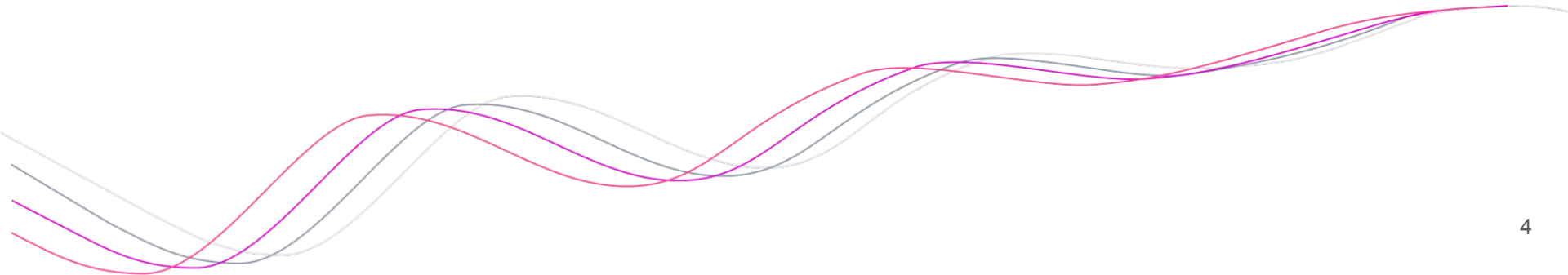
Analyzing 40 years of data is no small feat, and it wouldn't be possible without this wealth of information. I hope you'll find in the following slides valuable insights 📈

A special thanks to Ocean Protocol 🌊 for having this challenge and Desights 🏢 for hosting it.

Let's dive into the numbers and see what stories they tell! 🤿

Overview

Data Preprocessing



Data Preprocessing

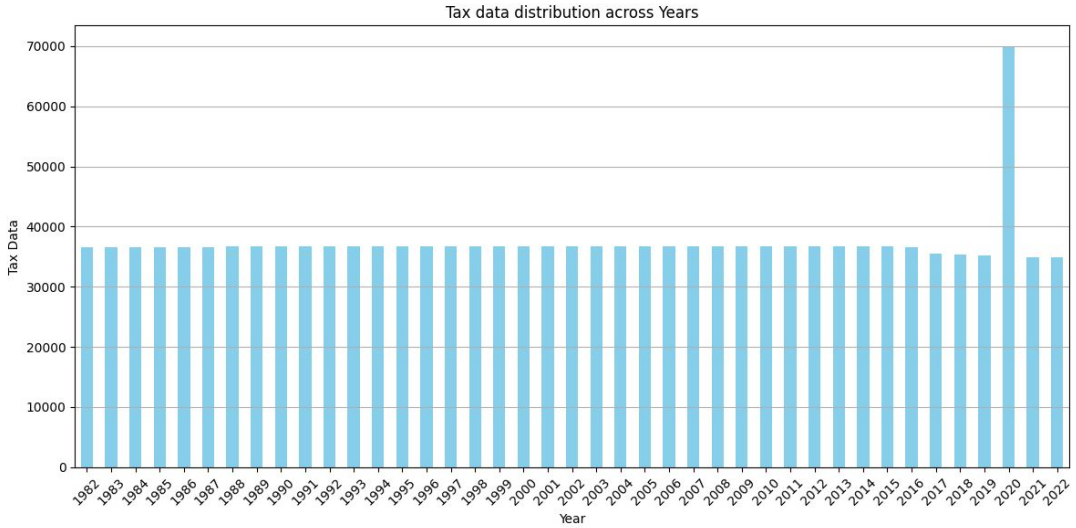
Target: Conduct exploratory data analysis (EDA) on the dataset.

Process Overview

- **Source:** The data was downloaded from the S3 bucket and worked with locally as a parquet file.
- **Data Processing**: Processed the data locally to carefully clean and normalize the dataset. This allowed me to make necessary changes and adjustments to various fields, ensuring high quality and accurate results.
- **Tools:** Dask and Pandas are the main tools used to extract insights and information from the dataset. The processing is done on multiple Jupyter notebooks, with data saved at each step as additional datasets to enhance subsequent processing steps.

Dataset Summary

- Total Number of Rows: **1,528,922**
- Total Number of Columns: **1,181**
- Tax-Related Columns: Approx **1,080**
- Columns for **Identifying** Regions, Departments, Syndicates etc.: Approx **100**



Data Preprocessing

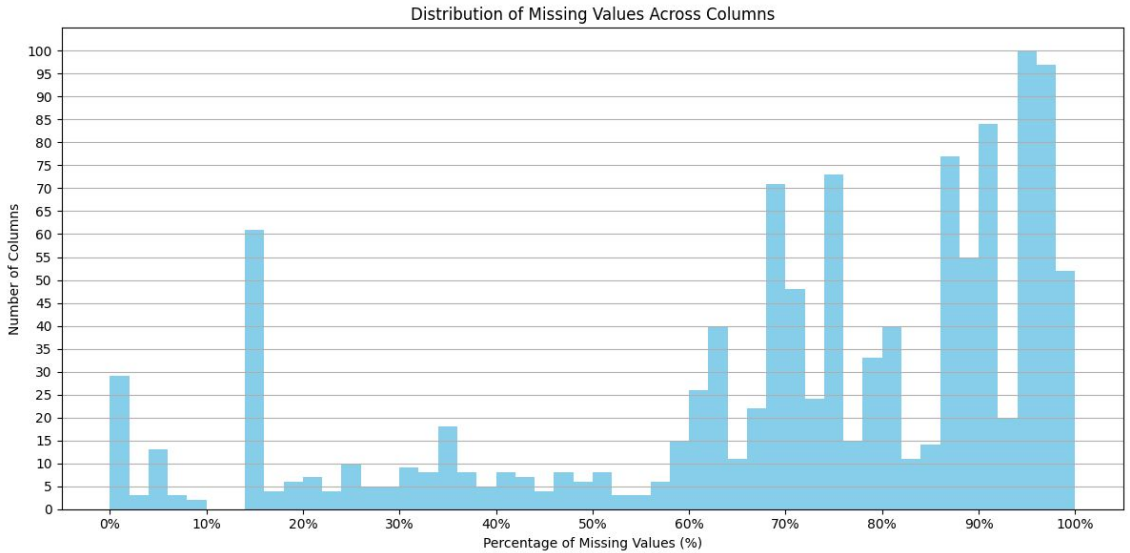
Target: Conduct exploratory data analysis (EDA) on the dataset.

Fill Rate of the Dataset

To ensure the quality and completeness of the dataset, I performed an extensive analysis of missing values across all columns. The histogram below shows the distribution of missing values:

Key Insights:

- **Overall Fill Percentage:** The dataset has an overall fill percentage of **29.49%**, reflecting the average completeness across all columns.
- **Number of Columns with 0% Missing Values:** Out of **1,181** total columns, there are **4** columns with no missing values, indicating strong data quality in these areas.
- **Number of Columns with High Missing Values:** Out of **1,181** total columns, **743** columns have more than **70%** missing values, suggesting that these columns may require further attention or may be less critical for certain analyses.



Data Preprocessing

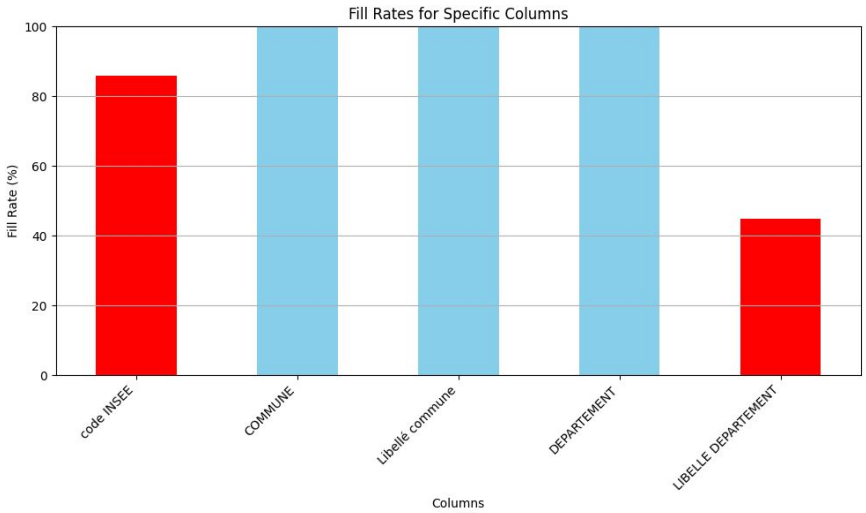
Target: Conduct exploratory data analysis (EDA) on the dataset.

Dataset cleaning & pre-process

As part of the data preparation, specific fields related to commune (municipality) identifiers were carefully cleaned, filled and standardized to ensure consistency and accuracy of the results.

1. **DEPARTEMENT**:
    a. Remove whitespaces (\n)
    b. Standardized single-digit entries (e.g., 1 -> 01)
    c. Corrected overseas department codes:
        i. 96 -> 971 (Guadeloupe)
        ii. 97 -> 972 (Martinique)
        iii. 98 -> 973 (Guyane)
        iv. 99 -> 974 (La Réunion)
2. **COMMUNE**
    a. Corrected the 999 commune code to 56 (especially **75056** - **Paris**)
    b. Corrected commune codes for overseas departments:
        i. 96101 -> 97101 (Les Abymes) and more
3. **LIBELLE DEPARTEMENT (DEPARTEMENT_LABEL)** - Processed all department names for easy identification of a commune. Increased fill rate from **44.87%** to **100%**. Utilized an additional clean and validated dataset to achieve this.

4. **LABEL** - Created a new column by merging the *'Clean code INSEE*', '*Libellé commune'*, and 'DEPARTEMENT_LABEL'. Example: *'75056 - VILLE DE PARIS - Paris'*



Data Preprocessing

Target: Conduct exploratory data analysis (EDA) on the dataset.

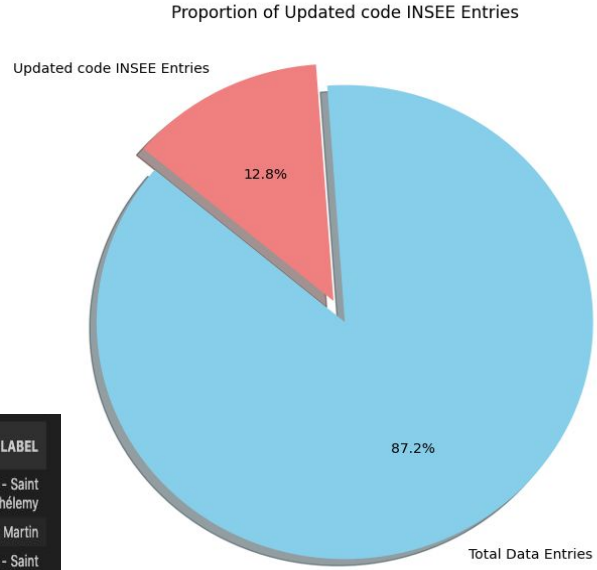
Dataset cleaning & pre-process - code INSEE

The key field used to identify a municipality (commune) is the **code INSEE**. After cleaning up the department and commune codes, I created a new column (**Clean code INSEE)** that combines all processed *code INSEE* to ensure data & statistics accuracy.

The clean INSEE code was calculated after thoroughly cleaning the *DEPARTEMENT* and *COMMUNE* fields. This unique identifier for French administrative units consists of a **two-digit department number followed by a three-digit commune number**. This process addressed all discrepancies and standardized the data for accurate analysis.

- Total number of rows: **1,528,922**
- Total number of rows with *recalculated code INSEE:* **223,619 (12.8%)**

The recalculated clean code INSEE field played a crucial role in the selection, ranking, and analysis of communes (municipalities). It enabled me to accurately track growth, performance, and other important metrics, ensuring that the evaluations and insights are based on reliable and consistent data.



	Libellé commune	COMMUNE	DEPARTEMENT	DEPARTEMENT_LABEL	LIBELLE DEPARTEMENT	code INSEE	Clean code INSEE	LABEL
34958	SAINT-BARTHELEMY	7	977	Saint Barthélemy	SAINT-BARTHELEMY	9777	97707	97707 - SAINT-BARTHELEMY - Saint Barthélemy
34959	SAINT-MARTIN	8	978	Saint Martin	SAINT-MARTIN	9788	97808	97808 - SAINT-MARTIN - Saint Martin
69927	SAINT-BARTHELEMY	7	977	Saint Barthélemy	SAINT-BARTHELEMY	9777	97707	97707 - SAINT-BARTHELEMY - Saint Barthélemy
69928	SAINT-MARTIN	8	978	Saint Martin	SAINT-MARTIN	9788	97808	97808 - SAINT-MARTIN - Saint Martin
69929	ABERGEMENT CLEMENCIAT	1	01	Ain	AIN	<NA>	01001	01001 - ABERGEMENT CLEMENCIAT - Ain

Data Preprocessing

Target: Conduct exploratory data analysis (EDA) on the dataset.

Dataset cleaning & pre-process - communes

After cleaning all the identifiers, it was observed during the analysis that some communes have either no revenue generated or only 1 or 2 scattered entries. While this information is valuable, these entries were excluded from the calculations to ensure more reliable results.

- **14** communes with less than **5** entries or with data spanning for less than **5** years have been excluded from the analysis
- Remaining number of rows: **1,528,887**
- Remaining communes: **36.746**

	Clean code INSEE	LABEL	entry_count	year_count
364025	72206	72206 - MONTFORT LE ROTROU - Sarthe	4	4
375182	13120	13120 - RIVES DE L'ETANG DE BERRE - Bouches-du...	3	3
402639	77535	77535 - MARNE-LA-VALLEE - Seine-et-Marne	3	3
402640	77536	77536 - GRAND-MELUN - Seine-et-Marne	3	3
402641	77537	77537 - SENART-VILLENEUVE - Seine-et-Marne	3	3
402902	78689	78689 - ST QUENTIN EN YVELINES - Yvelines	3	3
403932	80772	80772 - VACQUERIE - Somme	3	3
406842	91693	91693 - EVRY VILLE NOUVELLE - Essonne	3	3
406843	91694	91694 - ROUGEAU-SENART - Essonne	3	3
407152	95691	95691 - CERGY-POINTOISE - Val-d'Oise	3	3
409396	07046	07046 - CASTELJAU - Ardèche	1	1
411769	13120	13120 - N-O DE L ETANG DE BERRE - Bouches-du-R...	3	3
446447	08221	08221 - HAVYS - Ardennes	1	1
471167	66200	66200 - TALAU - Pyrénées-Orientales	1	1
471392	67211	67211 - HOHWILLER - Bas-Rhin	1	1

Data Preprocessing

Target: Conduct exploratory data analysis (EDA) on the dataset.

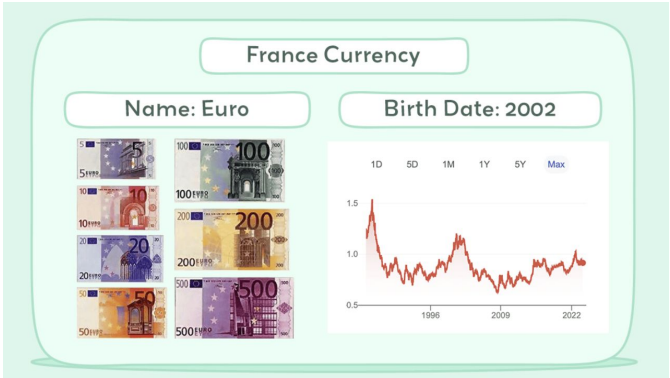
Currency: French franc & Euro

The franc, also known as the French franc (FF), was the currency of France.

Introduction of the Euro: The Euro (€) was introduced as an accounting currency on January 1, 1999, and became the official currency in **France since January 1, 1999.**

Adoption of the Euro
The Euro banknotes and coins were introduced in France on **1 January 2002**, after a transitional period of three years when the Euro was the official currency but only existed as 'book money'.

Conversion Rate: The conversion rate was fixed at **1 euro = 6.55957** French francs. This rate was established by the European Central Bank (ECB) and was used for all conversions from francs to euros.



Analyzing the data, a significant drop in tax revenue was observed in 2002 📉, which cannot be solely attributed to tax changes. If such a drop were due to tax changes alone, it would have led to an economic collapse 💥, which did not occur.

Therefore, it is assumed that the data prior to 2002 was recorded in francs 🇫🇷. Consequently, all values prior to 2002 have been converted to euros 🇪🇺 at the fixed conversion rate of **1 euro = 6.55957** to ensure the total tax values are accurate and consistent.

Data Preprocessing

Target: Conduct exploratory data analysis (EDA) on the dataset.

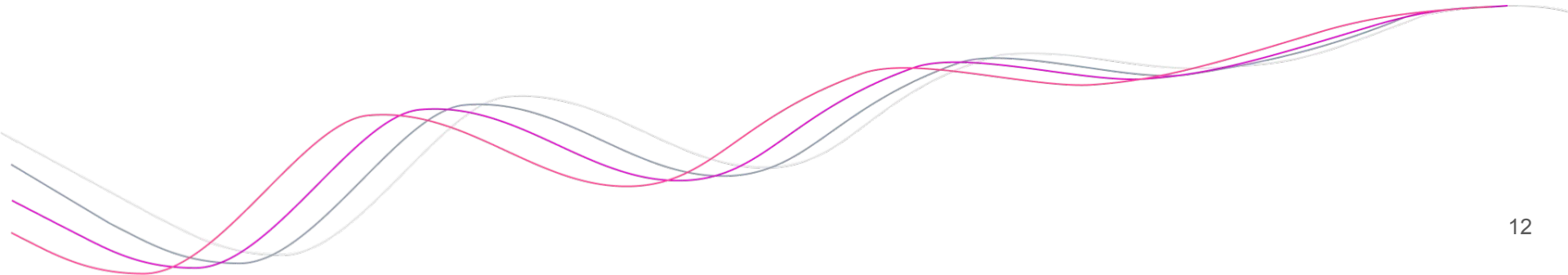
Additional datasets & external resources

To enhance the dataset and ensure its accuracy, several external resources were used. These resources provided vital information that was instrumental in filling missing data and correcting discrepancies.

- INSEE (Institut national de la statistique et des études économiques)
  - Provided crucial data about municipalities, departments, and regions, including INSEE codes, names, and other relevant details.
- Statistiques Locales INSEE
  - Offered detailed statistics about local areas, which were essential for ensuring the accuracy and completeness of the dataset.
- OFGL (Observatoire des Finances et de la Gestion Locale)
  - Provided comprehensive data on local fiscality, which was used to enhance the understanding and analysis of local tax data.
- French Tax Law Brochure
  - This document was essential for understanding the complexities of the French tax system, ensuring that the analysis was aligned with current tax laws and regulations.
- French Franc - Euro
  - The official european bank conversion rate and info about the french franc to euro conversion
- French Franc - Euro adoption in France
- ChatGPT
  - ChatGPT was an invaluable companion throughout the project, providing assistance in data analysis, interpretation, and generating insights.

These resources collectively ensured that the dataset was accurate, complete, and enriched with valuable information. By integrating data from these authoritative sources, we were able to achieve a high level of data quality, which was crucial for conducting a thorough and reliable analysis.

Municipality Rankings



Municipality Rankings

Target: Rank municipalities based on their tax revenue. Display the top 5 and bottom 5 using a visual aid of your choice. What conclusions can you draw from this?

Data Preparation: I reviewed all the columns in the dataset, using the provided column descriptions, and categorized each one. Additionally, the collector of the revenue was identified and extracted.

The newly calculated **'Clean code INSEE'** was used as an identifier for each municipality.

Key Data for Ranking:
The following **24 taxes** are used to determine the total tax revenue per each municipality (commune).

General Taxes

1. **CFE - COMMUNE / PRODUIT REEL NET** - Real net product from the Contribution on Business Value Added (CFE) at the commune level.
2. **FB - COMMUNE / MONTANT REEL** - Actual amount of property tax on buildings (FB) at the commune level.
3. **FNB - COMMUNE / MONTANT REEL** - Actual amount of property tax on undeveloped land (FNB) at the commune level.
4. **IFER TOTALE / COMMUNE - Total IFER** (Flat-rate Tax on Network Companies) at the commune level.
5. **TH - COMMUNE / MONTANT REEL COMMUNAL AU PROFIT DE LA COMMUNE** - Actual amount of housing tax (TH) for the benefit of the commune.
6. **TAFNB - COMMUNE / MONTANT REEL NET** - Real net amount of the additional tax on undeveloped land (TAFNB) at the commune level.
7. **TASCOM** au profit de la commune - Tax on Commercial Surfaces (TASCOM) for the benefit of the commune.
8. **Part de CVAE au profit de la commune** - Share of the Contribution on Business Value Added (CVAE) for the benefit of the commune.
9. **Part de CVAE dégrevée au profit de la commune** - The amount of CVAE that has been rebated back to the commune, reflecting a real adjustment in the financial records.
10. **Part de CVAE exonérée compensée au profit de la commune** - Indicates the amount of CVAE that is exempt but compensated to the commune by other means (possibly state or higher administrative bodies), showing a tangible impact on the commune's finances.

Municipality Rankings

Target: Rank municipalities based on their tax revenue. Display the top 5 and bottom 5 using a visual aid of your choice. What conclusions can you draw from this?

Extra/Specific Taxes

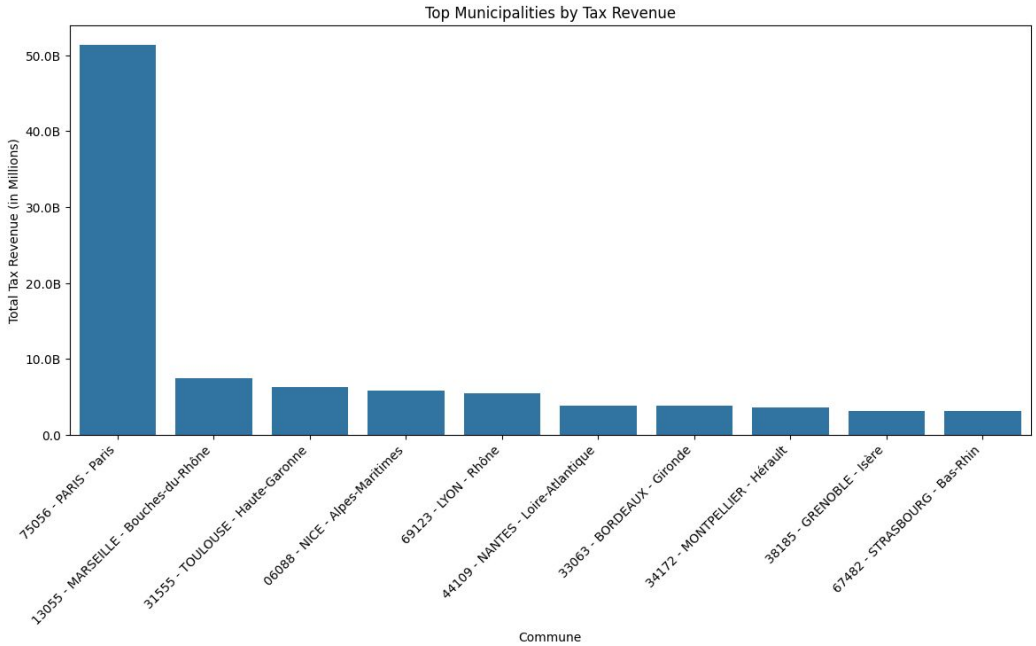
1. **CFE - TSE / PRODUIT REEL NET -** Real net product of the Special Equipment Tax (TSE) backed by the Contribution on Business Value Added (CFE) on the commune's territory
2. **FB - TSE / MONTANT REEL -** Actual amount of Special Equipment Tax (TSE) for property tax on buildings (FB).
3. **FNB - TSE / MONTANT REEL -** Actual amount of Special Equipment Tax (TSE) on undeveloped land (FNB).
4. **TH - TSE / MONTANT REEL -** Actual amount of Special Equipment Tax (TSE) for housing tax (TH).
5. **IFER EOLIENNES ART 1519 D DU CGI / COMMUNE / MONTANT** - Amount of IFER on wind turbines at the commune level.
6. **IFER HYDROLIENNES ART 1519 D DU CGI / COMMUNE / MONTANT** - Amount of IFER on tidal turbines at the commune level.
7. **IFER CENTRALES NUCLEAIRES OU THERMIQUES A FLAMME ART 1519 E DU CGI / COMMUNE / MONTANT** - Amount of IFER on nuclear or fossil fuel power plants at the commune level.
8. **IFER CENTRALES PHOTOVOLTAIQUES ART 1519 F DU CGI / COMMUNE / MONTANT** - Amount of IFER on photovoltaic power plants at the commune level.
9. **IFER BARRAGES HYDRAULIQUES ART 1519 F DU CGI / COMMUNE / MONTANT** - Amount of IFER on hydraulic dams at the commune level.
10. **IFER TRANSFORMATEURS ELECTRIQUES ART 1519 G DU CGI / COMMUNE / MONTANT** - Amount of IFER on electrical transformers at the commune level.
11. **IFER STATIONS RADIOELECTRIQUES ART 1519 H DU CGI / COMMUNE / MONTANT** - Amount of IFER on radio stations at the commune level.
12. **IFER INSTALLATIONS DE GAZ NATUREL ART 1519HA DU CGI / COMMUNE / MONTANT** - Amount of IFER on natural gas installations at the commune level.
13. **IFER GEOTHERMIE (Art 1519 HB) DU CGI / COMMUNE / MONTANT** - Amount of IFER on geothermal installations at the commune level.
14. **TH - MONTANT REEL DE LA MAJORATION DES RESIDENCES SECONDAIRES** - Actual amount of the surcharge on second homes.

Municipality Rankings

Target: Rank municipalities based on their tax revenue. Display the top 5 and bottom 5 using a visual aid of your choice. What conclusions can you draw from this?

Top Municipalities by Total Tax Revenue

1. 75056 - PARIS - Paris: **51.4B**
2. 13055 - MARSEILLE - Bouches-du-Rhône: **7.4B**
3. 31555 - TOULOUSE - Haute-Garonne: **6.3B**
4. 06088 - NICE - Alpes-Maritimes: **5.9B**
5. 69123 - LYON - Rhône: **5.5B**
6. 44109 - NANTES - Loire-Atlantique: **3.9B**
7. 33063 - BORDEAUX - Gironde: **3.9B**
8. 34172 - MONTPELLIER - Hérault: **3.6B**
9. 38185 - GRENOBLE - Isère: **3.2B**
10. 67482 - STRASBOURG - Bas-Rhin: **3.2B**



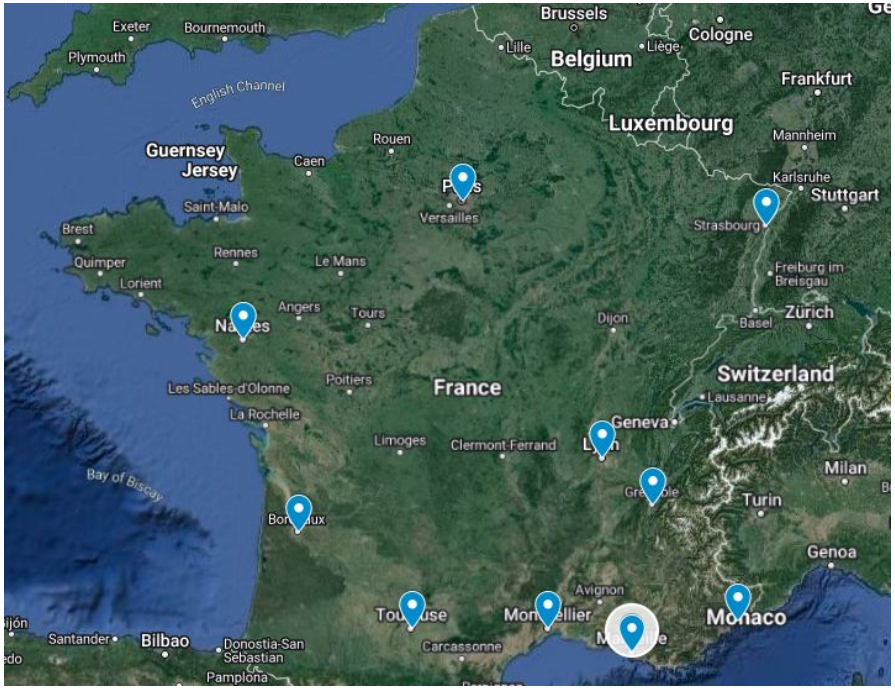
Municipality Rankings

Target: Rank municipalities based on their tax revenue. Display the top 5 and bottom 5 using a visual aid of your choice. What conclusions can you draw from this?

Top Municipalities by Total Tax Revenue

Insights:

1. **Paris Dominance**: Paris vastly outstrips other municipalities in tax revenue, confirming its economic dominance. With a tax revenue of **€51.4B**, it serves as France's primary hub for finance, commerce, and culture.
2. **Regional Hubs**: Toulouse, Marseille, Nice, and Lyon are key regional economic centers, each generating significant tax revenue.
3. **Port Cities' Economic Role**: Cities like Marseille, which is a major port city, contribute significantly to the economy through maritime trade and logistics.
4. **Geographic Spread**: Top revenue-generating municipalities are spread across France, showing a balanced economic distribution.
5. **Tourism Impact**: Cities such as Paris, Nice and Bordeaux, known for their tourism, show high tax revenues, indicating the substantial economic impact of tourism on local economies.
6. **Technological and Industrial Hubs**: Toulouse, known for its aerospace industry, and Grenoble, known for its technology and research sectors, reflect the importance of specialized industries in boosting local economies.
7. **Cultural and Academic Influence**: Cities like Lyon and Strasbourg, known for their cultural heritage and academic institutions, contribute significantly to the economy.
8. **Infrastructure and Connectivity**: High revenues in cities like Paris and Lyon can be attributed to their well-developed infrastructure and connectivity, facilitating business and commerce.

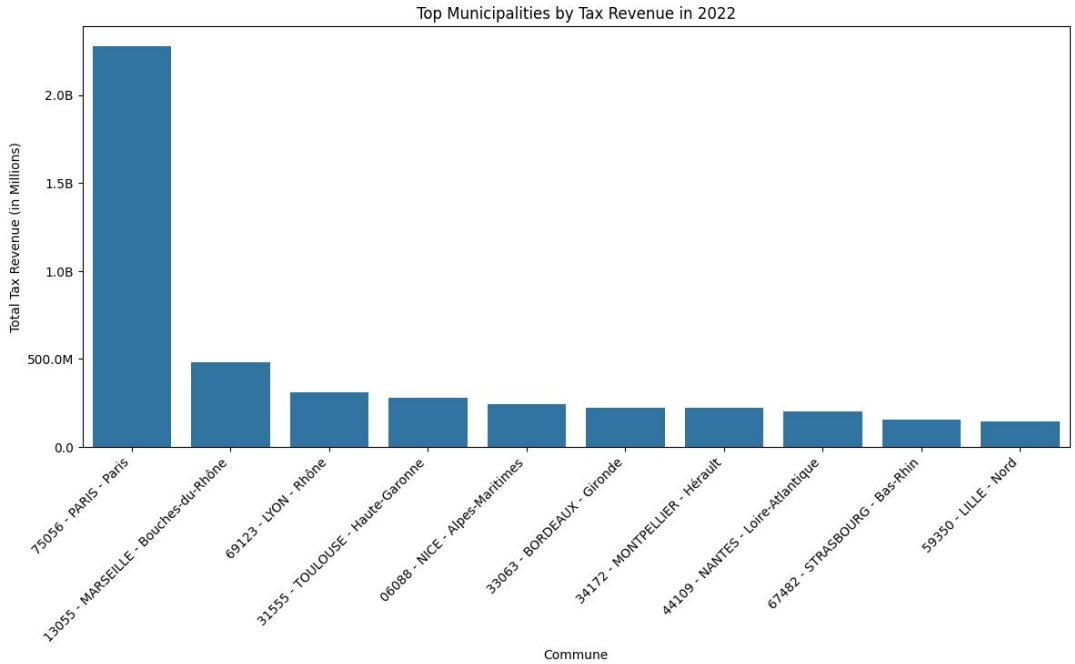


Municipality Rankings

Target: Rank municipalities based on their tax revenue. Display the top 5 and bottom 5 using a visual aid of your choice. What conclusions can you draw from this?

Top Municipalities by 2022 Tax Revenue

1. 75056 - PARIS - Paris: **2.3B**
2. 13055 - MARSEILLE - Bouches-du-Rhône: **479.8M**
3. 69123 - LYON - Rhône: **310.7M**
4. 31555 - TOULOUSE - Haute-Garonne: **281.0M**
5. 06088 - NICE - Alpes-Maritimes: **241.6M**
6. 33063 - BORDEAUX - Gironde: **220.5M**
7. 34172 - MONTPELLIER - Hérault: **220.1M**
8. 44109 - NANTES - Loire-Atlantique: **201.2M**
9. 67482 - STRASBOURG - Bas-Rhin: **154.9M**
10. 59350 - LILLE - Nord: **142.5M**



Insights:

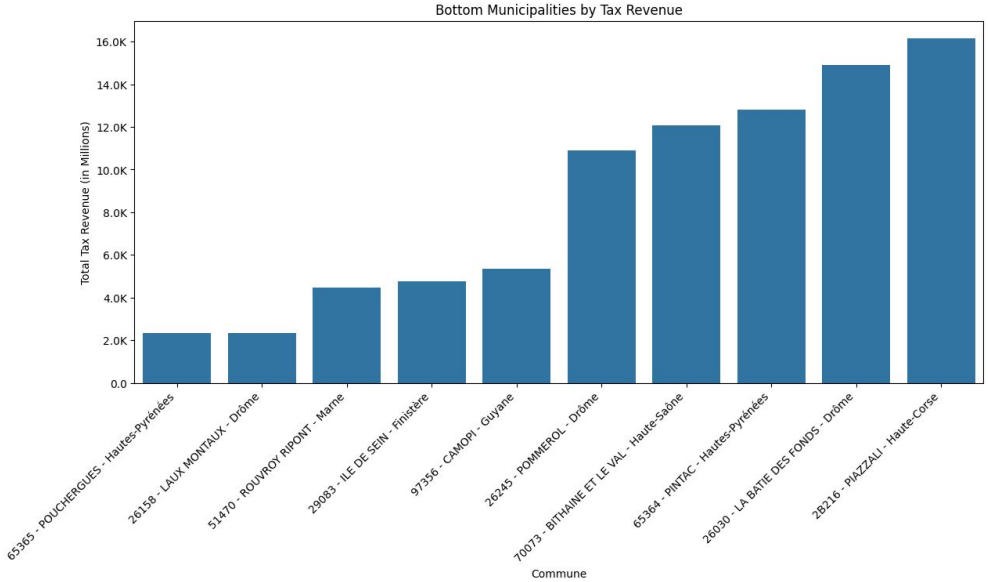
1. **Consistent Top Performers**: Paris, Marseille, Lyon, and Toulouse remain top performers, showing their long-term economic resilience and importance in the national economy.
2. **Emergence of New Players**: Lille appear in the top municipalities for 2022. This suggests these cities have experienced recent growth and increased economic activity.
3. **Economic Diversification**: The shift in rankings and the emergence of new cities in the 2022 list may indicate economic diversification and development in various regions across France

Municipality Rankings

Target: Rank municipalities based on their tax revenue. Display the top 5 and bottom 5 using a visual aid of your choice. What conclusions can you draw from this?

Bottom Municipalities by Total Tax Revenue

1. 65365 - POUCHERGUES - Hautes-Pyrénées: **2.3K**
2. 26158 - LAUX MONTAUX - Drôme: **2.3K**
3. 51470 - ROUVROY RIPONT - Marne: **4.5K**
4. 29083 - ILE DE SEIN - Finistère: **4.8K**
5. 97356 - CAMOPI - Guyane: **5.4K**
6. 26245 - POMMEROL - Drôme: **10.9K**
7. 70073 - BITHAINE ET LE VAL - Haute-Saône: **12.1K**
8. 65364 - PINTAC - Hautes-Pyrénées: **12.8K**
9. 26030 - LA BATIE DES FONDS - Drôme: **14.9K**
10. 2B216 - PIAZZALI - Haute-Corse: **16.2K**



PS: A few municipalities (29084 - ILE MOLENE - Finistère, 97123 - SAINT-BARTHELEMY - Guadeloupe, 97707 - SAINT-BARTHELEMY - Saint Barthélemy) generated no revenue. These were considered outliers and excluded from the ranking. Also, municipalities that have less than 5 entries and data for less than 5 years was removed. Details here.

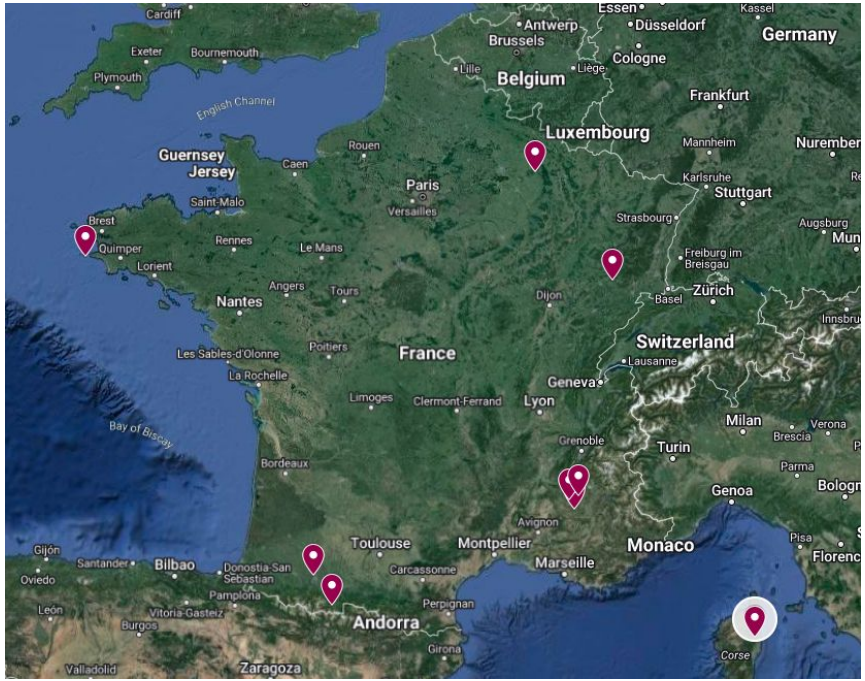
Municipality Rankings

Target: Rank municipalities based on their tax revenue. Display the top 5 and bottom 5 using a visual aid of your choice. What conclusions can you draw from this?

Bottom Municipalities by Total Tax Revenue

Insights:

1. **Economic Modesty**: Pouchergues and Laux Montaux show the modest scale typical of France's smallest rural communes with limited fiscal capacities.
2. **Geographic Constraints**: Ile de Sein and Camopi demonstrate how geographic isolation can impact economic output and tax revenues due to infrastructural challenges.
3. **Agricultural Dependence**: Communities such as Rouvroy Ripont rely heavily on agriculture, which typically results in lower economic throughput and variable financial stability.
4. **Limited Fiscal Capacity**: Pouchergues and Laux Montaux face limited fiscal capacity due to small populations and fewer business activities, reflecting economic modesty.
5. **Cultural and Natural Preservation**: Locations like Ile de Sein and Piazzali may prioritize preserving cultural heritage and natural landscapes over commercial development.
6. **Impact of Demographics**: Low revenue figures in places like Pommerol highlight the impact of demographic factors such as aging populations and youth migration.
7. **Infrastructure Challenges**: Communes like Camopi face significant infrastructure challenges, which hinder economic development and limit tax revenue generation.
8. **Fiscal Growth Amid Challenges:** La Batie des Fonds indicates potential fiscal growth amid challenges, possibly due to effective local governance or specific economic activities.

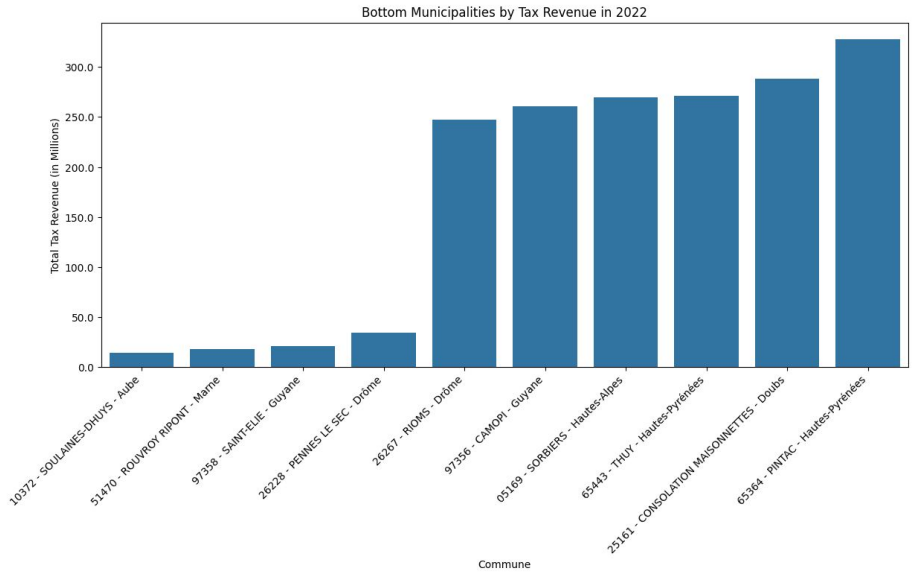


Municipality Rankings

Target: Rank municipalities based on their tax revenue. Display the top 5 and bottom 5 using a visual aid of your choice. What conclusions can you draw from this?

Bottom Municipalities by 2022 Tax Revenue

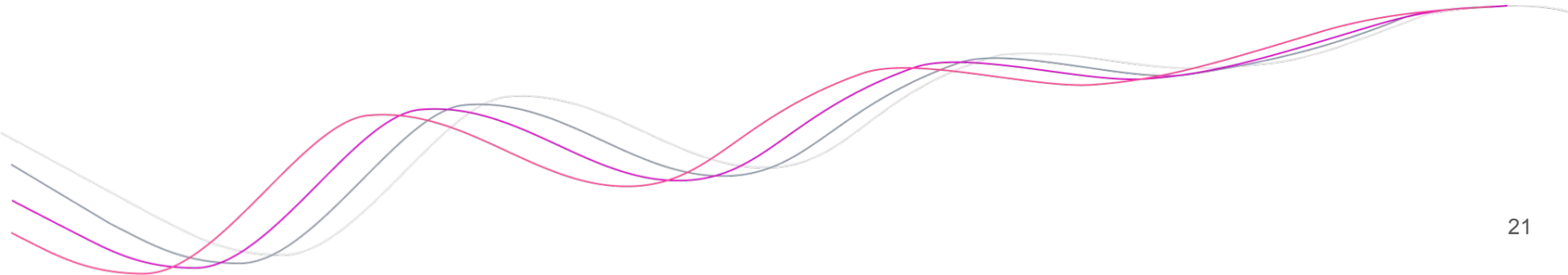
1. 10372 - SOULAINES-DHUYS - Aube: **14.0**
2. 51470 - ROUVROY RIPONT - Marne: **18.0**
3. 97358 - SAINT-ELIE - Guyane: **21.0**
4. 26228 - PENNES LE SEC - Drôme: **34.0**
5. 26267 - RIOMS - Drôme: **247.0**
6. 97356 - CAMOPI - Guyane: **261.0**
7. 05169 - SORBIERS - Hautes-Alpes: **270.0**
8. 65443 - THUY - Hautes-Pyrénées: **271.0**
9. 25161 - CONSOLATION MAISONNETTES - Doubs: **288.0**
10. 65364 - PINTAC - Hautes-Pyrénées: **328.0**



Insights:

1. **Emergence of New Low Performers**: The appearance of new municipalities like SOULAINES-DHUYS (Aube) and SAINT-ELIE (Guyane) in the 2022 list suggests that these areas have experienced recent economic downturns or challenges.
2. **Geographic Concentration**: Several municipalities from Drôme and Hautes-Pyrénées appear on both lists, suggesting persistent economic challenges in these regions.
3. **Minimal Revenue Increase**: The revenue figures for 2022 remain very low (ranging from 14.0 to 328.0 euros), indicating that these municipalities continue to struggle with generating significant tax revenue.

Department Rankings



Department Rankings

Target: Rank departments based on their tax revenue. Display the top 5 and bottom 5 using a visual aid of your choice. What conclusions can you draw from this?

Key Data for Ranking:

The following **10 taxes** are used to determine the total tax revenue per each department.

1. **FNB - CHAMBRE D'AGRICULTURE / MONTANT REEL -** Actual amount of property tax on undeveloped land (FNB) at the level of the Chamber of Agriculture.

2. **IFER EOLIENNES ART 1519 D DU CGI / DEPARTEMENT / MONTANT -** The amount of the Flat-rate Tax on Network Companies (IFER) specifically for wind turbines, at the departmental level.

3. **IFER HYDROLIENNES ART 1519 D DU CGI / DEPARTEMENT / MONTANT -** The amount of the IFER specifically for hydro turbines, at the departmental level.

4. **IFER CENTRALES NUCLEAIRES OU THERMIQUES A FLAMME ART 1519 E DU CGI / DEPARTEMENT / MONTANT -** The amount of the IFER specifically for nuclear or fossil fuel power plants at the departmental level.

5. **IFER CENTRALES PHOTOVOLTAIQUES ART 1519 F DU CGI / DEPARTEMENT / MONTANT -** The amount of the IFER specifically for photovoltaic (solar) power plants at the departmental level.

6. **IFER BARRAGES HYDRAULIQUES ART 1519 F DU CGI / DEPARTEMENT / MONTANT -** The amount of the IFER specifically for hydraulic dams at the departmental level.

7. **IFER INSTALLATIONS DE GAZ NATUREL ART 1519HA DU CGI / DEPARTEMENT / MONTANT -** The amount of the IFER specifically for natural gas installations at the departmental level.

8. **IFER STATIONS RADIOELECTRIQUES ART 1519 H DU CGI / DEPARTEMENT / MONTANT -** The amount of the IFER specifically for radioelectric stations at the departmental level.

9. **IFER TOTALE / DEPARTEMENT -** Total amount of the IFER at the departmental level.

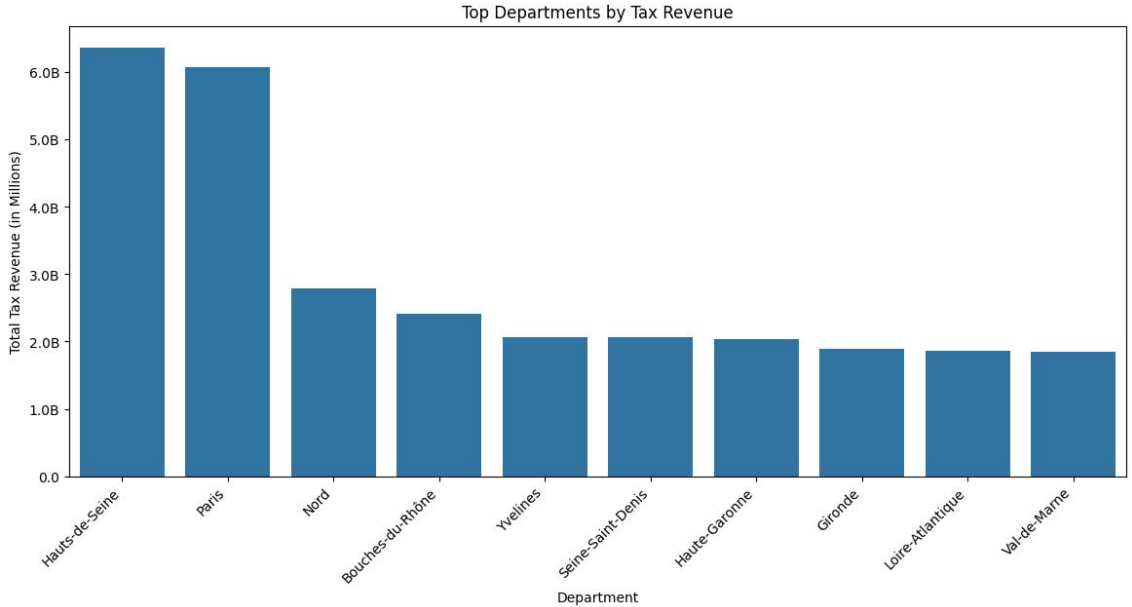
10. **Part de CVAE au profit du département -** Share of the Contribution on Business Value Added (CVAE) for the benefit of the department.

Department Rankings

Target: Rank departments based on their tax revenue. Display the top 5 and bottom 5 using a visual aid of your choice. What conclusions can you draw from this?

Top Departments by Total Tax Revenue

1. Hauts-de-Seine: **6.4B**
2. Paris: **6.1B**
3. Nord: **2.8B**
4. Bouches-du-Rhône: **2.4B**
5. Yvelines: **2.1B**
6. Seine-Saint-Denis: **2.1B**
7. Haute-Garonne: **2.0B**
8. Gironde: **1.9B**
9. Loire-Atlantique: **1.9B**
10. Val-de-Marne: **1.9B**



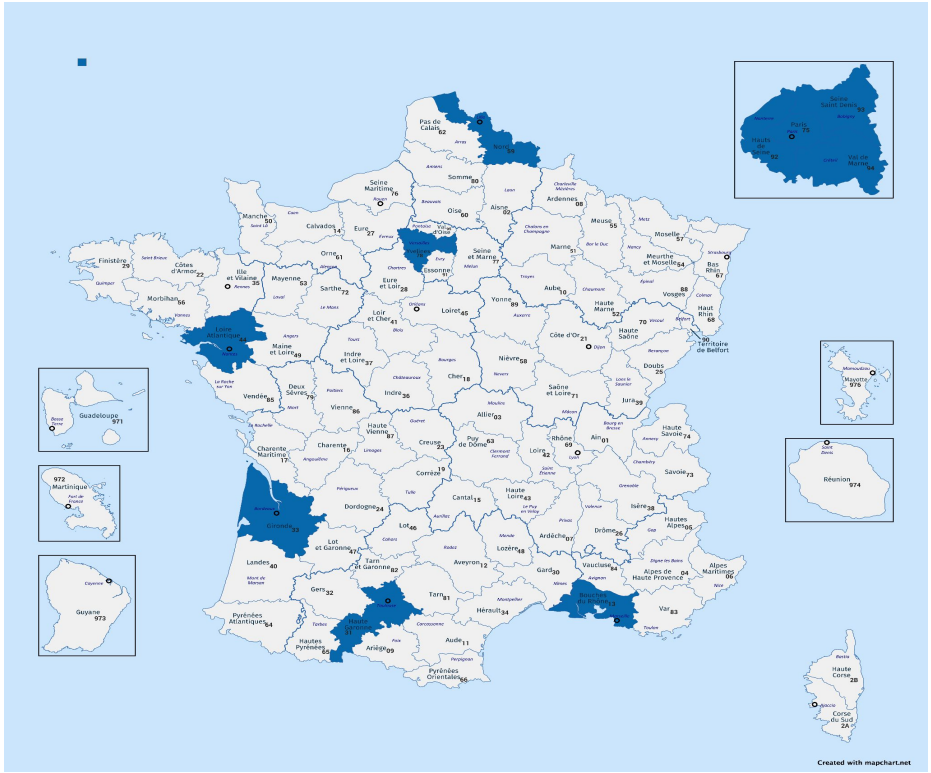
Department Rankings

Target: Rank departments based on their tax revenue. Display the top 5 and bottom 5 using a visual aid of your choice. What conclusions can you draw from this?

Top Departments by Total Tax Revenue

Insights

1. **Economic Concentration**: Hauts-de-Seine and Paris have the highest revenues, indicating concentrated economic activities and higher tax bases.
2. **Regional Disparities**: There's a significant gap between the top two departments and the rest, showing economic disparities.
3. **Population and Urbanization:** Higher revenues often correspond to more densely populated and urbanized areas.
4. **Economic Hubs**: Hauts-de-Seine, Bouches-du-Rhône, and Gironde are key economic centers, reflected in their revenues.
5. **Balanced Development:** Loire-Atlantique and Haute-Garonne show strong revenues, indicating thriving economies beyond Paris.
6. **Potential for Investment:** High revenue departments indicate areas with significant economic activities and investment opportunities.
7. **Policy Implications**: Revenue disparities could guide government policies for regional development and resource distribution.

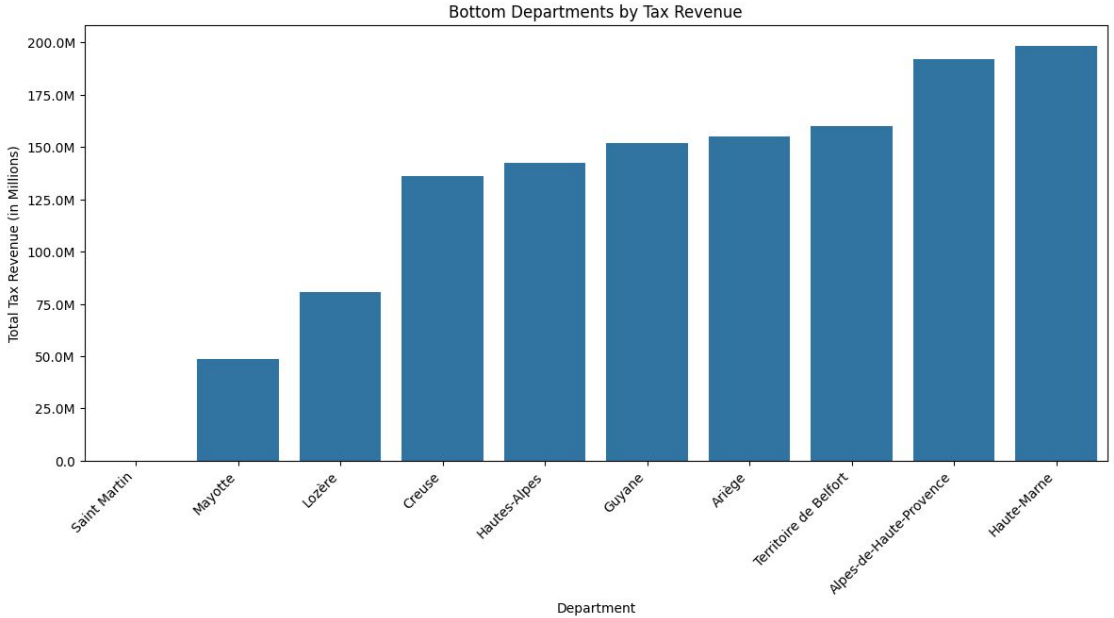


Department Rankings

Target: Rank departments based on their tax revenue. Display the top 5 and bottom 5 using a visual aid of your choice. What conclusions can you draw from this?

Bottom Departments by Total Tax Revenue

1. Saint Martin: **63.8K**
2. Mayotte: **48.6M**
3. Lozère: **80.8M**
4. Creuse: **136.1M**
5. Hautes-Alpes: **142.4M**
6. Guyane: **151.8M**
7. Ariège: **154.9M**
8. Territoire de Belfort: **160.2M**
9. Alpes-de-Haute-Provence: **192.2M**
10. Haute-Marne: **198.5M**



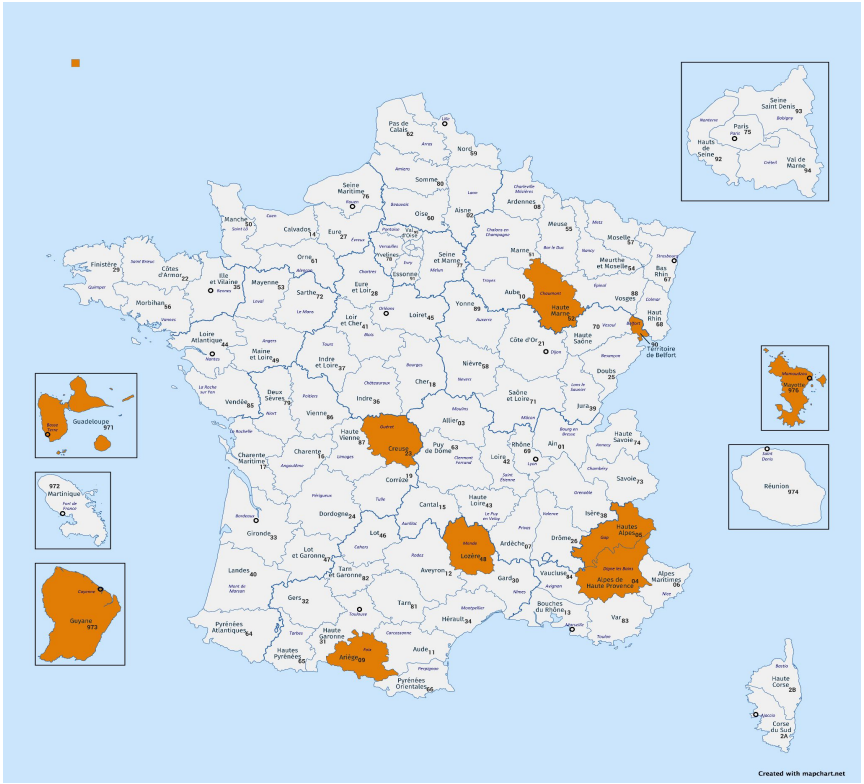
Department Rankings

Target: Rank departments based on their tax revenue. Display the top 5 and bottom 5 using a visual aid of your choice. What conclusions can you draw from this?

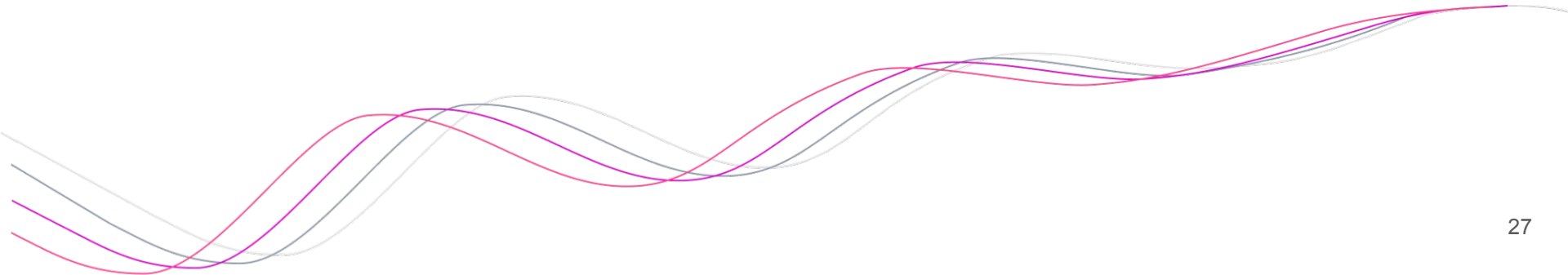
Bottom Departments by Total Tax Revenue

Insights

1. **Low Economic Activity**: Saint Martin has the lowest revenue, indicating limited economic activities and tax base.
2. **Regional Disparities**: Mayotte and Lozère also have low revenues, showing significant economic disparities compared to top departments.
3. **Population and Urbanization**: Departments with lower revenues are generally less densely populated and less urbanized.
4. **Rural and Remote Areas**: Lozère, Creuse, and Hautes-Alpes are more rural, which contributes to their lower economic activity and revenue.
5. **Development Challenges**: Guyane and Mayotte, despite being larger territories, face development challenges that limit their revenue generation.
6. **Investment Needs**: These departments may need targeted investments to boost economic activities and improve their revenue bases.
7. **Policy Focus**: The low revenues highlight areas where government policies might focus on stimulating growth and addressing disparities.

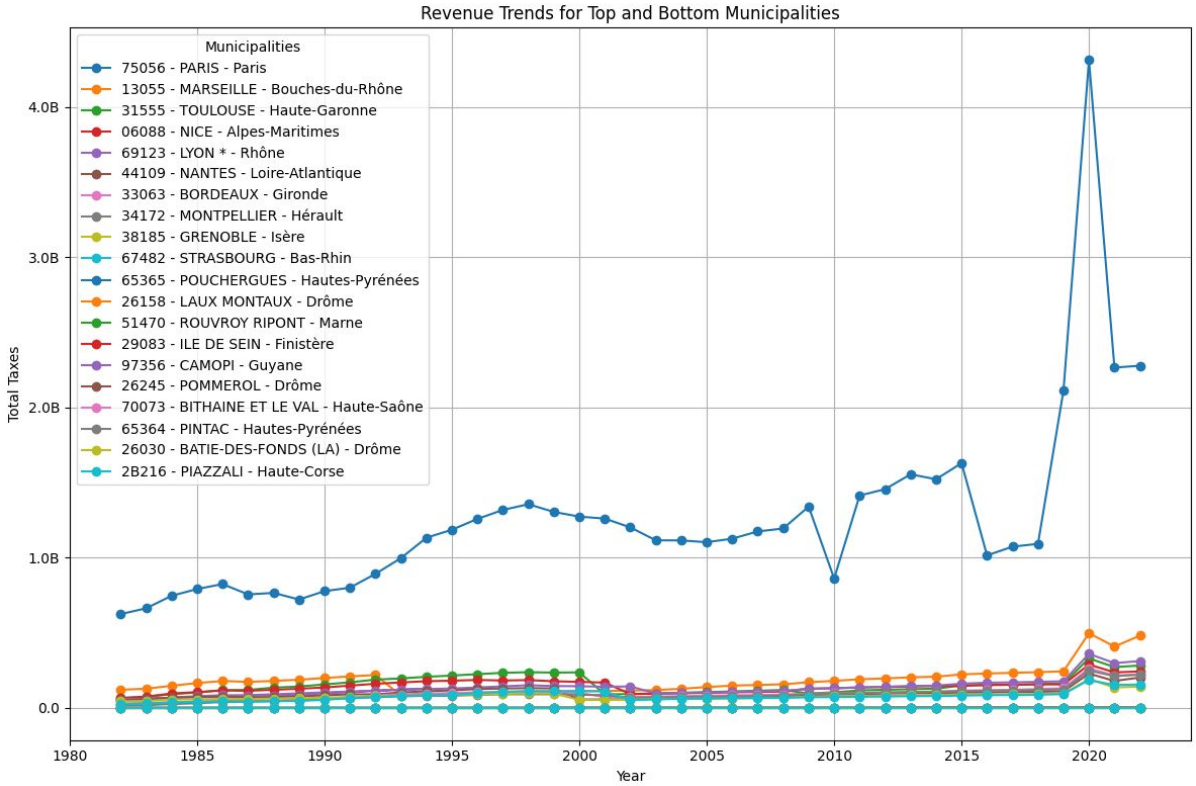


Revenue Trends



Revenue Trends

Target: Create a graph to illustrate the revenue trends in the 10 municipalities mentioned above. What insights can you derive from this data?



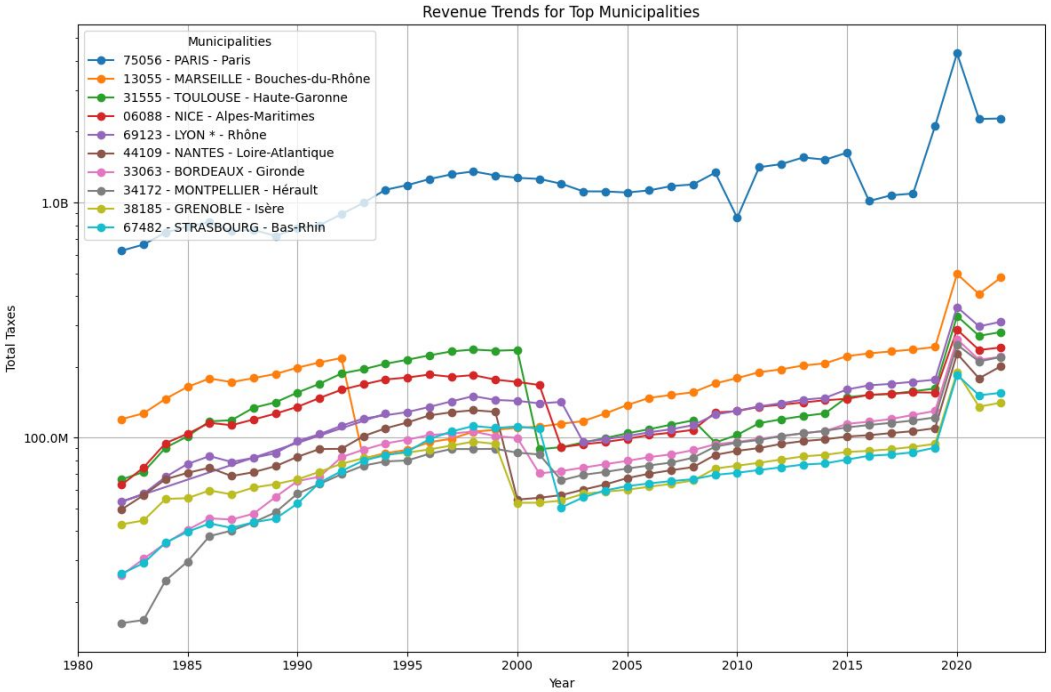
Revenue Trends

Target: Create a graph to illustrate the revenue trends in the 10 municipalities mentioned above. What insights can you derive from this data?

Revenue Trends for Top Municipalities

Insights:

1. **Paris's Exponential Growth**: Paris shows significant exponential growth, especially post-2010, indicating substantial economic expansion.
2. **General Growth Trend Post-2000**: Most municipalities show a growth trend starting around 2000, likely due to economic improvements and tax policy changes.
3. **Recovery and Growth in the 2010s**: Visible recovery and growth post-2010 for many cities, indicating recovery from the **2008 financial crisis** and subsequent economic policies.
4. **Impact of Economic Cycles**: Cities like Lyon, Marseille, and Toulouse show similar growth patterns, suggesting regional or national economic cycles' influence.
5. **Divergence in Recent Years**: In recent years, cities show varying growth dynamics, reflecting differing local economic policies and industrial growth.
6. **Stability of Other Major Cities**: Nantes, Bordeaux, and Strasbourg demonstrate stable growth with fewer fluctuations compared to Paris, indicating less volatile economic conditions.
7. **Paris as an Outlier**: Paris outpaces other cities in absolute revenue and growth rate, emphasizing its unique status in France's economy.



Note: The graph uses a logarithmic scale to make smaller values more visible.

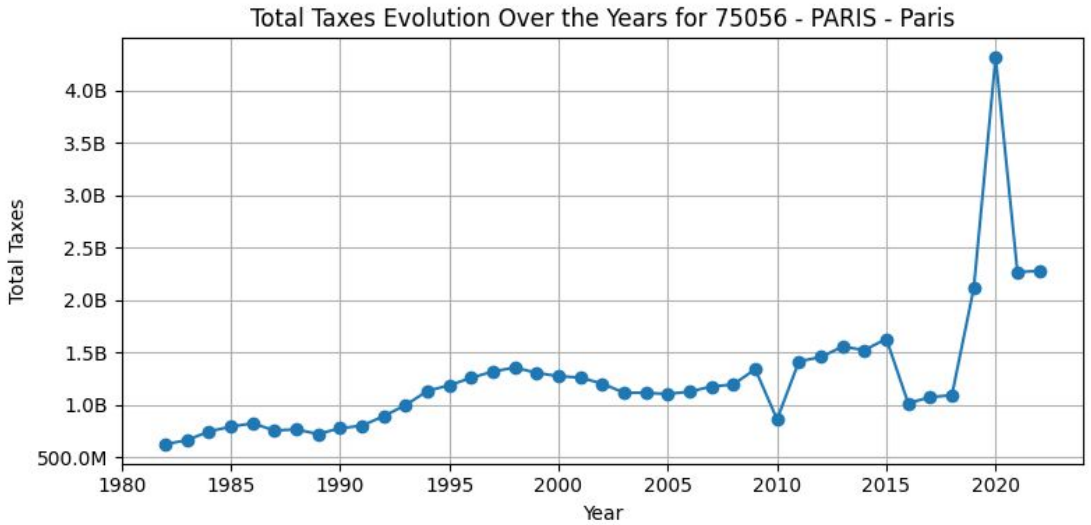
Revenue Trends

Target: Create a graph to illustrate the revenue trends in the 10 municipalities mentioned above. What insights can you derive from this data?

Revenue Trends for Paris

Insights:

1. **Significant Growth Post-2010**: The tax revenues for Paris show a substantial increase after 2010, peaking around 2020. This sharp rise could be attributed to several factors including real estate market booms, increases in local taxes, and business relocations due to Brexit, which collectively boosted revenue collection.
2. **Stability and Gradual Increase Pre-2010**: From 1980 to 2010, Paris's tax revenues exhibit a stable and gradual increase, with a noticeable dip around the late 2000s. This pattern reflects steady economic growth with minor fluctuations, possibly due to economic cycles or policy changes.
3. **Sharp Peaks and Subsequent Decline Around 2020**: The graph shows a dramatic spike in revenue around 2020, followed by a decline. This spike might be attributed to exceptional economic activities such as fiscal stimulus measures during the COVID-19 pandemic, increased government subsidies, a rebound in domestic tourism, and one-time fiscal adjustments, followed by normalization or adjustment in subsequent years.



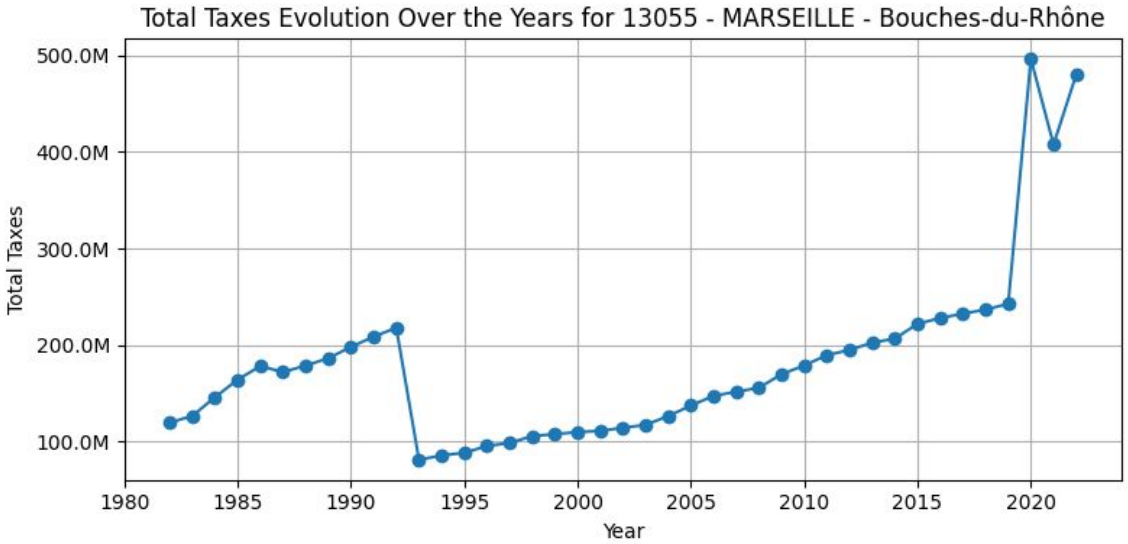
Revenue Trends

Target: Create a graph to illustrate the revenue trends in the 10 municipalities mentioned above. What insights can you derive from this data?

Revenue Trends for Marseille

Insights:

1. **Post-2000 Steady Growth**: From 2000 onwards, Marseille shows a steady increase in tax revenues, culminating in a significant rise around 2020. This consistent growth reflects ongoing economic development, possibly influenced by local industrial growth, improvements in tourism, and increased business activities.
2. **Sharp Decline in Early 1990s**: The noticeable decline in tax revenues around the early 1990s might be attributed to economic downturns, local fiscal policy changes, or the impact of national economic crises. This period of decline highlights the economic challenges Marseille faced during that time.
3. **Significant Spike Around 2020**: Similar to Paris, Marseille experiences a sharp spike in tax revenue around 2020, followed by a slight decrease. This spike could be due to several factors, including increased government subsidies during the COVID-19 pandemic, fiscal stimulus measures, and a rebound in economic activities as restrictions were lifted.



Revenue Trends

Target: Create a graph to illustrate the revenue trends in the 10 municipalities mentioned above. What insights can you derive from this data?

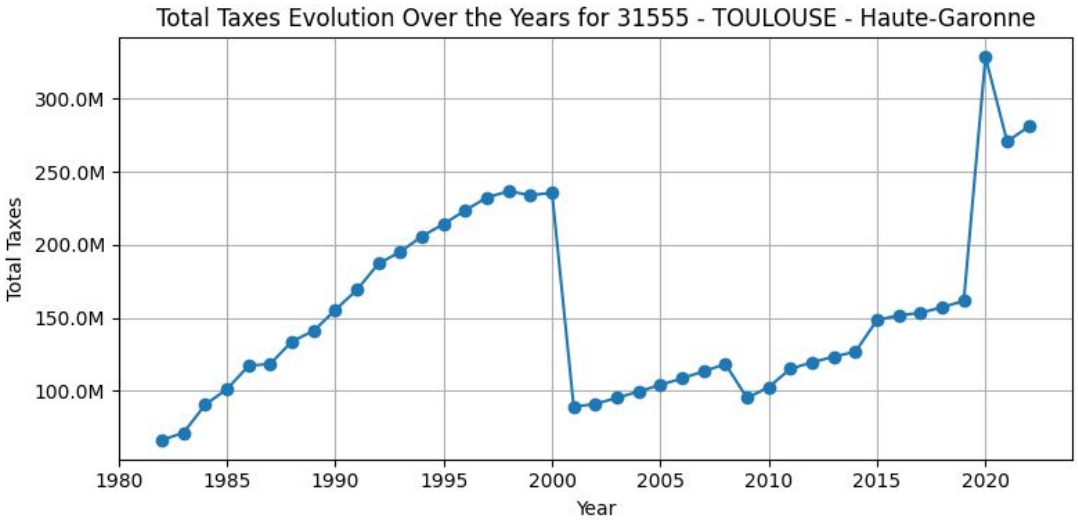
Revenue Trends for Toulouse

Insghts:

1. **Early 2000s Sharp Decline**: The significant decline in tax revenues around the early 2000s could be attributed to the burst of the dot-com bubble, which affected many tech-focused economies. Additionally, local economic challenges or fiscal policy changes could have contributed to this sharp decrease.

2. **Steady Growth Post-2005**: From around 2005 onwards, Toulouse shows a steady increase in tax revenues, reflecting the city's recovery and growth. This period likely benefited from the booming aerospace industry, with Toulouse being home to Airbus and other significant aerospace companies, contributing to sustained economic growth.

3. **Significant Spike Around 2020**: Similar to other major cities, Toulouse experiences a sharp spike in tax revenues around 2020. This spike might be due to government fiscal stimulus measures in response to the COVID-19 pandemic, a rebound in economic activities, and possibly increased investments in the aerospace sector as travel restrictions began to lift and demand for aircraft started to recover.



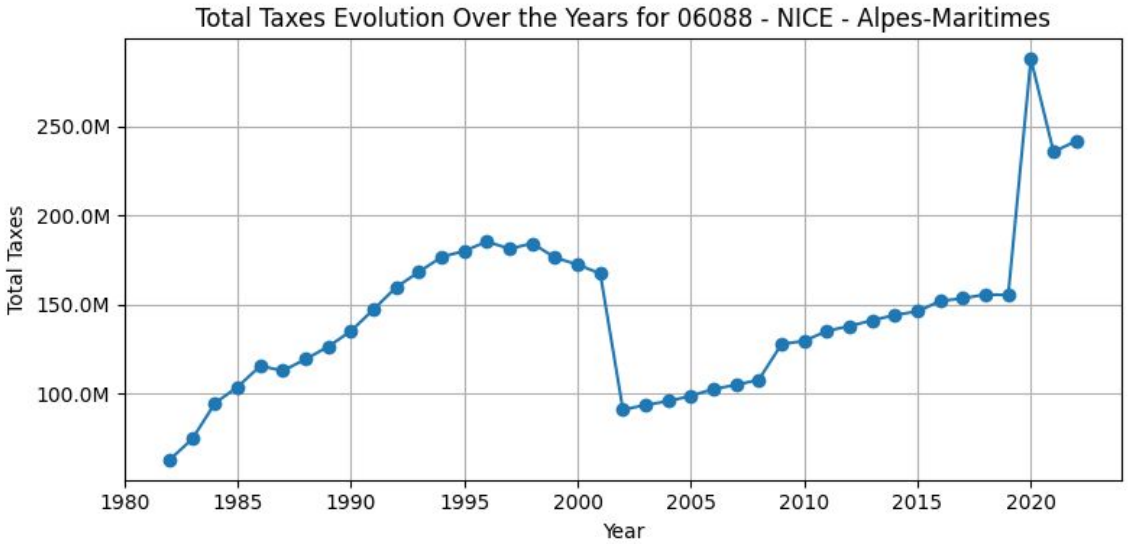
Revenue Trends

Target: Create a graph to illustrate the revenue trends in the 10 municipalities mentioned above. What insights can you derive from this data?

Revenue Trends for Nice

Insights:

1. **Early 2000s Decline**: The drop in tax revenues around the early 2000s could be due to the dot-com bubble burst, economic downturns, and short-term disruptions from the transition to the Euro in 2002.
2. **Post-2005 Recovery:** Steady revenue growth from 2005 onwards reflects economic recovery, boosted tourism, and the stabilization of the Euro, aiding economic confidence.
3. **2020 Spike:** The sharp increase around 2020 likely results from COVID-19 fiscal stimulus, a tourism rebound, and increased real estate activities as travel restrictions eased.



Revenue Trends

Target: Create a graph to illustrate the revenue trends in the 10 municipalities mentioned above. What insights can you derive from this data?

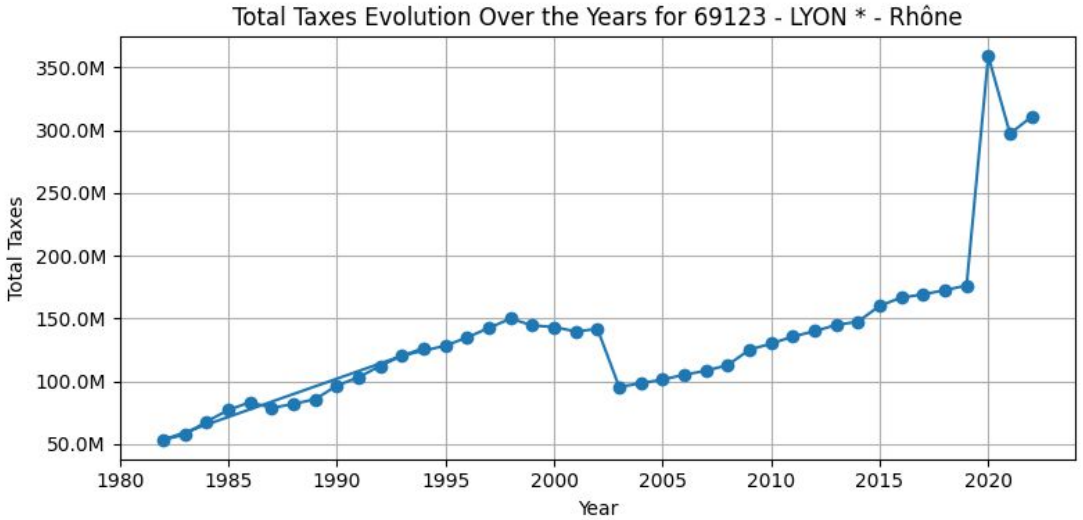
Revenue Trends for Lyon

Insights:

1. **Early 2000s Decline**: The drop in tax revenues around the early 2000s could be due to economic downturns, local fiscal policy changes, and short-term disruptions from France's transition to the Euro in 2002.

2. **Steady Recovery Post-2005**: From around 2005 onwards, Lyon shows a steady increase in tax revenues, reflecting economic recovery and growth. This period likely benefited from industrial and commercial expansion and the stabilization of the Euro, which boosted economic confidence.

3. **2020 Spike**: The sharp increase around 2020 is likely due to COVID-19 fiscal stimulus measures, a rebound in economic activities as restrictions eased, and increased investments and commercial activities in the region.

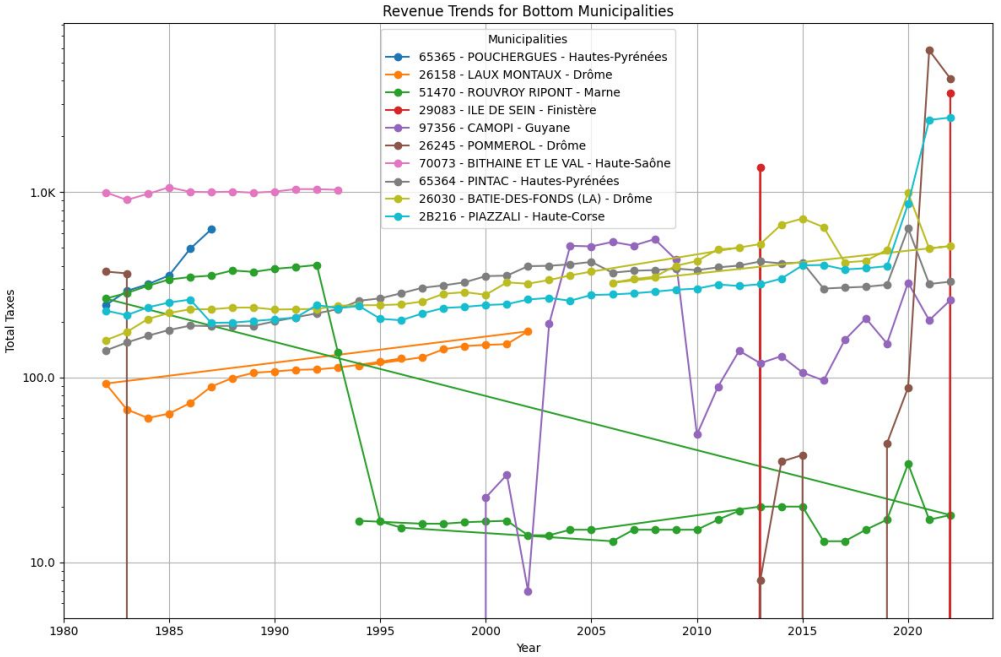


Revenue Trends

Target: Create a graph to illustrate the revenue trends in the 10 municipalities mentioned above. What insights can you derive from this data?

Revenue Trends for Bottom Municipalities
Insights:

1. **Fluctuating Revenues**: Municipalities such as Ile de Sein (Finistère) and Camopi (Guyane) show significant fluctuations in their tax revenues over time. These fluctuations suggest instability or irregular economic activities within these areas.
2. **Consistent Low Revenue**: Municipalities like Pouchergues (Hautes-Pyrénées) and Laux Montaux (Drôme) exhibit consistently low tax revenues throughout the observed period, reflecting minimal economic growth and limited economic activities.
3. **Sharp Declines**: Rouvroy Ripont (Marne) and Camopi (Guyane) experience sharp declines in revenue at certain points, indicating possible economic downturns, policy changes, or shifts in population.
4. **Sudden Increases**: Pommerol (Drôme) shows a sudden increase in revenue around 2020. This might be due to specific local developments, new economic activities, or could possibly be attributed to data anomalies.
5. **Limited Growth**: Municipalities like Laux Montaux (Drôme) and Piazzali (Haute-Corse) demonstrate limited growth over the observed period, indicating stagnant economic conditions.
6. **Impact of Small Population**: The overall low tax revenues in these municipalities reflect the impact of small populations and limited economic bases, which is common in rural and less developed areas.



Note: The graph uses a logarithmic scale to make smaller values more visible.

Revenue Trends

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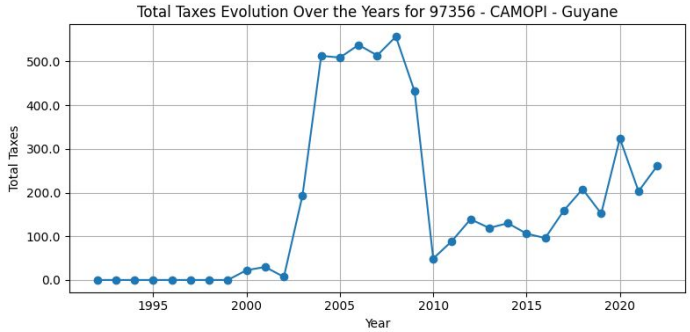
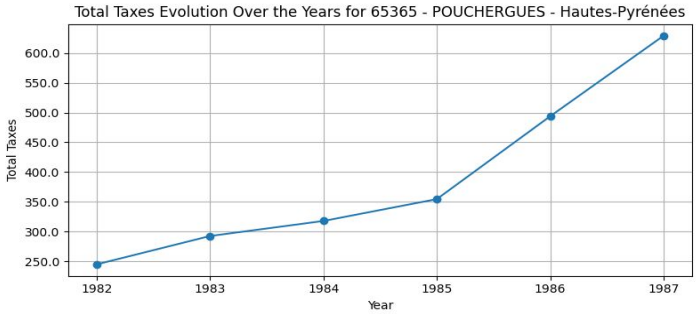
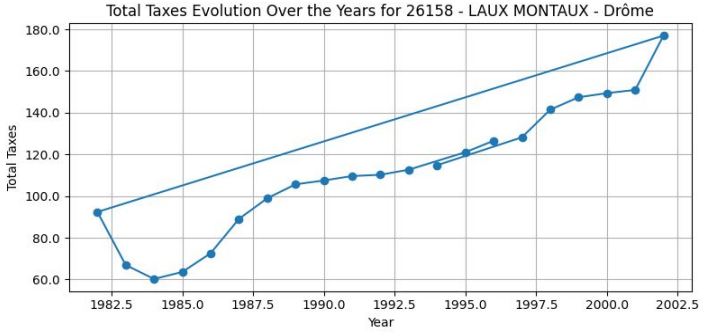
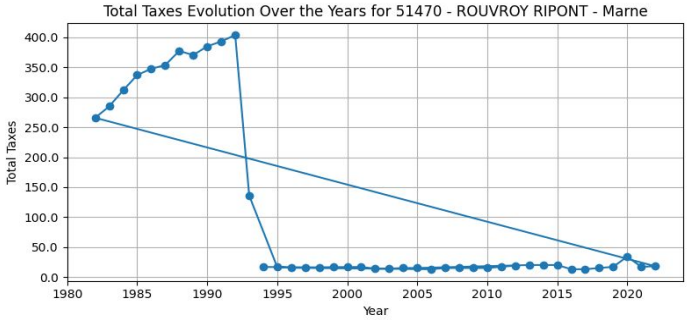
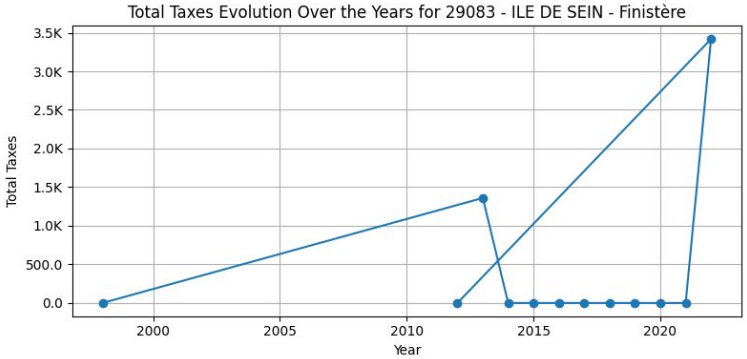
Revenue Trends for Bottom Municipalities



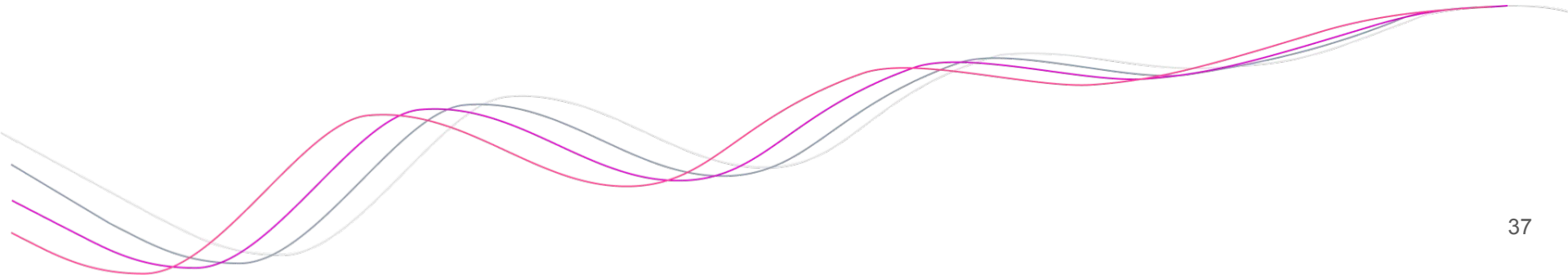








Revenue Growth

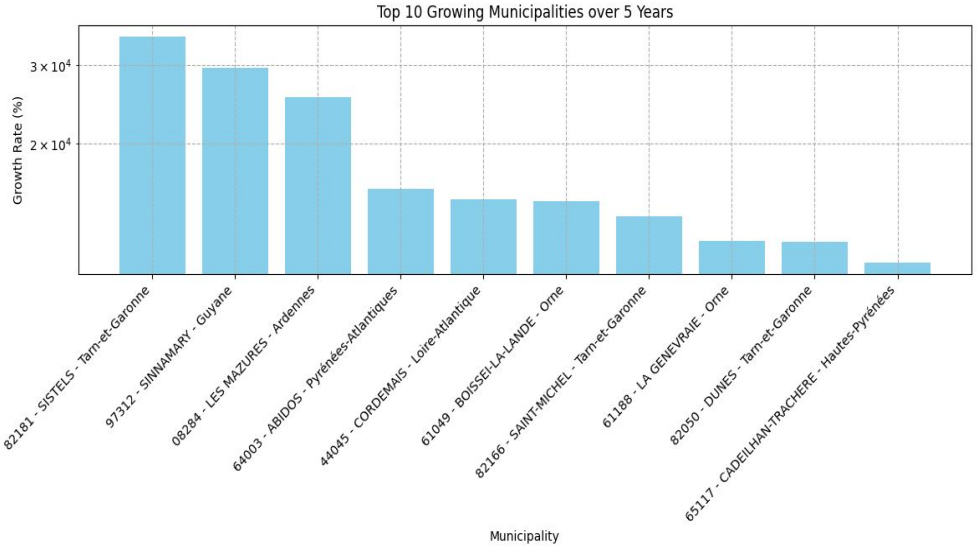


Revenue Growth

Target: Categorize municipalities based on their tax revenue growth over the past 5, 10, 15, and 20 years.

Top Growing Municipalities over 5 Years

1. Sistels (82181 - Tarn-et-Garonne): **34,759.00%**
2. Sinnamary (97312 - Guyane): **29,564.27%**
3. Les Mazures (08284 - Ardennes): **25,367.83%**
4. Abidos (64003 - Pyrénées-Atlantiques): **15,740.36%**
5. Cordemais (44045 - Loire-Atlantique): **14,942.30%**
6. Boissei-la-Lande (61049 - Orne): **14,819.85%**
7. Saint-Michel (82166 - Tarn-et-Garonne): **13,687.19%**
8. La Genevraie (61188 - Orne): **12,025.15%**
9. Dunes (82050 - Tarn-et-Garonne): **11,996.42%**
10. Cadeilhan-Trachère (65117 - Hautes-Pyrénées): **10,749.34%**

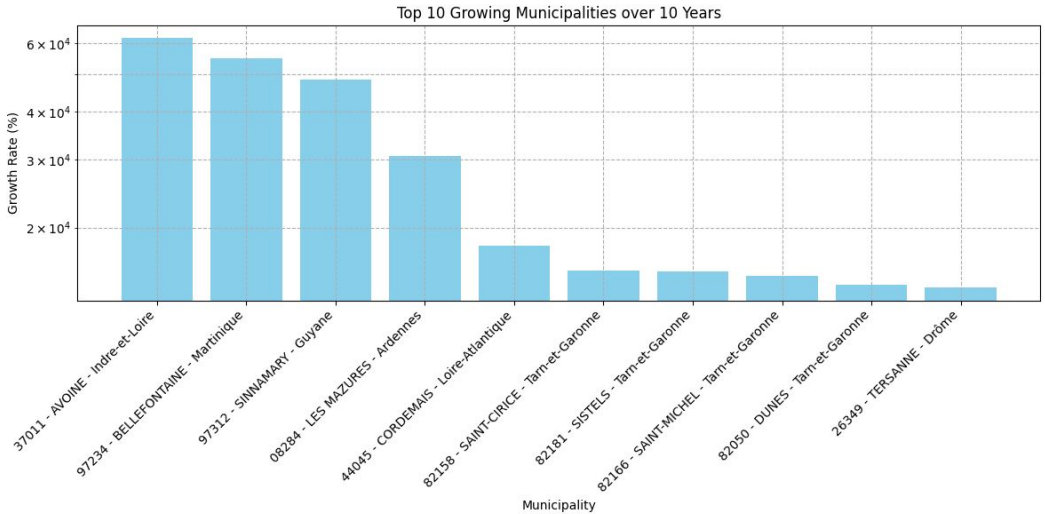


Revenue Growth

Target: Categorize municipalities based on their tax revenue growth over the past 5, 10, 15, and 20 years.

Top Growing Municipalities over 10 Years

1. Avoine, Indre-et-Loire (37011) - **61,913.88%**
2. Bellefontaine, Martinique (97234) - **54,814.22%**
3. Sinnamary, Guyane (97312) - **48,401.86%**
4. Les Mazures, Ardennes (08284) - **30,599.89%**
5. Cordemais, Loire-Atlantique (44045) - **17,914.58%**
6. Saint-Cirice, Tarn-et-Garonne (82158) - **15,497.81%**
7. Sistels, Tarn-et-Garonne (82181) - **15,392.89%**
8. Saint-Michel, Tarn-et-Garonne (82166) - **15,000.25%**
9. Dunes, Tarn-et-Garonne (82050) - **14,258.86%**
10. Tersanne, Drôme (26349) - **13,968.34%**

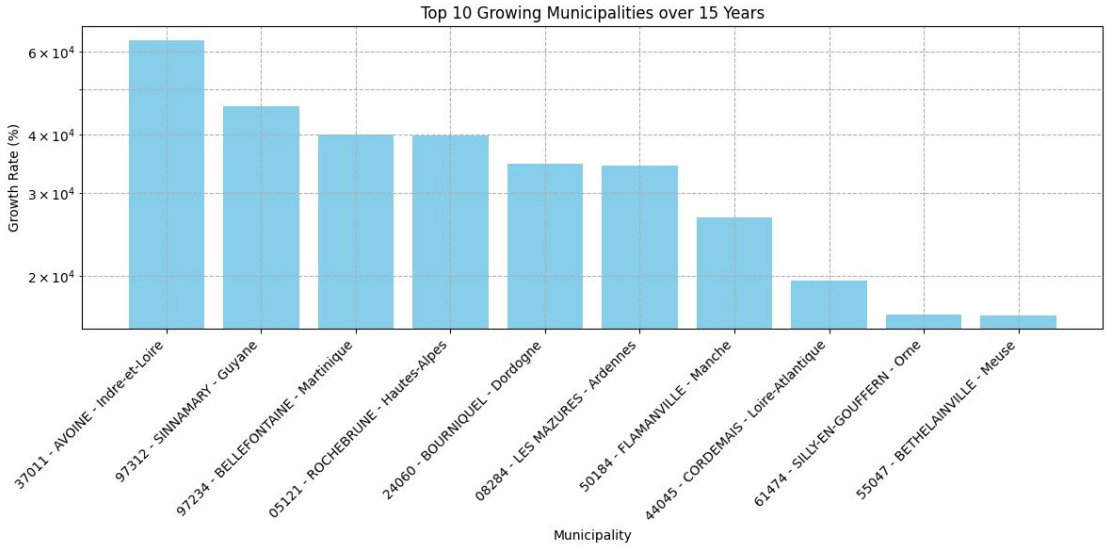


Revenue Growth

Target: Categorize municipalities based on their tax revenue growth over the past 5, 10, 15, and 20 years.

Top Growing Municipalities over 15 Years

1. Avoine, Indre-et-Loire (37011) - **63,502.22%**
2. Sinnamary, Guyane (97312) - **45,954.08%**
3. Bellefontaine, Martinique (97234) - **39,958.02%**
4. Rochebrune, Hautes-Alpes (05121) - **39,876.28%**
5. Bourniquel, Dordogne (24060) - **34,757.27%**
6. Les Mazures, Ardennes (08284) - **34,434.11%**
7. Flamanville, Manche (50184) - **26,636.95%**
8. Cordemais, Loire-Atlantique (44045) - **19,552.73%**
9. Silly-en-Gouffern, Orne (61474) - **16,602.96%**
10. Bethelainville, Meuse (55047) - **16,512.87%**

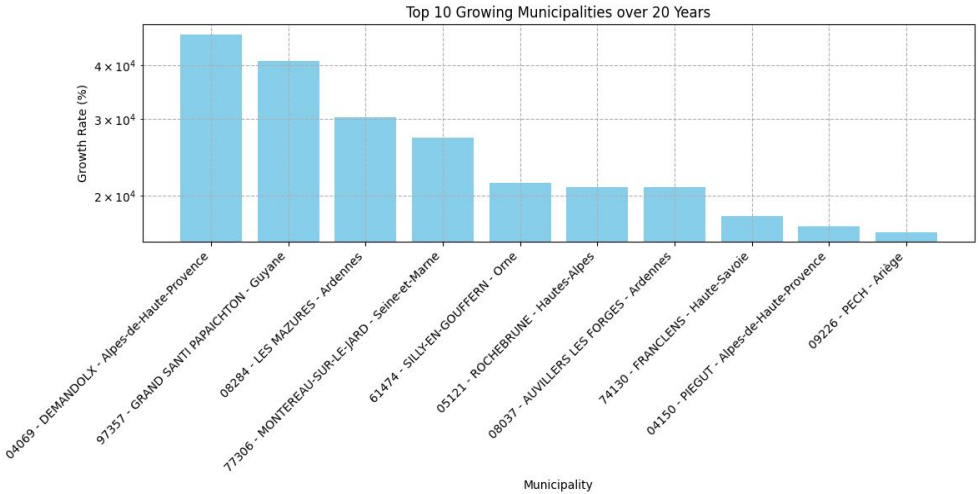


Revenue Growth

Target: Categorize municipalities based on their tax revenue growth over the past 5, 10, 15, and 20 years.

Top Growing Municipalities over 20 Years

1. Demandolx, Alpes-de-Haute-Provence (04069) - **47,070.30%**
2. Grand Santi Papaichton, Guyane (97357) - **40,830.43%**
3. Les Mazures, Ardennes (08284) - **30,346.93%**
4. Montereau-sur-le-Jard, Seine-et-Marne (77306) - **27,151.43%**
5. Silly-en-Gouffern, Orne (61474) - **21,427.58%**
6. Rochebrune, Hautes-Alpes (05121) - **20,888.83%**
7. Auvillers les Forges, Ardennes (08037) - **20,888.01%**
8. Franclêns, Haute-Savoie (74130) - **17,897.15%**
9. Piegut, Alpes-de-Haute-Provence (04150) - **17,007.16%**
10. Pech, Ariège (09226) - **16,466.01%**



Revenue Growth

Target: Categorize municipalities based on their tax revenue growth over the past 5, 10, 15, and 20 years.

Insights:

1. **Regional Economic Growth**: The consistent presence of municipalities from specific regions like Tarn-et-Garonne (82158, 82181, 82166, 82050) across multiple growth periods suggests a pattern of regional economic growth. This could be influenced by regional development policies, investments in infrastructure, or local economic activities that foster growth over time.

2. **Sector-Specific Growth**: Municipalities showing significant growth rates over longer periods, such as Avoine (37011 - Indre-et-Loire) and Bellefontaine (97234 - Martinique), may indicate growth accumulated under specific conditions. For example:
    a. Avoine in Indre-et-Loire might be benefiting from agricultural modernization, tourism, or local industry expansion.
    b. Bellefontaine in Martinique could be experiencing growth linked to tourism development, infrastructure improvements, or economic diversification efforts.

3. **Cumulative Impact of Policies:** Municipalities showing sustained growth over 15 to 20 years, such as Les Mazures (08284 - Ardennes) and Cordemais (44045 - Loire-Atlantique), may reflect the cumulative impact of long-term policies or strategic investments:
    a. Les Mazures might have benefited from regional development initiatives, heritage preservation efforts, or local business expansions.
    b. Cordemais could be influenced by investments in renewable energy, industrial activities, or strategic geographic location.

4. **Demographic and Migration Trends**: High growth rates in municipalities could be indicative of favorable demographic trends, such as population growth or influx of new residents. This may be driven by factors like urbanization, quality of life improvements, or housing affordability in those areas.

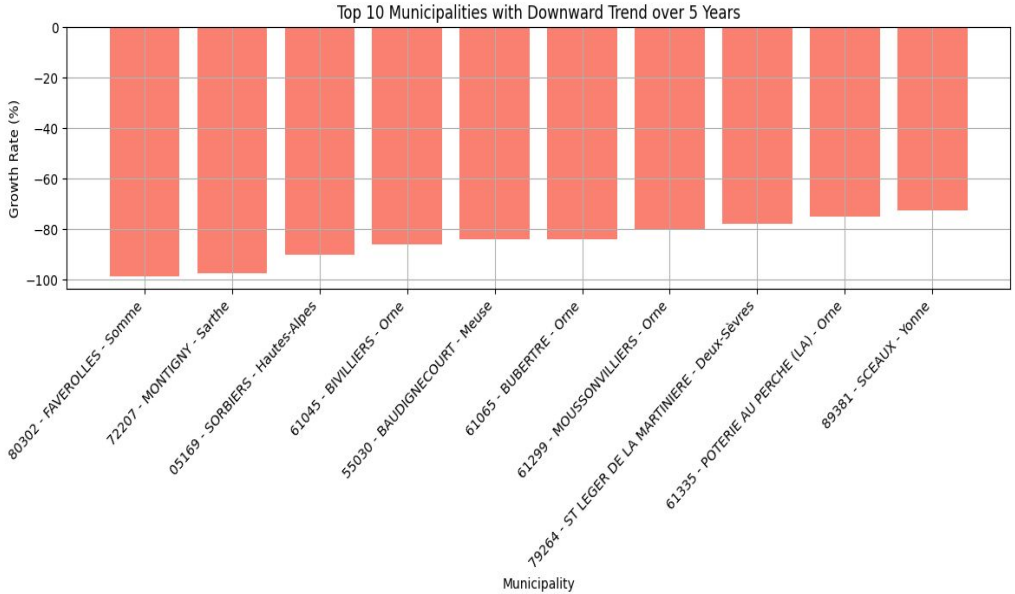
5. **Infrastructure Investments**: Growth in municipalities could also be attributed to significant investments in infrastructure projects. This might include new transportation networks, utility expansions, or digital infrastructure upgrades that attract businesses and residents.

Revenue Growth

Target: Categorize municipalities based on their tax revenue growth over the past 5, 10, 15, and 20 years.

Top Declining Municipalities over 5 Years

1. Faverolles, Somme (80302): **-98.49%**
2. Montigny, Sarthe (72207): **-97.24%**
3. Sorbiers, Hautes-Alpes (05169): **-90.06%**
4. Bivilliers, Orne (61045): **-85.76%**
5. Baudignecourt, Meuse (55030): **-84.06%**
6. Bubertre, Orne (61065): **-83.92%**
7. Moussonvilliers, Orne (61299): **-80.02%**
8. St Leger de la Martiniere, Deux-Sèvres (79264): **-77.78%**
9. Poterie au Perche (La), Orne (61335): **-74.76%**
10. Sceaux, Yonne (89381): -**72.59%**

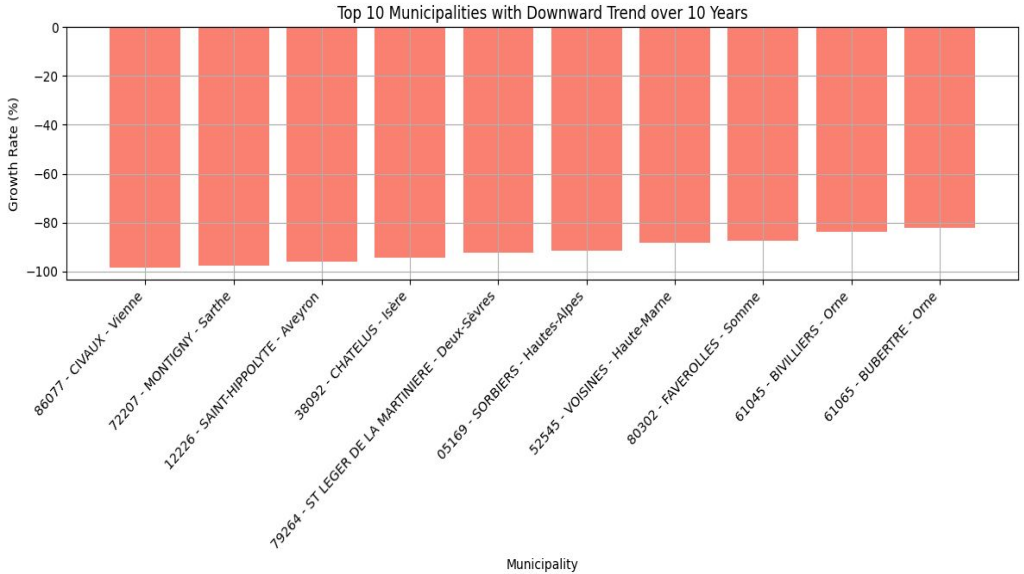


Revenue Growth

Target: Categorize municipalities based on their tax revenue growth over the past 5, 10, 15, and 20 years.

Top Declining Municipalities over 10 Years

1. Civaux, Vienne (86077): **-98.41%**
2. Montigny, Sarthe (72207): -**97.55%**
3. Saint-Hippolyte, Aveyron (12226): **-95.88%**
4. Chatelus, Isère (38092): **-94.31%**
5. St Leger de la Martiniere, Deux-Sèvres (79264): **-92.30%**
6. Sorbiers, Hautes-Alpes (05169): **-91.52%**
7. Voisines, Haute-Marne (52545): **-88.42%**
8. Faverolles, Somme (80302): **-87.52%**
9. Bivilliers, Orne (61045): -**83.77%**
10. Bubertre, Orne (61065): -**82.00%**

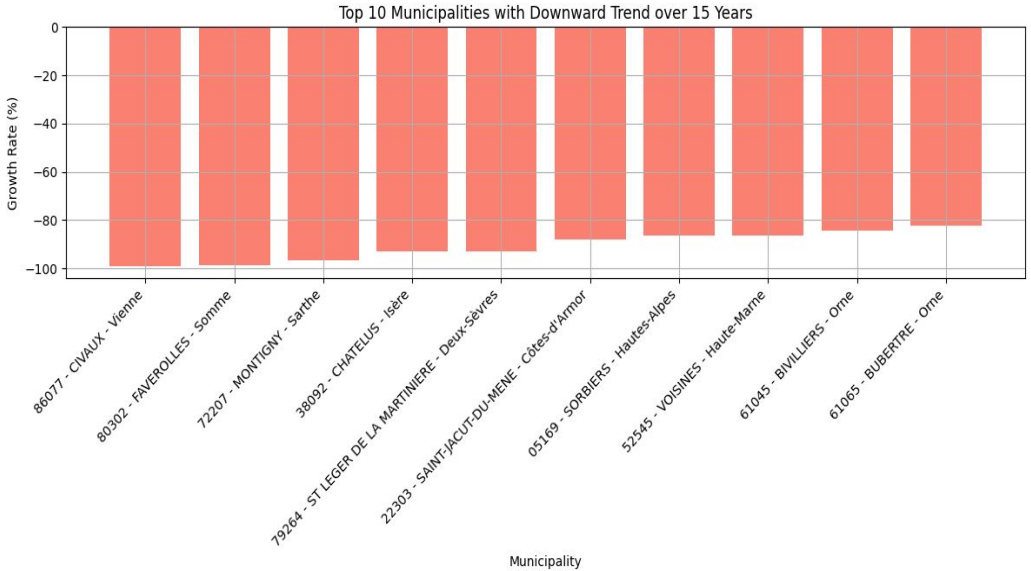


Revenue Growth

Target: Categorize municipalities based on their tax revenue growth over the past 5, 10, 15, and 20 years.

Top Declining Municipalities over 15 Years

1. Civaux, Vienne (86077): **-99.04%**
2. Faverolles, Somme (80302): **-98.56%**
3. Montigny, Sarthe (72207): **-96.73%**
4. Chatelus, Isère (38092): **-92.95%**
5. St Leger de la Martiniere, Deux-Sèvres (79264): **-92.88%**
6. Saint-Jacut-du-Mene, Côtes-d'Armor (22303): **-88.02%**
7. Sorbiers, Hautes-Alpes (05169): **-86.57%**
8. Voisines, Haute-Marne (52545): **-86.30%**
9. Bivilliers, Orne (61045): **-84.38%**
10. Bubertre, Orne (61065): **-82.34%**

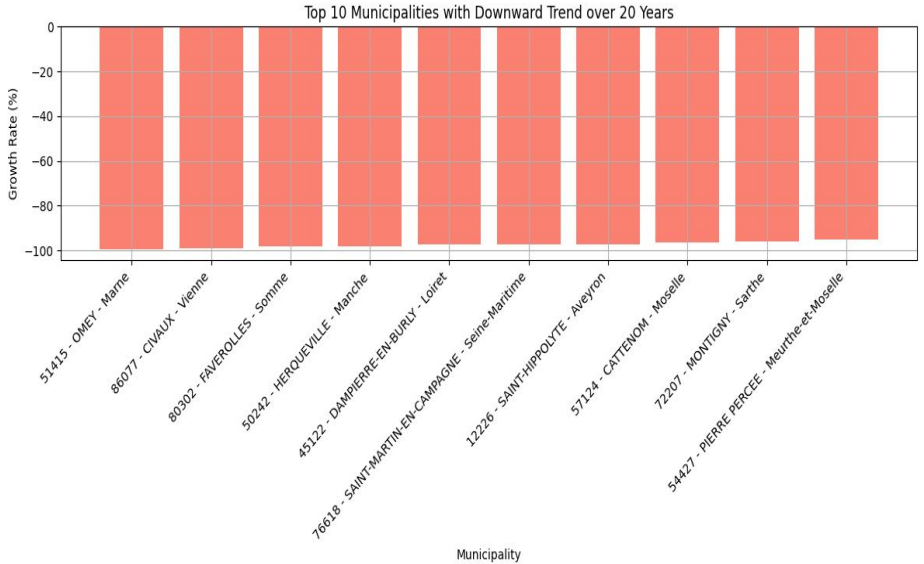


Revenue Growth

Target: Categorize municipalities based on their tax revenue growth over the past 5, 10, 15, and 20 years.

Top Declining Municipalities over 20 Years

1. Omey, Marne (51415): **-99.45%**
2. Civaux, Vienne (86077): -**98.99%**
3. Faverolles, Somme (80302): **-98.34%**
4. Herqueville, Manche (50242): **-98.30%**
5. Dampierre-en-Burly, Loiret (45122): **-97.30%**
6. Saint-Martin-en-Campagne, Seine-Maritime (76618): **-97.21%**
7. Saint-Hippolyte, Aveyron (12226): **-97.11%**
8. Cattenom, Moselle (57124): **-96.62%**
9. Montigny, Sarthe (72207): **-96.05%**
10. Pierre Percee, Meurthe-et-Moselle (54427): **-95.26%**



Revenue Growth

Target: Categorize municipalities based on their tax revenue growth over the past 5, 10, 15, and 20 years.

Insights:

1. **Consistent Challenges in Specific Municipalities**: Several municipalities appear in the top declining lists across multiple time periods, indicating persistent challenges or negative economic trends:
    a. Faverolles, Somme (80302) and Montigny, Sarthe (72207) consistently show steep declines over 5, 10, 15, and 20 years. This suggests ongoing economic difficulties or structural issues affecting these areas.

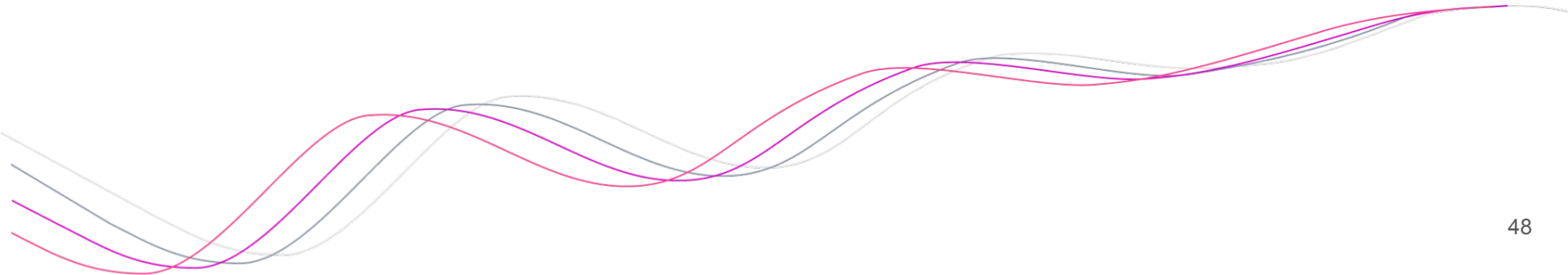
2. **Regional Economic Decline**: Similar to growth trends, regions with municipalities showing significant decline may indicate broader regional economic challenges:
    a. Municipalities in Orne (Bivilliers - 61045, Bubertre - 61065, Moussonvilliers - 61299, Poterie au Perche (La) - 61335) consistently appear in the top declining lists, pointing towards regional economic decline or specific local factors impacting growth negatively.

3. **Sectoral and Demographic Implications**: Understanding the sectors affected by decline (e.g., agriculture, manufacturing) and demographic changes (e.g., population aging, outmigration) can provide insights into the root causes of economic contraction in these municipalities.

4. **Policy and Intervention Needs**: Municipalities with prolonged decline may require targeted policy interventions, such as economic diversification strategies, infrastructure investments, or workforce development initiatives, to reverse negative trends and stimulate growth.

5. **Environmental and Natural Resources**: In some cases, decline may be linked to environmental challenges or the depletion of natural resources. Municipalities like Civaux, Vienne (86077) and Omey, Marne (51415) facing severe declines over 20 years could indicate environmental degradation or resource depletion issues impacting local economies.

Correlations



Correlations

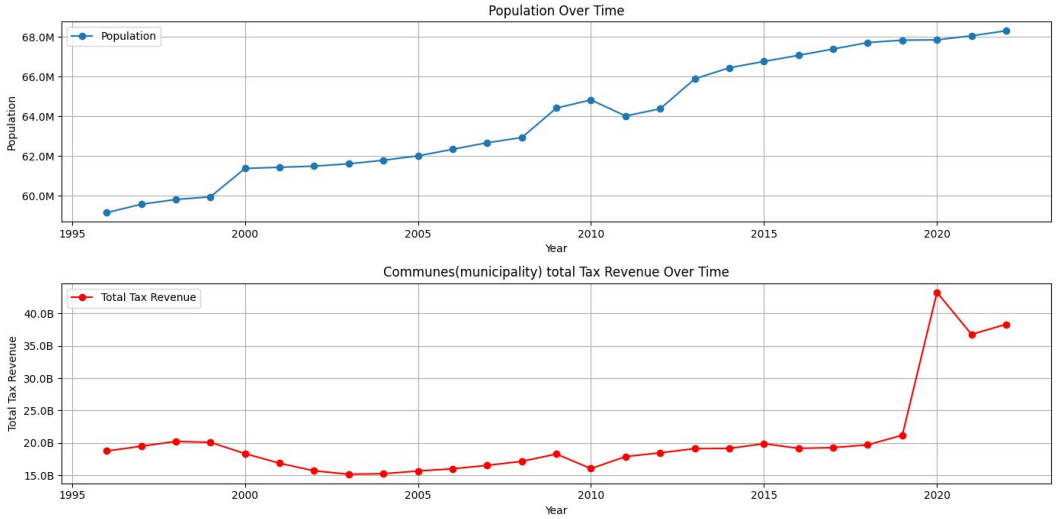
Target: Analyze the correlation between population size and tax revenue in municipalities (the variable for number of inhabitants in the dataset is Z08).

Population and Tax Revenue Over Time

Insights:

1. **Population Over Time**
   a. **Growth**: Population increased from ~60M (1995) to >68M (2022).
   b. Rate: **Steady growth** with notable increases around 2000 and post-2010.

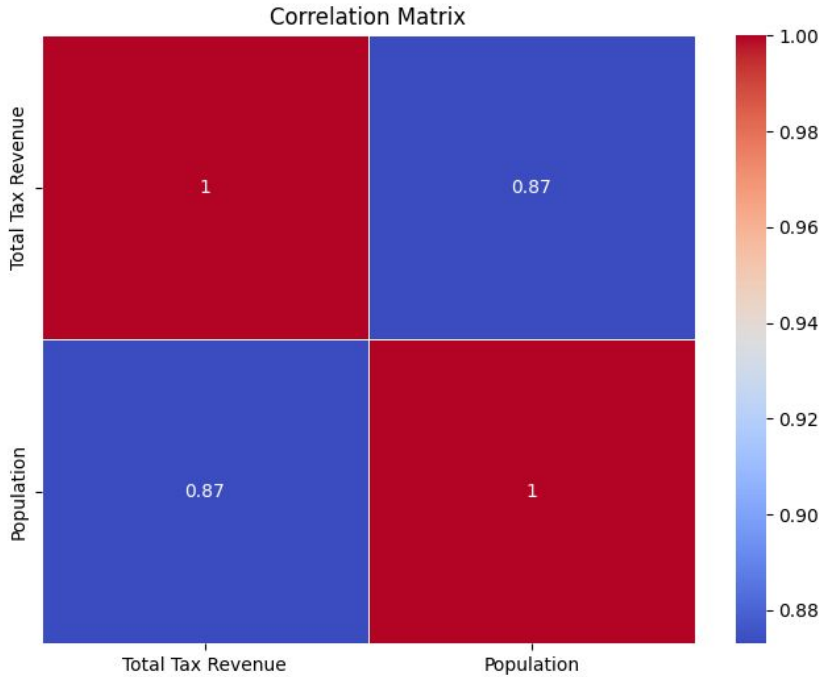
2. **Tax Revenue Over Time**
   a. **Stability and Decline**: Stable with a slight decline from 1995 to 2005, continuing slightly until 2010.
   b. **Increase**: Noticeable increase post-2010, with a sharp spike around 2020.
   c. **Volatility**: Sharp increase around 2020 followed by a drop and slight recovery.



Correlations

Target: Analyze the correlation between population size and tax revenue in municipalities (the variable for number of inhabitants in the dataset is Z08).

General Correlation Matrix



Key Insights:

1. **Strong Positive Relationship**: The correlation between the French population size and total tax revenue is **0.87**, indicating a strong positive relationship. This suggests that as the population of France grows, the total tax revenue also tends to increase significantly.

2. **Predictive Indicator**: Given the strong correlation, population size can be a reliable predictor of total tax revenue in France. Policymakers can use population growth trends to estimate future tax revenues.

3. **Economic Planning**: The strong correlation emphasizes the importance of demographic factors in economic planning. For France, accommodating a growing population likely requires corresponding increases in infrastructure, services, and budget allocations, supported by rising tax revenues.

4. **Revenue Management**: The matrix underscores the need for effective tax revenue management in response to population changes. As France's population grows, ensuring efficient tax collection and allocation becomes crucial to sustain economic stability and development.

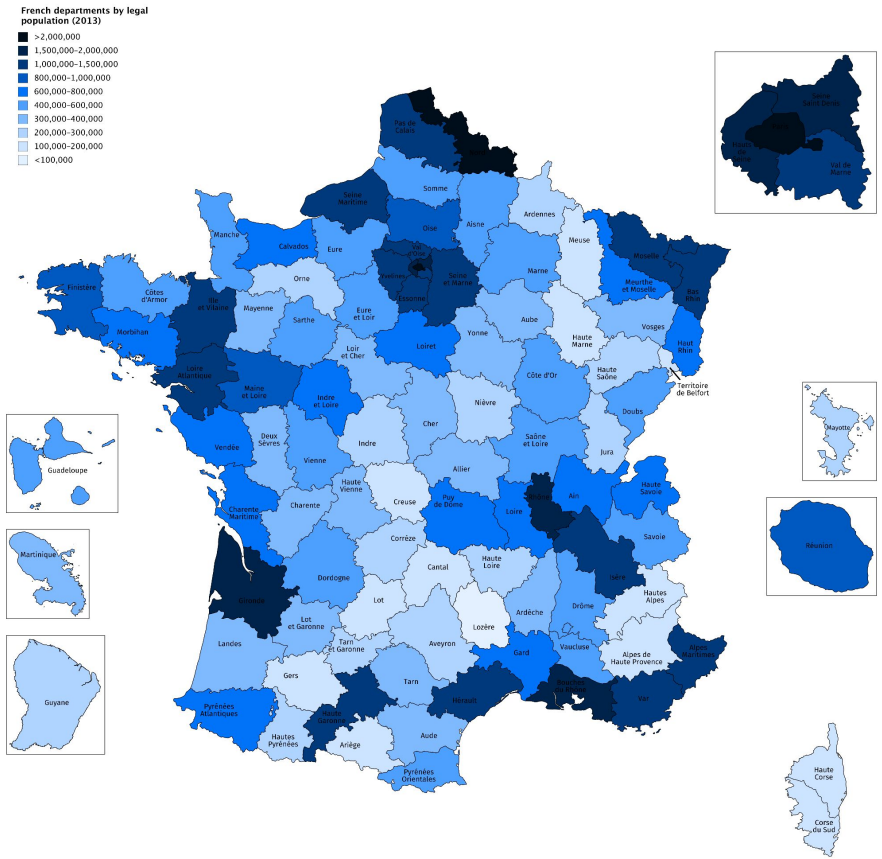
ℹ️**Note: From my observations, the correlation is actually higher if the data is analysed on a year basis. See next slide for details.**

Correlations

Target: Analyze the correlation between population size and tax revenue in municipalities (the variable for number of inhabitants in the dataset is Z08).

Yearly Correlation Trends

Year	Correlation
1996	0.950680
1997	0.949375
1998	0.949845
1999	0.950427
2000	0.940431
2001	0.932256
2002	0.927702
2003	0.933124
2004	0.936034
2005	0.940061
2006	0.941045
2007	0.940401
2008	0.941022
2009	0.935169
2010	0.974431
2011	0.943450
2012	0.945094
2013	0.942395
2014	0.945696
2015	0.943266
2016	0.980406
2017	0.977266
2018	0.976009
2019	0.918068
2020	0.917129
2021	0.960364
2022	0.965296



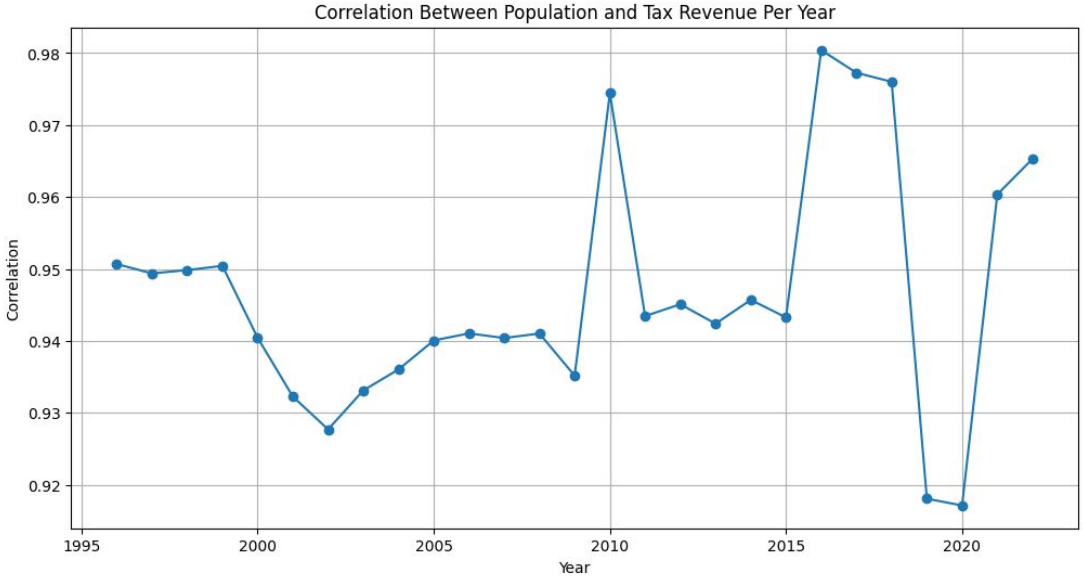
Correlations

Target: Analyze the correlation between population size and tax revenue in municipalities (the variable for number of inhabitants in the dataset is Z08).

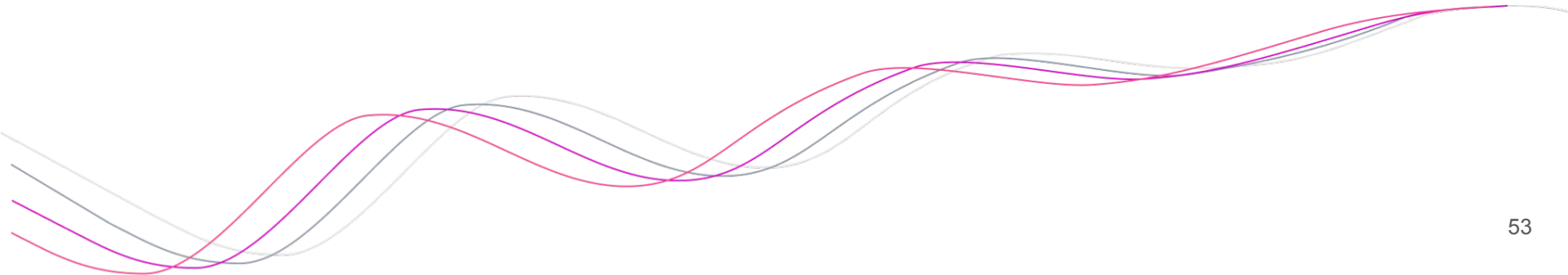
Yearly Correlation Trends

Key Insights:

1. **Strong Positive Relationship:** The consistently high correlation (**>90%** in most years) indicates a very strong positive relationship between population and tax revenue. This means that as the population increases or decreases, tax revenue tends to increase or decrease in a proportional manner.
2. **Predictive Indicator:** Given the strong yearly correlation, population size can be used as a reliable predictive indicator for tax revenue. Policymakers and economists can utilize population data to forecast future tax revenues with a high degree of confidence.
3. **Policy Implications:** The strong correlation emphasizes the importance of policies aimed at attracting and retaining residents. Efforts to improve living conditions, create jobs, and enhance local amenities can boost population growth and, in turn, increase tax revenues.
4. **Sensitivity to Demographic Changes:** The high correlation also indicates that municipal tax revenues are highly sensitive to demographic changes. Declines in population due to migration, aging, or other factors can lead to significant drops in tax revenue, highlighting the need for proactive measures to stabilize or grow the population.



Significant Taxes



Significant Taxes

Target: Identify the most significant tax for municipalities and for labor unions and examine whether the same tax is predominant across all municipalities and labor unions.

Top Significant taxes for municipalities

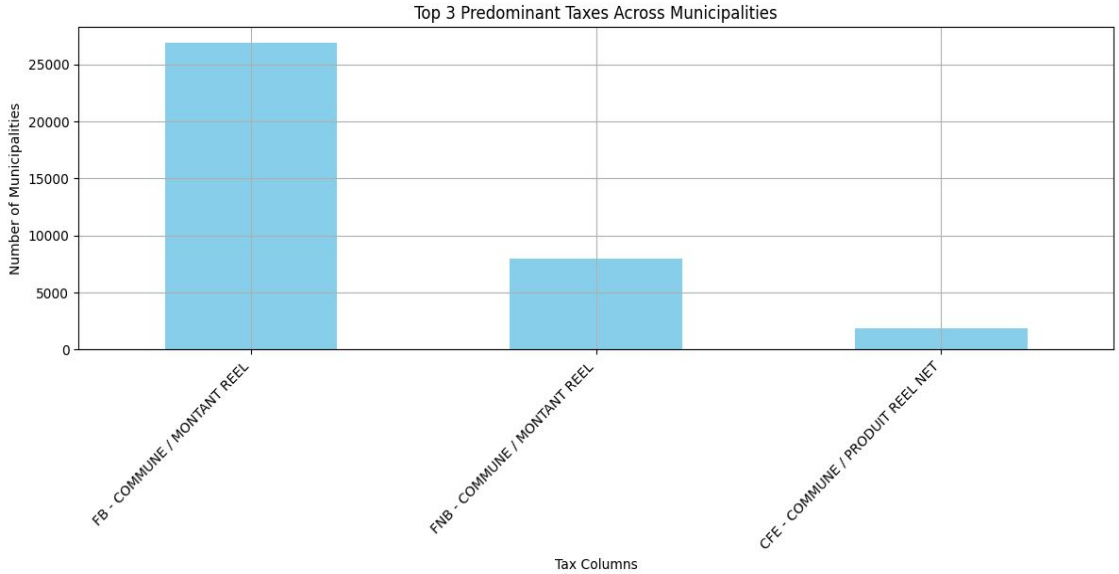
Insights:

1. **FB Tax Importance:** The property tax on buildings (FB) is the main revenue source for over 25,000 municipalities, highlighting its importance.

2. **Tax Reliance Variation: T**he reliance on different taxes shows diverse economic bases. While FB tax is crucial, some municipalities depend on FNB (non-built property) or CFE (business property) taxes.

3. **Significance of FNB Tax:** The FNB tax on non-built properties, like agricultural land, is the second most important, affecting around 8,000 municipalities, vital for rural and semi-urban areas.

4. **Role of CFE Tax:** The CFE tax on businesses is the third most important, impacting around 2,000 municipalities, essential for areas with strong business activity. Its significance has decreased since the 2010 tax reform.



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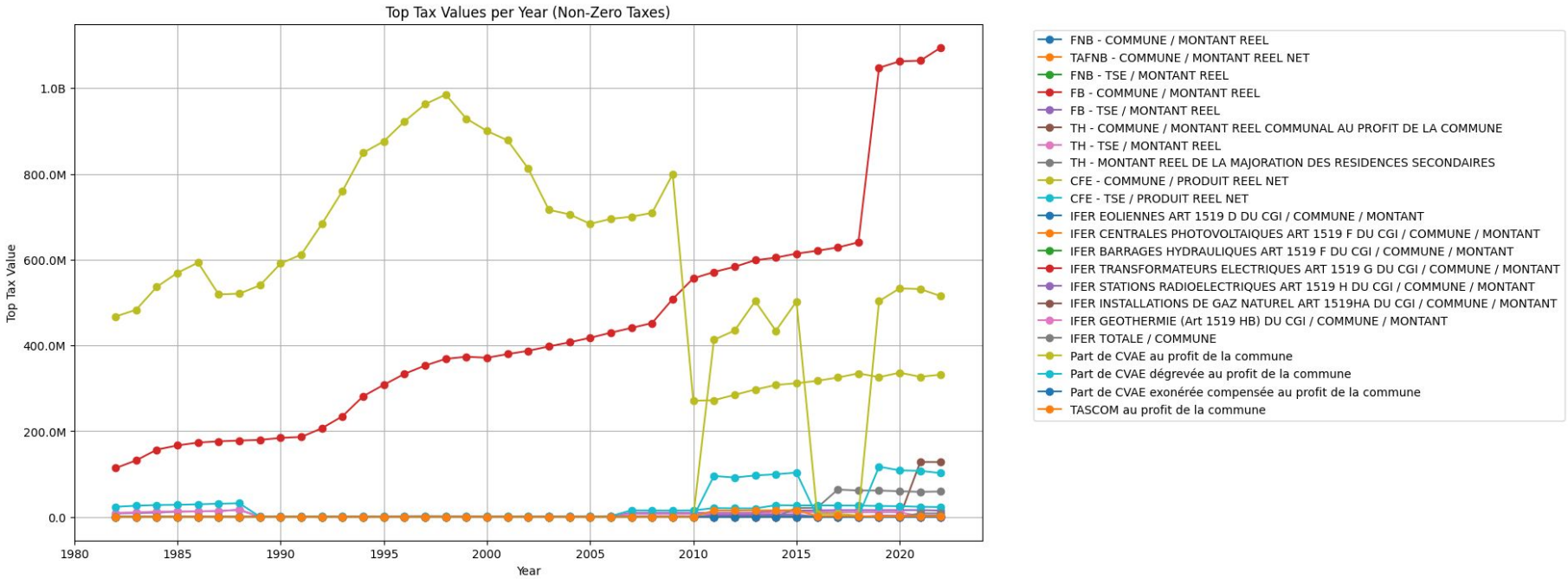
Taxes for municipalities



Significant Taxes

Target: Identify the most significant tax for municipalities and for labor unions and examine whether the same tax is predominant across all municipalities and labor unions.

Taxes for municipalities

Insights:

1. **FNB Tax Growth** - The FNB shows a significant and steady increase over the years, particularly from around 2005 onwards. It reaches over 1 billion by 2022, indicating its growing importance in municipal revenues.

2. **FB Tax Consistency** - The FB has a consistent upward trend from 1980, with a notable spike around 2010. This tax remains a stable and significant contributor to municipal finances, surpassing 200 million.

3. **CFE Tax Drops Around 2010** - The "CFE - COMMUNE / MONTANT REEL" tax shows a noticeable drop around 2010. This drop aligns with the period when France underwent significant tax reforms, particularly the abolition of the "Taxe Professionnelle."

4. **Diverse Tax Contributions** - Various other taxes such as "TAFNB", "CFE", and different IFER taxes (e.g., IFER EOLIENNES, IFER CENTRALES PHOTOVOLTAIQUES) show more modest but steady contributions. These taxes reflect the diversity in the tax base supporting municipal budgets.

5. **Sudden Changes** in TH Tax - The "TH - COMMUNE / MONTANT REEL" shows significant fluctuations, especially around 2010, suggesting possible policy changes or economic impacts affecting residential tax revenues.

6. **Recent Increases** - Some taxes like "IFER EOLIENNES" and "IFER CENTRALES PHOTOVOLTAIQUES" show increases in recent years, likely reflecting the growing importance of renewable energy infrastructure and its taxation.

Significant Taxes

Target: Identify the most significant tax for municipalities and for labor unions and examine whether the same tax is predominant across all municipalities and labor unions.

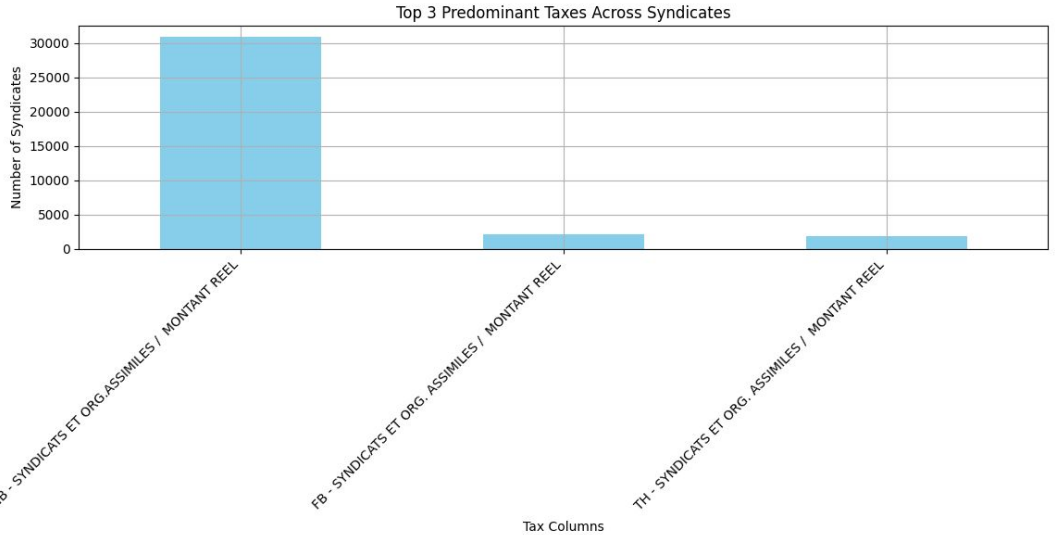
Top Significant taxes for labor unions (SYNDICATS)

Insights:

1. **Dominance of FNB Tax**: The most significant tax for syndicates in France is the FNB. This tax is crucial for the financial health of most syndicates, indicating its primary role in their revenue structure.

2. **Significance of FB Tax**: **FB** tax is the second most significant tax, affecting a smaller number of syndicates compared to the FNB tax. This tax still plays an important role but is less universally applied among syndicates.

3. **Role of TH Tax**: The TH (Taxe d'Habitation) tax is the third most significant, impacting an even smaller number of syndicates. This tax contributes to the revenue of those specific syndicates that rely on it but is not as predominant as the FNB and FB taxes.



Significant Taxes

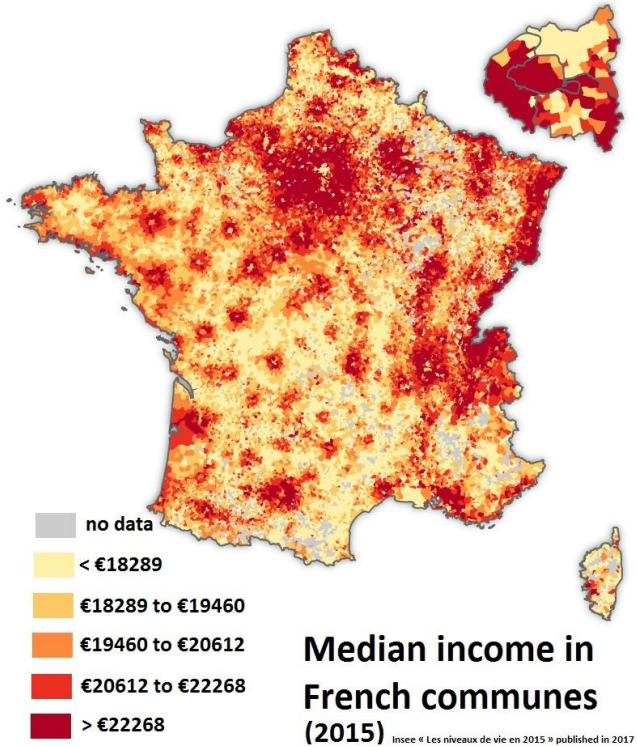
Target: Identify the most significant tax for municipalities and for labor unions and examine whether the same tax is predominant across all municipalities and labor unions.

Top Significant tax

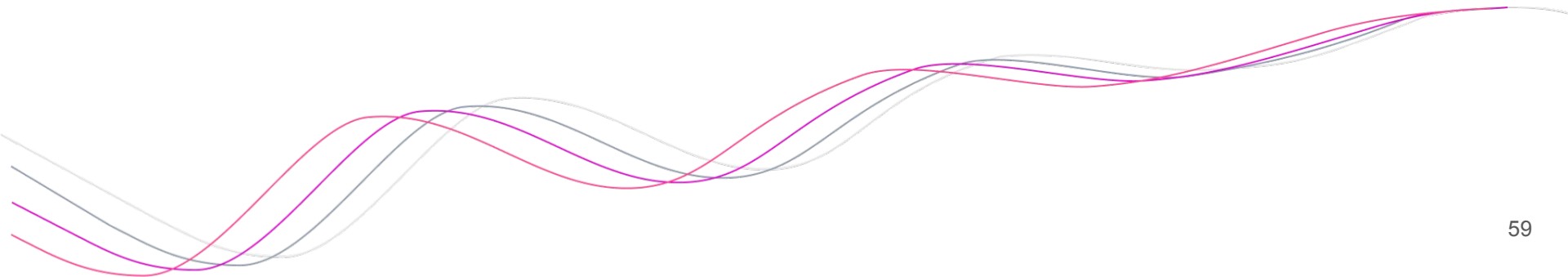
1. FB (property tax on buildings) Tax for Municipalities: The **FB** tax is the most significant for municipalities. Other municipalities have a different main source of revenue.

2. FNB (non-built properties) Tax for Syndicates: The **FNB** tax is the most significant for syndicates. Other syndicates have a different main source of revenue.

Essentially, taxes on buildings and land are the top contributors to the municipal revenue in France.



Professional Tax Reform



Professional Tax Reform

Target: Assess the impact of eliminating the "Professional Tax", which was collected prior to 2010, on municipal tax revenues. How did this change affect different municipalities? This 2009/2010 reform refers to the removal of the "Taxe professionnelle" (TP), an important local business tax.

The Professional Tax is not present in the dataset as amounts gained; however, there are fields related to dotation and compensation, such as "TP - DOTATION - REDUCTION DE LA FRACTION IMPOSABLE DES SALAIRES / DEPARTEMENT" and "TP - DOTATION - ABATTEMENT GENERAL DE 16% (NET) / DEPARTEMENT." None of these fields represent the amounts collected at the municipality level before 2010.

Therefore, the professional tax items considered for the following analysis are the **CFE tax** and the **CVAE tax**. Specifically:

1. **CFE - COMMUNE / PRODUIT REEL NET -** Indicates the actual net revenue from CFE that has been issued to the municipality, directly reflecting the financial inflow from this tax to the commune's budget.

2. **CFE - TSE / PRODUIT REEL NET -** Represents another measure of net revenue from CFE directed to the municipality.

3. **Part de CVAE au profit de la commune -** Represents the actual portion of CVAE revenue allocated to the commune, indicating what the commune receives.

4. **Part de CVAE dégrevée au profit de la commune -** Reflects the amount of CVAE that has been rebated back to the commune, indicating an adjustment in the financial records.

5. **Part de CVAE exonérée compensée au profit de la commune -** Indicates the amount of CVAE that is exempt but compensated to the commune by other means, showing a tangible impact on the commune's finances.

Professional Tax Reform

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Total Professional tax revenue by Year

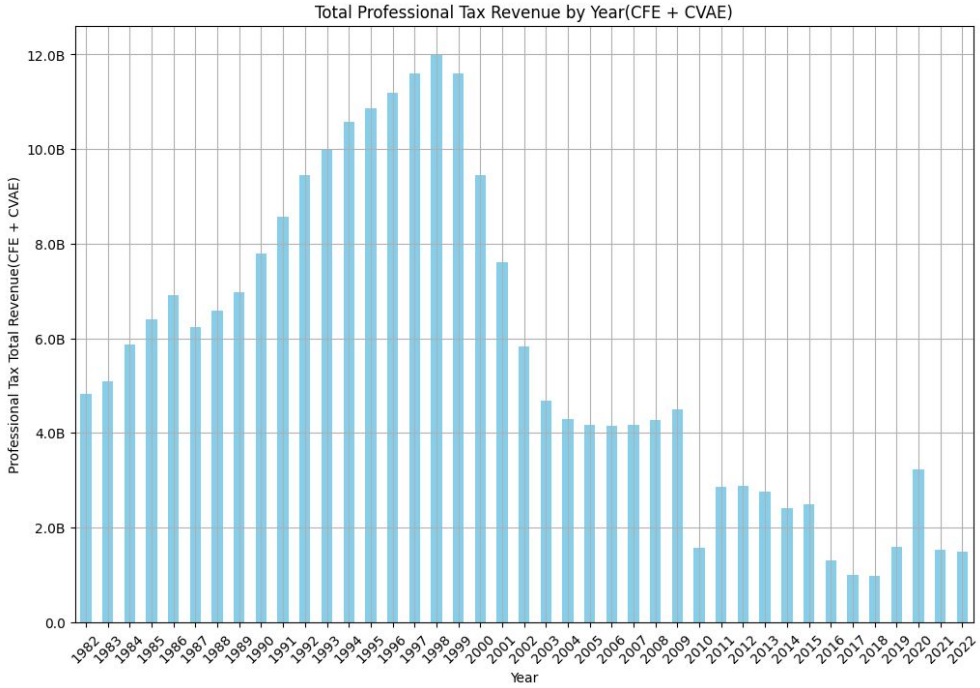
Insights:

1. **Initial Growth (1982-1998)**: From 1982 to 1998, professional tax revenue increased steadily, growing from 4.8 billion in 1982 to a peak of 12.0 billion in 1998. This period reflects a strong upward trend in tax revenue, suggesting an expanding tax base and possibly economic growth.

2. **Decline Before Reform (1999-2004)**: Starting in 1999, there is a notable decline in professional tax revenue, dropping from 11.6 billion in 1999 to 4.3 billion in 2004. This decline precedes the major tax reforms and indicates potential structural changes or economic factors affecting tax collections.

3. **Post-Reform Drop (2005-2010)**: The period from 2005 to 2010 shows a steady decline, with revenue decreasing from 4.2 billion in 2005 to just 1.6 billion in 2010. This sharp drop aligns with the abolition of the "Taxe Professionnelle" in 2010, reflecting the transition to the new tax system (CFE and CVAE).

4. **Stabilization and Variability (2011-2022)**: After the reform, professional tax revenue stabilizes at a lower level, with fluctuations ranging from 1.0 billion to 3.2 billion. This variability suggests ongoing adjustments to the new tax structure and the economic impacts on the tax base.



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TP & Total Tax Revenue

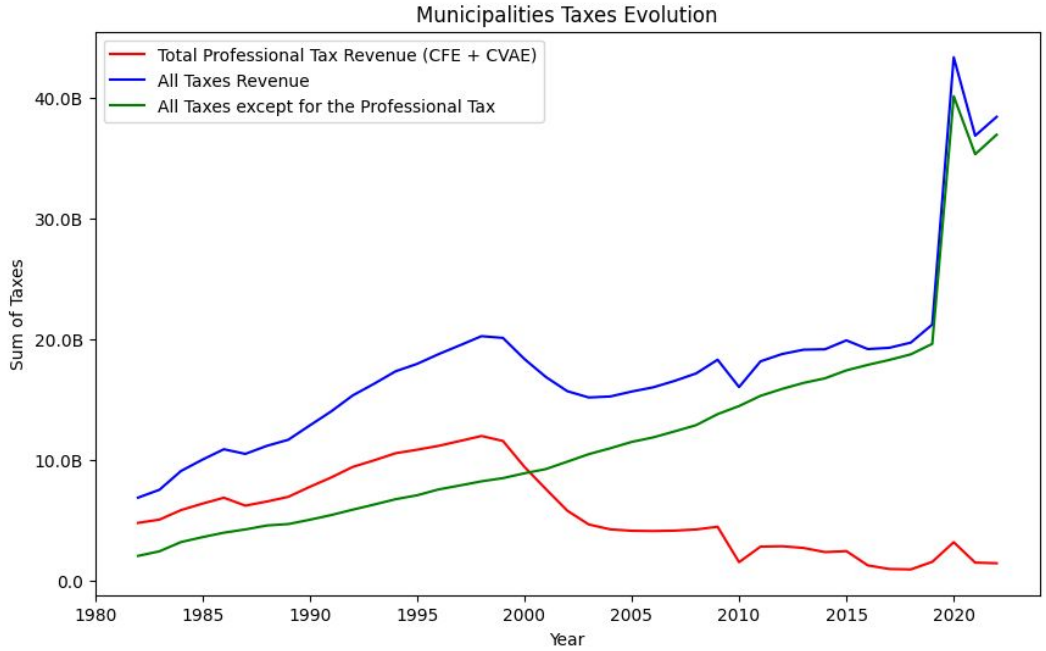
Insights:

1. **Professional Tax Decline** - The professional tax (red line) shows a significant decline starting around 1999, with a sharp drop around 2010 due to the abolition of the "Taxe Professionnelle." Post-2010, the professional tax revenue remains low, reflecting the impact of the reform.

2. **Total Tax Revenue Growth** - Despite the decline in professional tax revenue, the total tax revenue (blue line) continues to grow steadily. **This indicates that other sources of municipal tax revenue have increased, compensating for the loss from the professional tax.**

3. **Non-Professional Taxes Contribution:** The green line, representing all taxes except for the professional tax, shows a steady increase. This suggests that **other taxes, such as property taxes and other local taxes, have become more significant in supporting municipal budgets.**

4. **Post-Reform Stabilization and Growth:** Following the reform in 2010, total tax revenue experienced an initial dip but then recovered and grew significantly, especially around 2020. This growth indicates that municipalities have adapted to the new tax system and have potentially benefited from economic growth or additional tax measures.



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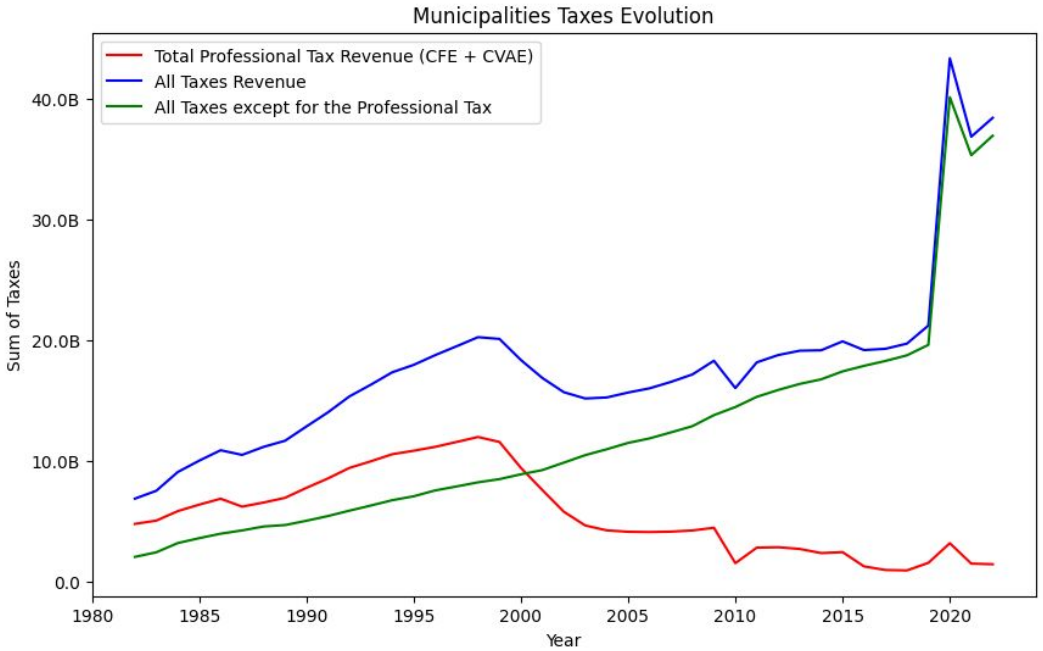
TP & Total Tax Revenue

Diversification of Revenue Sources: The continued growth in total tax revenue despite the decline in professional tax suggests a diversification of revenue sources for municipalities. This diversification reduces reliance on a single tax type and enhances financial stability.



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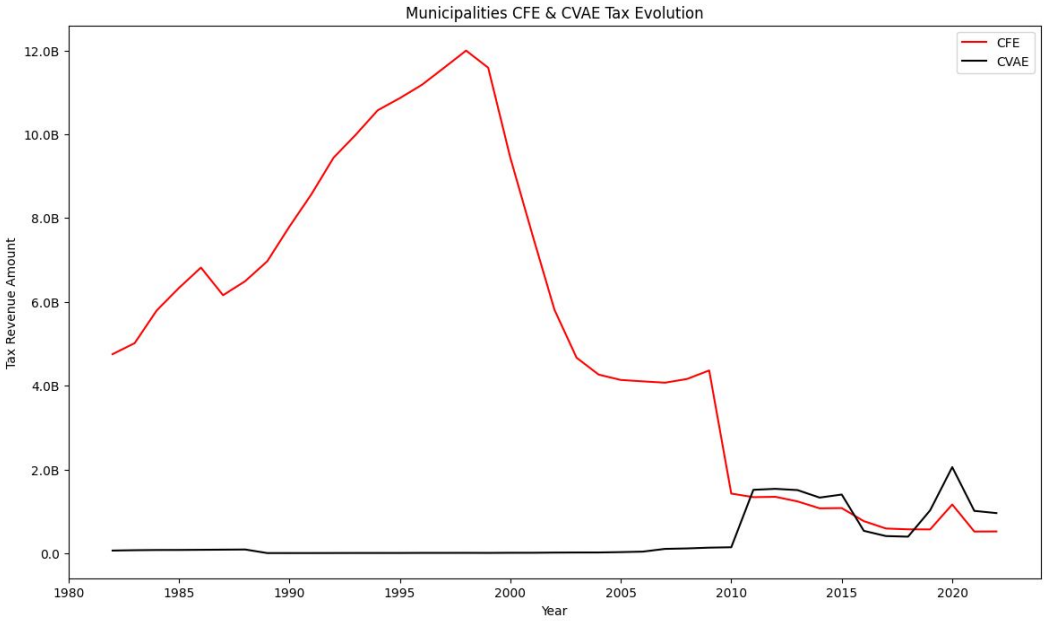
Target: Assess the impact of eliminating the "Professional Tax", which was collected prior to 2010, on municipal tax revenues. How did this change affect different municipalities? This 2009/2010 reform refers to the removal of the "Taxe professionnelle" (TP), an important local business tax.

Professional tax breakdown: CFE and CVAE Evolution

1. **Budget Adjustments and Cuts:** The drastic drop in CFE revenue post-2010 meant municipalities likely had to make significant budget adjustments. This could involve cutting costs, delaying infrastructure projects, or finding new revenue sources to compensate for the shortfall.

2. **Increased Financial Pressure on Local Governments:** With the new CVAE generating less revenue, local governments faced increased financial pressure. They might have had to lobby for additional funding from the central government or increase other local taxes and fees to maintain essential services.

3. **Economic Impact on Local Businesses:** The shift from CFE to CVAE changed the tax burden dynamics on local businesses. While the CVAE is based on value-added rather than fixed assets, the lower revenue generation might suggest that businesses had lower tax liabilities, potentially influencing their operations and investment decisions within municipalities.



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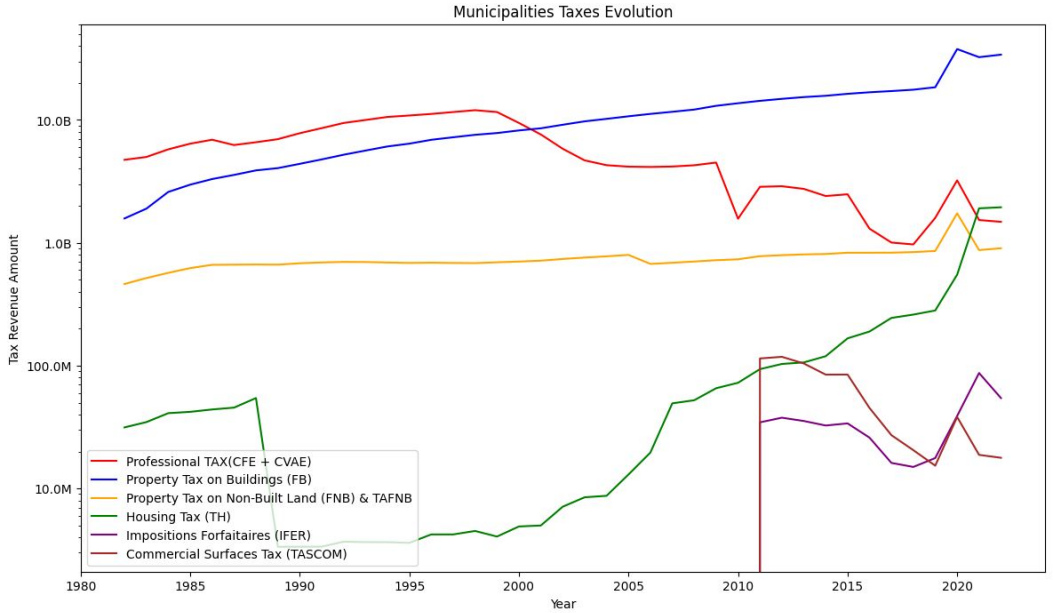
TP & FB & FNB + TAFNB & TH & IFER TASCOM evolution

Insights:

1. **Professional Tax Decline:** The Professional Tax (red line) shows a sharp decline starting around 1999 and drops significantly post-2010, reflecting its abolition. This highlights the substantial impact of tax reform on municipal revenue.

2. **Rise in Property Tax on Buildings (FB)**: The Property Tax on Buildings (blue line) has steadily increased, particularly from the late 1990s onward. The sharp rise around 2020 indicates its crucial role in compensating for the decline in Professional Tax revenue.

3. **Stable Growth in Other Taxes:** Other taxes (FNB, TH, IFER, TASCOM) show steady or incremental growth, providing a consistent revenue stream. Their stability underscores the importance of a diversified tax base for municipalities.



Note: The graph uses a logarithmic scale to make smaller values more visible.

Professional Tax Reform

Target: Assess the impact of eliminating the "Professional Tax", which was collected prior to 2010, on municipal tax revenues. How did this change affect different municipalities? This 2009/2010 reform refers to the removal of the "Taxe professionnelle" (TP), an important local business tax.

Impact on Different Municipalities:

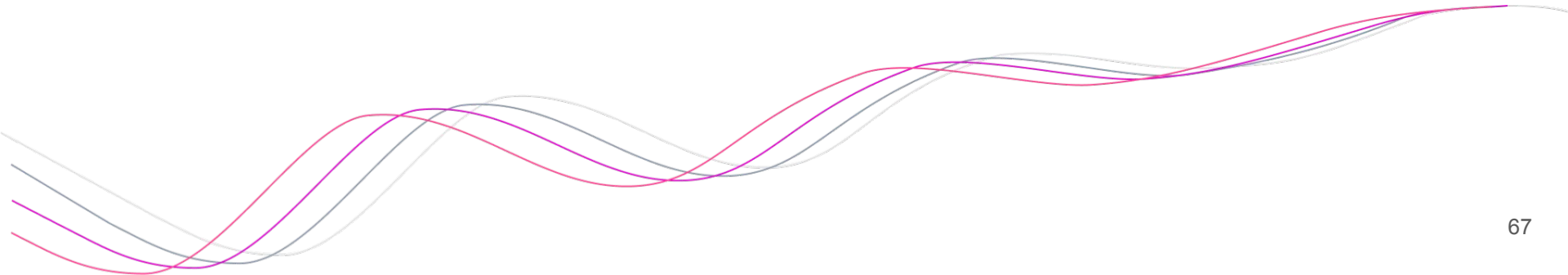
1. **Municipalities with Diverse Revenue Sources**: Municipalities that had a diversified tax base were better able to adapt to the elimination of the TP. The stable or incremental growth in other taxes helped these municipalities cushion the impact of the revenue loss from TP.

2. **Rural vs. Urban Municipalities**: Urban municipalities, with a larger base of property taxes (FB), could more easily offset the loss of TP revenue. The rise in property tax revenue in these areas suggests a shift in tax burden to property owners and businesses.

3. **Rural municipalities**, which might have relied more on non-built land taxes (FNB), experienced a more challenging transition. The relatively stable but lower revenue from FNB indicates these areas faced greater difficulty in compensating for the lost TP revenue.

4. **Economic and Policy Adaptation**: The overall rise in total municipal tax revenues post-2010, despite the TP's elimination, demonstrates effective economic and policy adaptations. Municipalities leveraged other tax avenues and possibly implemented measures to stimulate local economies, thus ensuring continued revenue growth.

Prediction Model



Prediction Model

Target: Develop and train a machine learning model capable of forecasting the yearly municipal tax revenues. Explain why you chose your specific model (linear regression, decision trees, neural networks, etc.) and discuss/compare their performance.

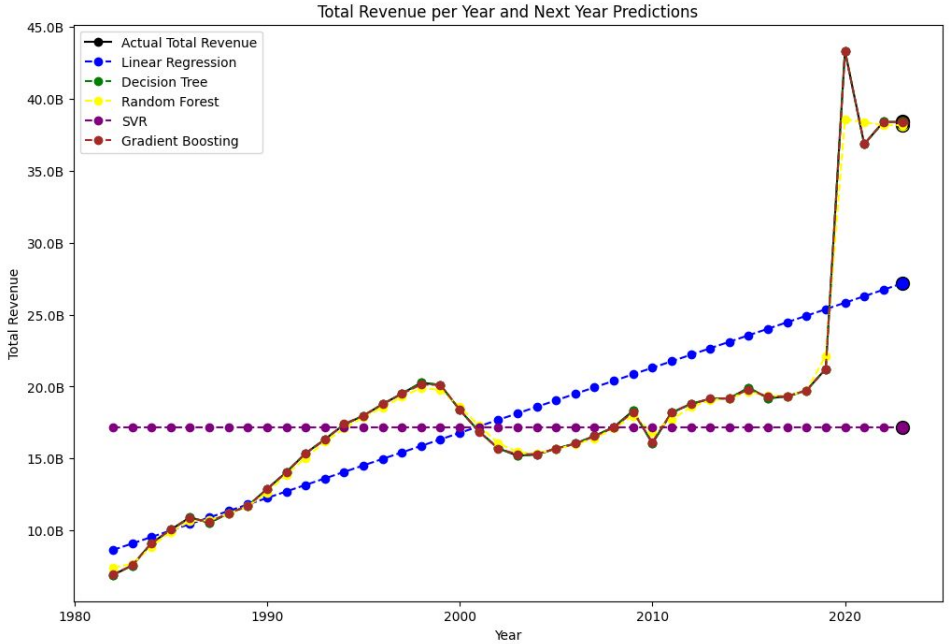
Predicting the total revenue (for all municipalities)

Multiple models were trained and the total revenue for all municipalities was forecasted.

Next Year Predictions:

- **Linear Regression**: Predicts a revenue of **27.2B.**
- **Decision Tree**: Predicts a revenue of **38.4B.**
- **Random Forest**: Predicts a revenue of **38.2B.**
- **SVR**: Predicts a revenue of **17.2B.**
- **Gradient Boosting**: Predicts a revenue of **38.4B.**

The models **Decision Tree**, **Random Forest**, and **Gradient Boosting** predict similar high values for the next year's revenue, **suggesting they may be capturing similar patterns in the data**. SVR predicts significantly lower revenue, indicating it might not be capturing the trends as well as the other models.



Prediction Model

Target: Develop and train a machine learning model capable of forecasting the yearly municipal tax revenues. Explain why you chose your specific model (linear regression, decision trees, neural networks, etc.) and discuss/compare their performance.

Model Performance

NMSE (Normalized Mean Squared Error):

- Linear Regression: **0.4412**
- Decision Tree: **0.0**
- Random Forest: **0.0135**
- SVR: **1.0049**
- Gradient Boosting: **0.000041**

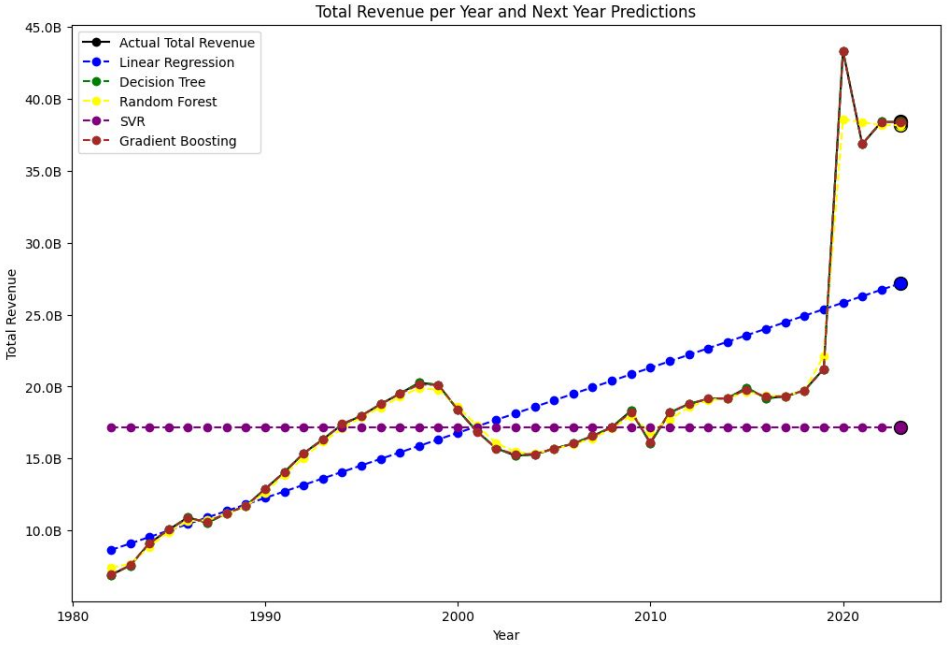
Lower NMSE values indicate better performance. Decision Tree has an NMSE of 0.0, which is unusual and may indicate overfitting to the training data. Gradient Boosting has an exceptionally low NMSE, suggesting it fits the data very well, followed by Random Forest. SVR has the highest NMSE, indicating poor performance compared to other models.

Insights:

1. **Gradient Boosting** and **Decision Tree** models appear to fit the data best, as indicated by their NMSE values and close fit to the actual data in the plot.

2. **SVR** does not seem to be a good fit for this data, as indicated by its high NMSE and poor prediction.

3. **Linear Regression** provides a simplistic view of the trend, missing the nuances and variations in the data.



Prediction Model

Target: Develop and train a machine learning model capable of forecasting the yearly municipal tax revenues. Explain why you chose your specific model (linear regression, decision trees, neural networks, etc.) and discuss/compare their performance.

Revenue prediction for: Paris

Next Year Predictions:

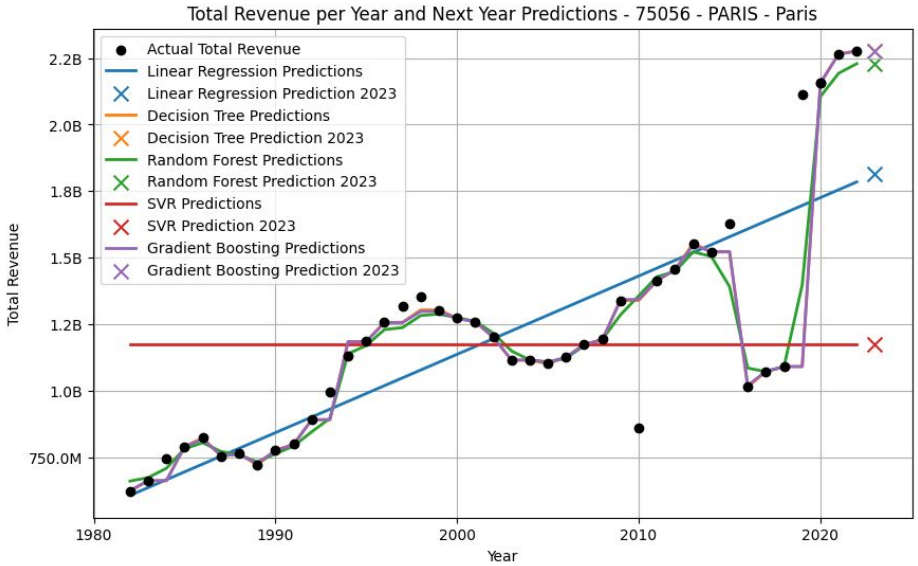
- Linear Regression: Predicts a revenue of **1.8B**
- Decision Tree: Predicts a revenue of **2.3B**
- Random Forest: Predicts a revenue of **2.2B**
- SVR: Predicts a revenue of **1.2B**
- Gradient Boosting: Predicts a revenue of **2.3B**

NMSE (Normalized Mean Squared Error):

- Linear Regression: **0.5052**
- Decision Tree: **0.9320**
- Random Forest: **0.5946**
- SVR: **1.0382**
- Gradient Boosting: **0.9351**

Best Model: Linear Regression has the lowest NMSE, suggesting it provides the most accurate predictions for the next year's revenue for Paris.

Worst Model: SVR has the highest NMSE, indicating it is the least accurate and should be avoided for this specific task.



Prediction Model

Target: Develop and train a machine learning model capable of forecasting the yearly municipal tax revenues. Explain why you chose your specific model (linear regression, decision trees, neural networks, etc.) and discuss/compare their performance.

Revenue prediction for: Marseille

Next Year Predictions:

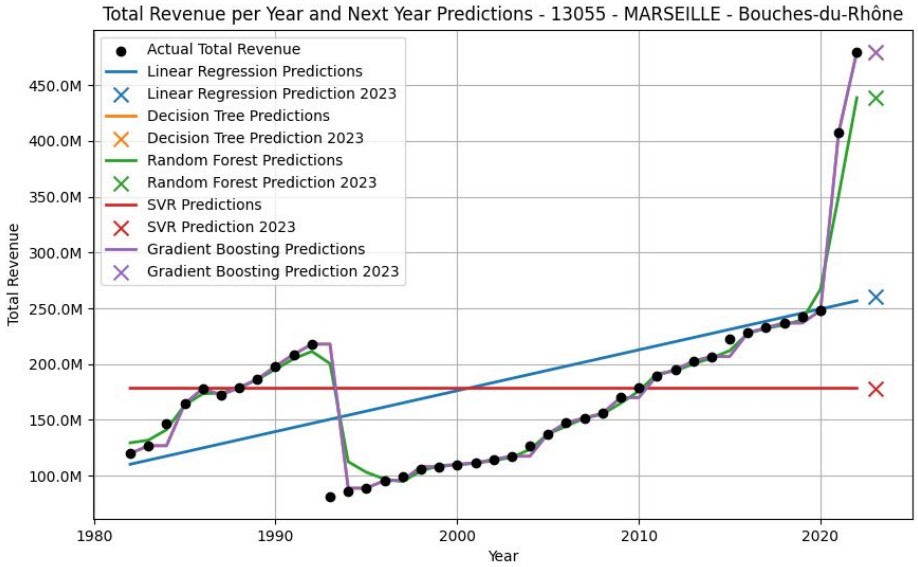
- Linear Regression: Predicts a revenue of **256.6M**
- Decision Tree: Predicts a revenue of **479.8M**
- Random Forest: Predicts a revenue of **438.7M**
- SVR: Predicts a revenue of **178.3M**
- Gradient Boosting: Predicts a revenue of **479.7M**

NMSE (Normalized Mean Squared Error):

- Linear Regression: **0.8518**
- Decision Tree: **0.6927**
- Random Forest: **0.5350**
- SVR: **1.3961**
- Gradient Boosting: **0.6909**

Best Model: Random Forest has the lowest NMSE, suggesting it provides the most accurate predictions for the next year's revenue for Marseille.

Worst Model: SVR has the highest NMSE, indicating it is the least accurate and should be avoided for this specific task.



Prediction Model

Target: Develop and train a machine learning model capable of forecasting the yearly municipal tax revenues. Explain why you chose your specific model (linear regression, decision trees, neural networks, etc.) and discuss/compare their performance.

Revenue prediction for: Lyon

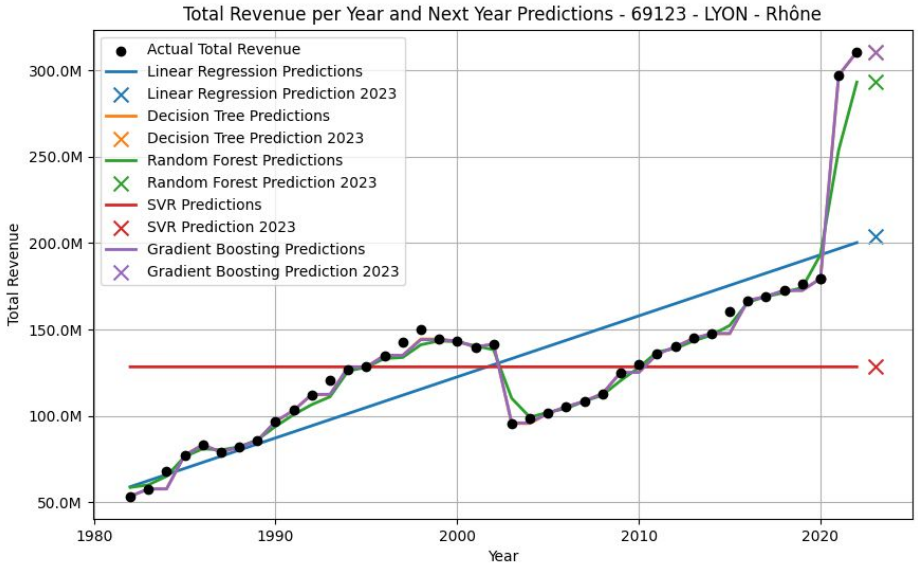
Next Year Predictions:

- Linear Regression: Predicts a revenue of **200.3M**
- Decision Tree: Predicts a revenue of **310.7M**
- Random Forest: Predicts a revenue of **293.2M**
- SVR: Predicts a revenue of **128.3M**
- Gradient Boosting: Predicts a revenue of **310.7M**

NMSE (Normalized Mean Squared Error):

- Linear Regression: **0.6937**
- Decision Tree: **0.0550**
- Random Forest: **0.0376**
- SVR: **1.0036**
- Gradient Boosting: **0.0540**

Recommendation: Consider using Random Forest for future predictions, as it offers the best accuracy based on the NMSE values. Decision Tree and Gradient Boosting are also strong alternatives with low NMSE values.



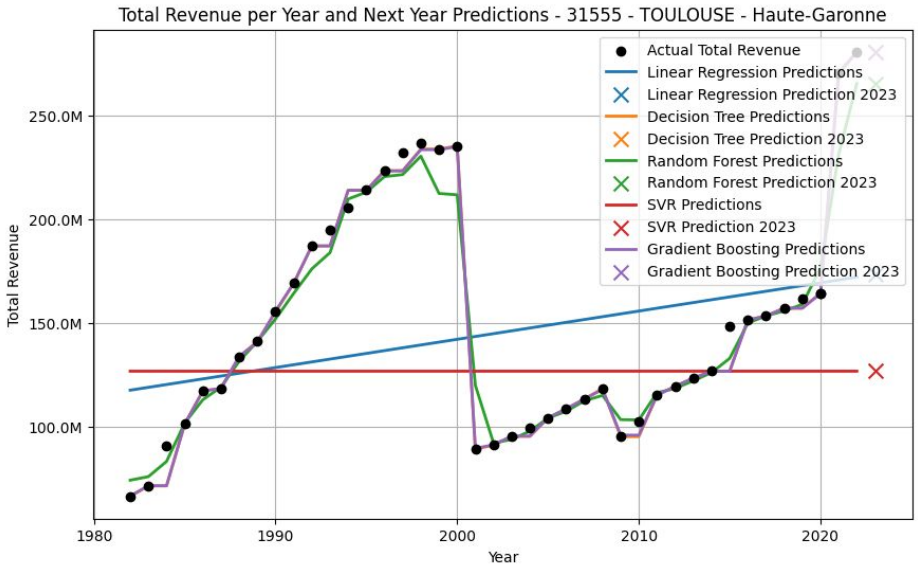
Prediction Model

Target: Develop and train a machine learning model capable of forecasting the yearly municipal tax revenues. Explain why you chose your specific model (linear regression, decision trees, neural networks, etc.) and discuss/compare their performance.

Revenue prediction for: Toulouse

Next Year Predictions:

- Linear Regression: Predicts a revenue of **172.2M**
- Decision Tree: Predicts a revenue of **281.0M**
- Random Forest: Predicts a revenue of **265.7M**
- SVR: Predicts a revenue of **126.7M**
- Gradient Boosting: Predicts a revenue of **280.9M**



NMSE (Normalized Mean Squared Error):

- Linear Regression: **1.2841**
- Decision Tree: **0.0437**
- Random Forest: **0.0227**
- SVR: **1.4664**
- Gradient Boosting: **0.0433**

Recommendation: Consider using Random Forest for future predictions, as it offers the best accuracy based on the NMSE values. Decision Tree and Gradient Boosting are also strong alternatives with low NMSE values.

Prediction Model

Target: Develop and train a machine learning model capable of forecasting the yearly municipal tax revenues. Explain why you chose your specific model (linear regression, decision trees, neural networks, etc.) and discuss/compare their performance.

Revenue prediction for: Nice

Next Year Predictions:

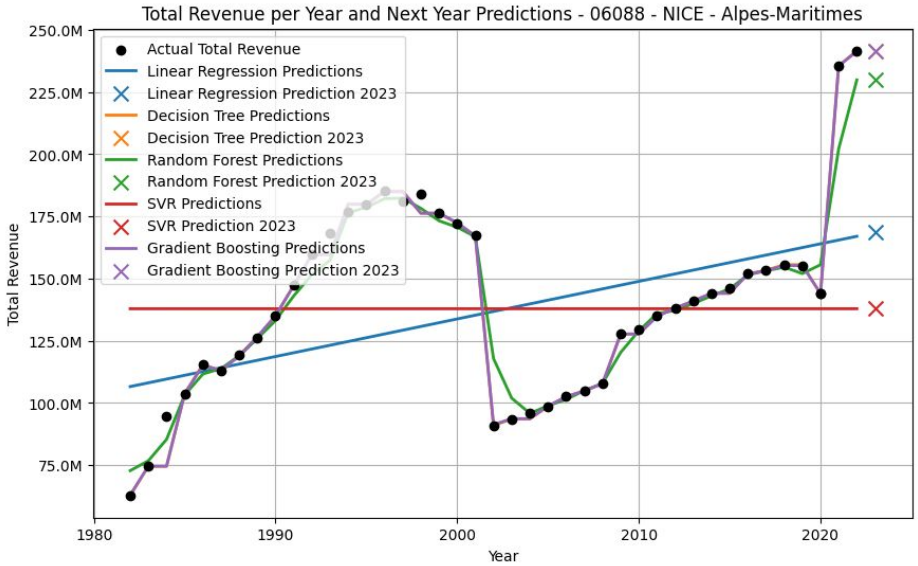
- Linear Regression: Predicts a revenue of **167.0M**
- Decision Tree: Predicts a revenue of **241.6M**
- Random Forest: Predicts a revenue of **229.9M**
- SVR: Predicts a revenue of **137.9M**
- Gradient Boosting: Predicts a revenue of **241.5M**

NMSE (Normalized Mean Squared Error):

- Linear Regression: **1.3486**
- Decision Tree: **0.0600**
- Random Forest: **0.0260**
- SVR: **1.0942**
- Gradient Boosting: **0.0592**

Best Model: Random Forest has the lowest NMSE, suggesting it provides the most accurate predictions for the next year's revenue for Nice.

Worst Model: Linear Regression has the highest NMSE, indicating it is the least accurate and should be avoided for this specific task.



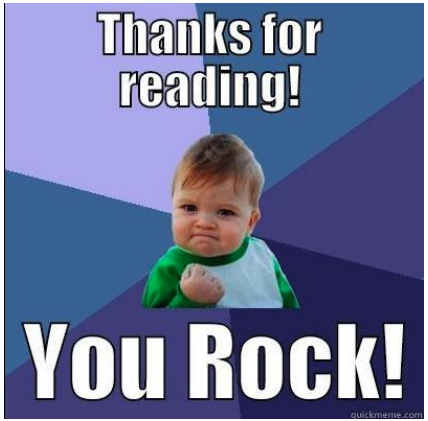
Prediction Model

Target: Develop and train a machine learning model capable of forecasting the yearly municipal tax revenues. Explain why you chose your specific model (linear regression, decision trees, neural networks, etc.) and discuss/compare their performance.

Conclusions

1. **Model Performance Varies by City: The performance of different models in predicting next year's revenue varies significantly from city to city. There is no single model that consistently outperforms the others across all locations.**
2. **Linear Regression:**
    a. **Best for Paris**: Linear Regression had the lowest NMSE for Paris, suggesting it is the most accurate model for predicting the next year's revenue in this city.
    b. **Worst for Nice and Nantes**: Linear Regression had the highest NMSE for Nice and Nantes, indicating it is the least accurate for these locations.
3. **Random Forest:**
    a. **Best for Multiple Cities**: Random Forest consistently showed the lowest NMSE for Marseille, Lyon, Toulouse, Nice, Montpellier, Bordeaux, and Nantes. This suggests that Random Forest is a highly reliable model for predicting revenue in these cities.
    b. **Moderate for Paris**: While it did not have the lowest NMSE for Paris, it still performed reasonably well.
4. **Decision Tree:**
    a. **Good Alternative**: Decision Tree models often had low NMSE values, making them a strong alternative to Random Forest. For instance, it performed well for Lyon, Toulouse, Montpellier, and Bordeaux.
    b. **Case Dependent**: The effectiveness of Decision Trees varies, sometimes matching closely with Gradient Boosting models in terms of accuracy.
5. **Gradient Boosting:**
    a. **Similar to Decision Tree:** Gradient Boosting showed similar performance to Decision Trees for cities like Lyon, Toulouse, Montpellier, and Bordeaux, indicating it can also be a reliable model.
    b. **Close Contender:** It is often a close contender for the best model in terms of NMSE.
6. **Support Vector Regression (SVR)**: Generally Poor Performance: SVR consistently had high NMSE values across all cities, suggesting it is generally the least reliable model for this prediction task.

Thank you for these incredible challenges that give us the opportunity to explore, learn, and harness the power of data! 🙏



For the code and additional resources, head over to the GitHub repository.
The code and notebooks are designed extensively to also incorporate taxes at the intercommunal, state, departmental, and regional levels. For additional insights, please reach out via Discord (white_rider_) or Twitter 🙏