

French Fiscal AI Innovation and Prediction Challenge

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Introduction

Purpose of analysis

This report explores **40 years** of French tax information to uncover patterns and **insights into municipal finances**, leveraging data collected with the EU Commission's Science Hub, the Joint Research Centre.

Dataset's Richness

The dataset preprocessing involved French franc values to euros **conversion**. Numeric format conversion for revenue and rates. **Locations** were integrated using the **Google Maps API** to consolidate entities with varying names or codes, resolving data fragmentation issues.

Type of Analysis

The report examines **tax rates**, offering a more balanced perspective on municipal finances. This dual focus on both revenue and rates provides a complete view of the fiscal situation, **highlighting not just the amounts collected but also the tax policies** and their effects.

Deep Dive into Relationships

We will highlight the relationships between population size, tax revenue, and tax rates, spotlighting top-performing municipalities and revealing critical fiscal trends and patterns.

Reforms Impact

We will analyze the impact of the 2009/2010 reform that abolished the "Professional Tax" and introduced the Territorial Economic Contribution (**CET**). The analysis will highlight how larger municipalities, which were **heavily reliant** on the Professional Tax, faced substantial fiscal challenges

ML Models and Takeaways

The report also dive into the development of machine learning models to **forecast yearly municipal tax revenues**. This includes advanced feature engineering, such as adjusting for inflation and applying **Box-Cox** transformations, to enhance the accuracy and quality of the forecasts.

Terms to be defined

TEOM (Taxe d'Enlèvement des Ordures Ménagères)

This is a tax annexed to property tax. Its amount does not depend on the service rendered. It also concerns owners who do not use the waste collection and treatment service

TH (Taxe d'habitation)

This is a local tax that is mainly due by anyone who has, in any capacity, the disposal or enjoyment of taxable.

IFER (Imposition Forfaitaire sur les Entreprises de Réseaux)

This is a tax levied for the benefit of local authorities. It applies to companies operating in the energy, rail, and telecommunications sectors

TASCOM (Taxe sur les Surfaces Commerciales)

This is a French tax that replaces the old tax to aid trade and crafts (Taca). It is levied on retail businesses with a sales area of more than 400 m² and whose annual turnover excluding taxes is at least €460,000

FNB (Foncier Non Bâti)

This refers to non-built real estate.

CFE (Cotisation Foncière des Entreprises)

This is a local tax payable by all companies and individuals carrying out a non-salaried professional activity

CVAE (Cotisation sur la Valeur Ajoutée des Entreprises)

This is a local tax paid by companies that generate a certain amount of turnover and carry out an activity taxable to the CFE.

TAFNB (Taxe Additionnelle à la Taxe sur le Foncier Non Bâti)

This is a direct tax, created in 2011, collected for the benefit of the communal sector including EPCI with FPU.

FB (Foncier Bâti)

This refers to built-up land. It is part of the property tax system in France

Taxes used to calculate municipal revenues

Dataset preparation

Selection of Relevant Columns

We conducted an in-depth analysis of various French taxation websites and data descriptions to select **the most pertinent columns** (Revenue and Rates). Details of this selection are presented in the previous slide, and the **column groupings are available in the annex slides**.

Currency Conversion

Values expressed in French francs were converted to euros to ensure **data uniformity**. The conversion was performed using the official exchange rate (**1 euro = 6.55957 francs**), harmonizing all values **before 2002**.

Data Transformation

Numerous columns were converted to numeric format, particularly revenues and rates. This step ensured data consistency and accuracy for the analysis.

Integration of Locations

Integrating the locations of municipalities via the **Google Maps API** was a game changer. This integration allowed us to **group municipalities with similar names or codes**, even when they had changed.

For example, entities like 'PARIS, 75999', 'PARIS, 75056', and 'VILLE DE PARIS, 75056' were consolidated for coherent analysis. Another instance is the differentiation between 'POINTE-NOIRE' and 'POINTE NOIRE' due to the hyphen.

This consolidation resolved issues with fragmented data across different years, thus **enhancing the relevance of the analysis**.

Municipality Rankings

Net Revenue

- Ranking municipalities by net revenue provides a direct comparison of total fiscal capacity, highlighting **which municipalities generate the most from their various local taxes.**
- This approach accounts for the aggregate financial resources available to each municipality.

$$\text{Total Revenue} = \text{IFER} + \text{TH} + \text{TASCOM} + \text{FB} + \text{FNB} + \text{TAFNB} + \text{CVAE} + \text{CFE}$$

Tax Rate

- Ranking by the mean tax rate allows for a comparison of **the tax policies set by each municipality**, independent of their population size or economic scale, focusing on the relative tax burden imposed by local governments.
- This method shows the approach and aggressiveness of municipal tax strategies, providing insight into **which municipalities impose higher rates and therefore potentially deter or attract businesses and residents based on fiscal policy alone.**

$$\text{Mean Tax Rate} = \frac{\text{TH (rate)} + \text{TAFNB (rate)} + \text{FNB (rate)} + \text{CFE (rate)} + \text{TEOM (rate)} + \text{FB (rate)}}{\text{Number of Tax rate}}$$

Municipality Rankings

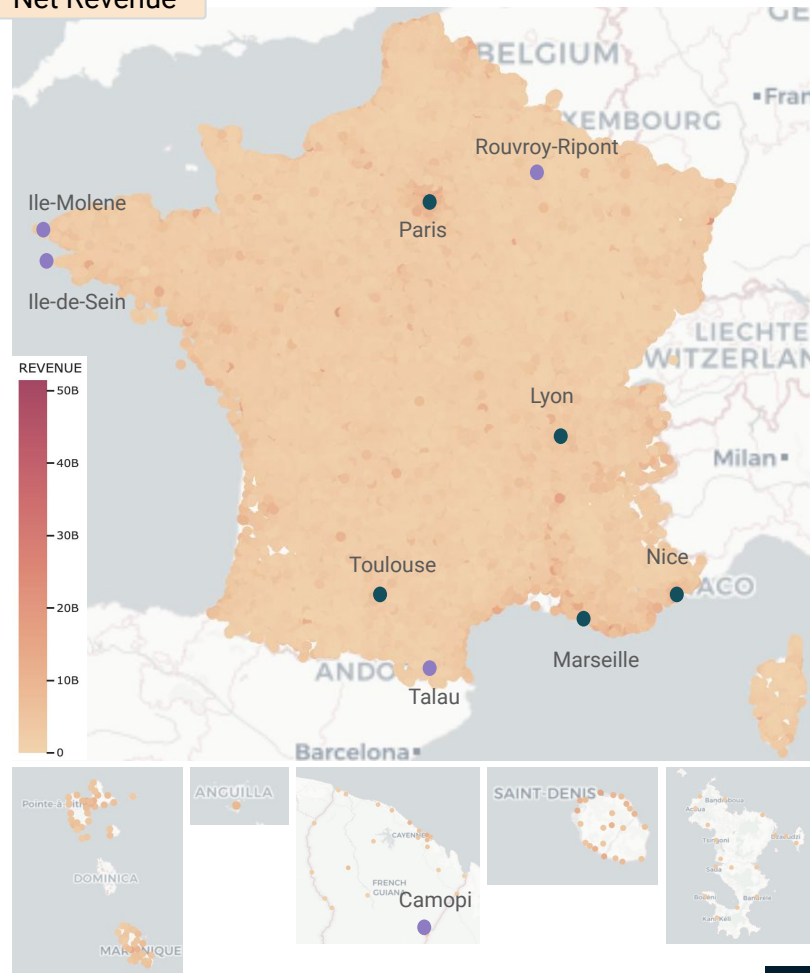
If we talk in terms of net revenue, going back to the municipalities, here are the rankings. Unsurprisingly, we find the **main French cities** with revenues of over €1 billion over the last 40 years.

Rank	Municipality	Net Revenue €
1	Paris	51,468,880,000
2	Marseille	7,534,103,000
3	Toulouse	6,180,910,000
4	Nice	5,872,051,000
5	Lyon	5,468,345,000

The last five municipalities, **ILE-MOLENE**, **CAMOPI**, **TALAU**, **ILE-DE-SEIN**, and **ROUVROY-RIPONT**, report incomes close to zero. This should be treated with caution, as it may indicate **missing data** and these are potentially **communes that have disappeared** over the last 40 years and no longer exist today.

Talau was a hamlet and a former municipality until 1982.

Net Revenue

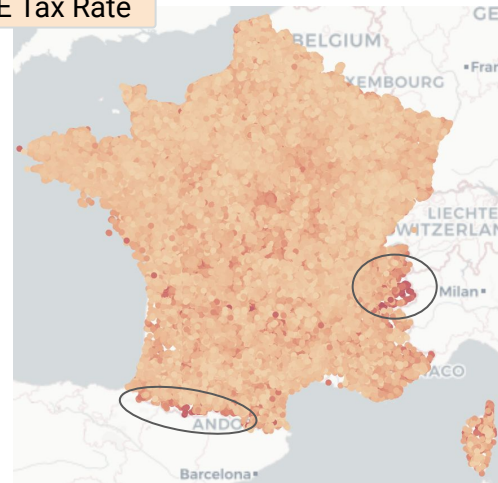


Municipality Rankings

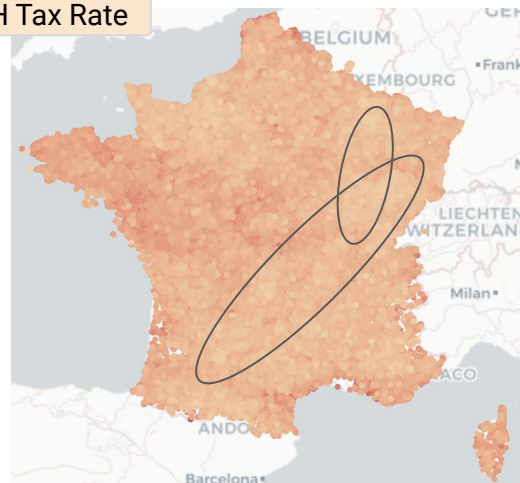
Municipality	CFE - Tax Rate (Rank)	TH - Tax Rate (Rank)
Lagrange	36.94 (1)	
Saint-Louis		41.85 (1)
Paris	13.41 (3821)	10.26 (16565)
Marseille	2.44 (33139)	25.69 (73)
Nice	9.83 (8940)	19.82 (629)
Toulouse	6.74 (17020)	18.27 (1101)
Lyon	4.57 (25206)	16.90 (1861)

Lagrange and Saint-Louis have the highest tax rates for CFE and TH respectively, with major cities like Paris, Marseille, Nice, Toulouse, and Lyon showing significantly lower rates. The maps reveal higher **CFE tax rates near the borders**, likely due to economic or administrative policies in border regions, and a **lighter diagonal band of lower TH tax rates**, reflecting regional variations in taxation policies.

CFE Tax Rate



TH Tax Rate

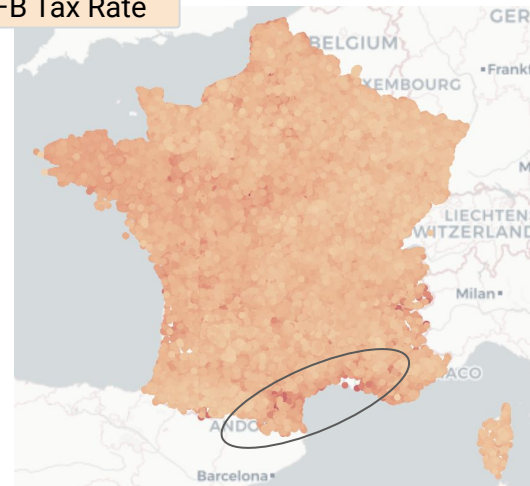


Municipality Rankings

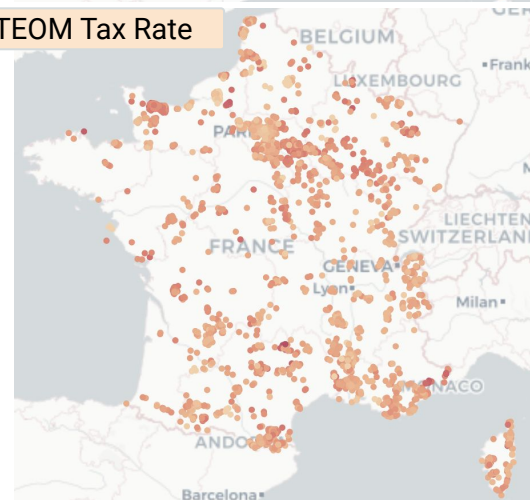
Municipality	FB - Tax Rate (Rank)	TEOM - Tax Rate (Rank)
Fontaines-de-Sault	59.87 (1)	
Jujols		35.85 (1)
Paris	7.82 (33458)	6.08 (1751)
Marseille	21.31 (4481)	-
Nice	21.52 (4265)	-
Toulouse	21.25 (4543)	8.5 (1364)
Lyon	14 (17834)	-

Fontaines-de-Sault and Jujols have the highest tax rates for FB and TEOM respectively. The maps reveal a **concentration of higher FB tax rates in the south of France**, while **TEOM tax rates are more scattered and not implemented in every municipality**, which can impact overall revenue.

FB Tax Rate



TEOM Tax Rate

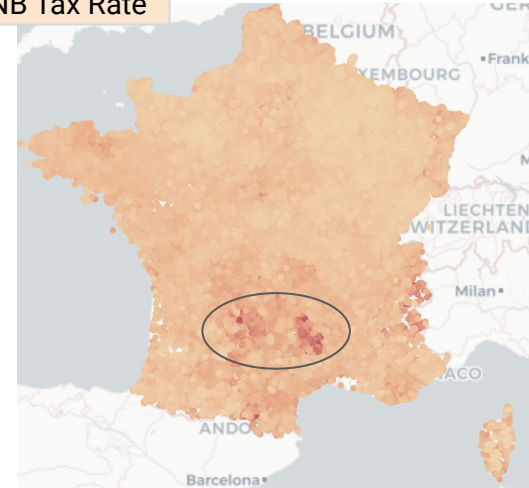


Municipality Rankings

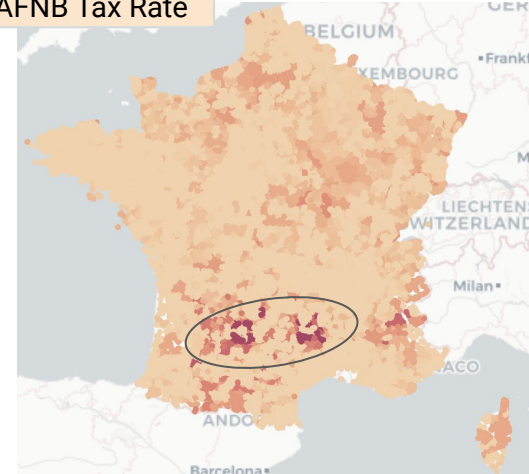
Municipality	FNB - Tax Rate (Rank)	TAFNB - Tax Rate (Rank)
Saint-Germain-du-Teil	322.5 (1)	
Banassac		136.96 (1)
Paris	16.67 (31791)	0.9625 (18709)
Marseille	24.99 (27527)	0
Nice	33.14 (22487)	0
Toulouse	65.52 (6729)	0
Lyon	19.97 (30203)	0

Saint-Germain-du-Teil and Banassac have the highest tax rates for FNB and TAFNB respectively. The maps reveal higher FNB tax rates concentrated in the south, likely due to larger areas of undeveloped or non-urbanized land, which are subject to the FNB tax. TAFNB tax rates are more prevalent in the southwestern region, reflecting regional differences in land use and property taxation policies that impact municipal revenue.

FNB Tax Rate



TAFNB Tax Rate

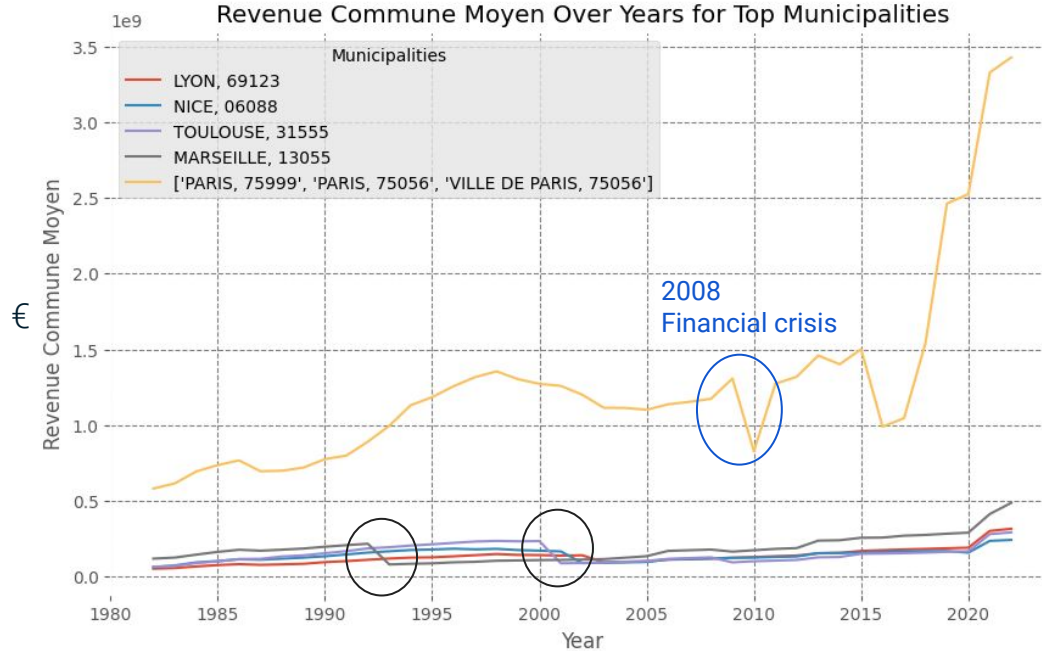


Municipality Rankings

Rank	<i>Rank By Revenue</i>	<i>Rank By Rate</i>
1	Paris	Fontiers-Cabardes
2	Marseille	Saint-Lary-Soulan
3	Toulouse	Orcieres
4	Nice	Nogaro
5	Lyon	Caudebronde

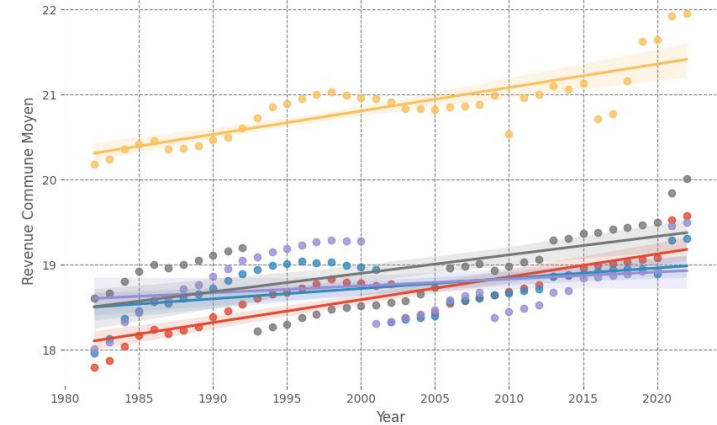


Revenue Trends



Significant drop, see next slide to see the rates (CFE) of cities decrease during these two periods

Revenue Commune Moyen Over Years for Top Municipalities (LOG SCALE) with Trendline



Trend Analysis Insights

As we can see with the above plot, the trend for 40 years has been upwards for each of the top cities. However, this trend is not linear. Some significant declines are present and justifiable due to reforms.

1992-1993: The creation of the Single European Market in 1993 necessitated tax reform to harmonise Member States' tax systems. In France, this led to a reduction in **local business tax rates** to make the country more competitive.

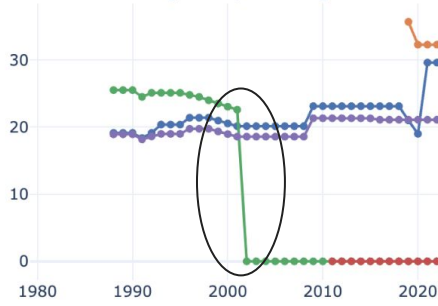
2000-2002: During this period, several reforms were implemented to reduce compulsory levies and modernise local taxation. The 2001 Finance Act introduced a three-year tax reduction plan, which led to a temporary fall in local authority revenues.

Revenue Trends

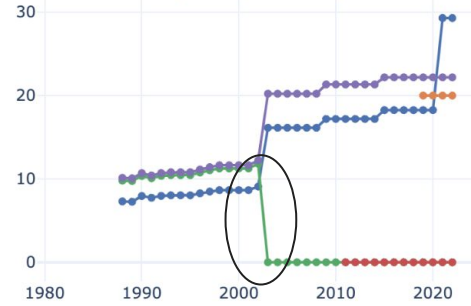
['TOULOUSE, 31555']



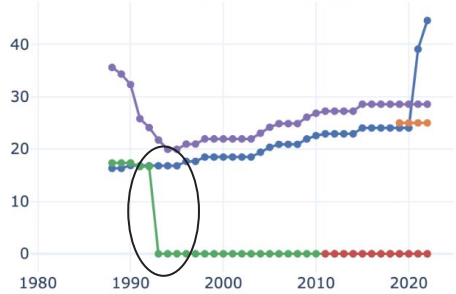
['NICE, 06088']



['LYON, 69123']



['MARSEILLE, 13055']



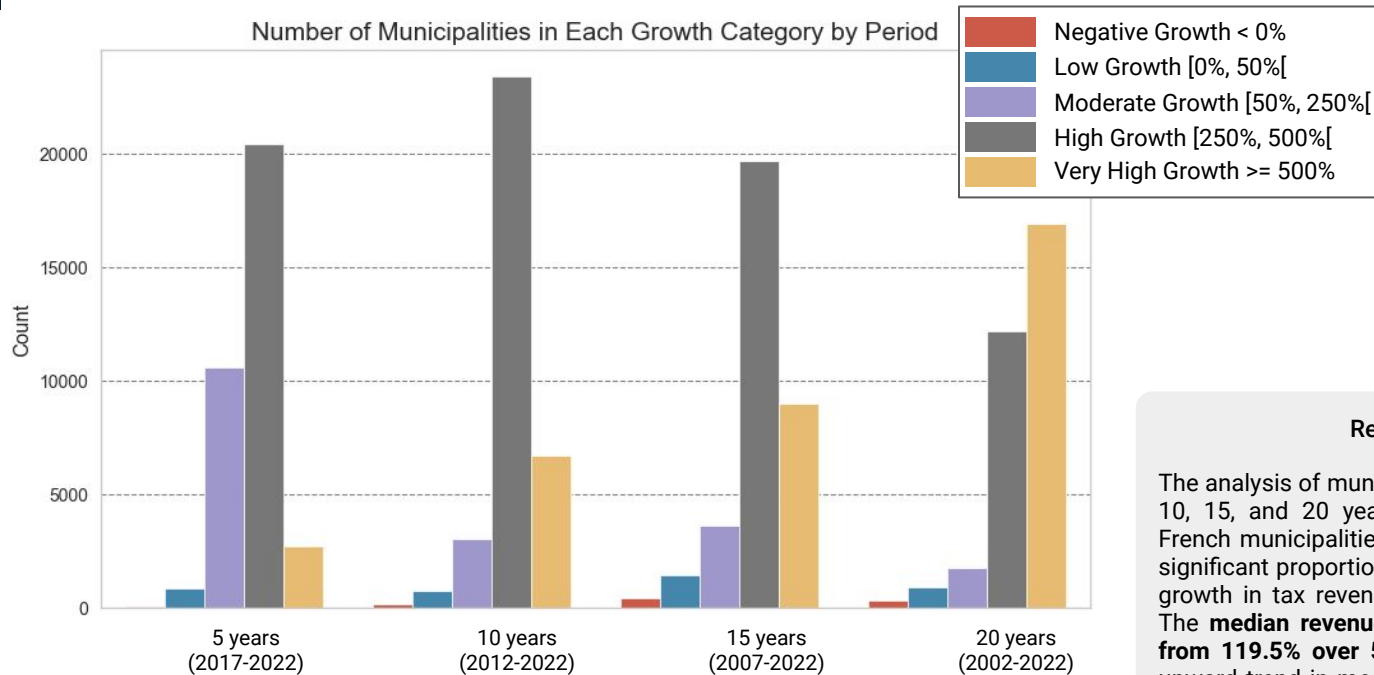
['PARIS, 75999', 'PARIS, 75056', 'VILLE DE PARIS, 75056']



Rates for each top municipality over the years

FB_RATE FNB_RATE CFE_RATE TAFNB_RATE TH_RATE TEOM_RATE

Revenue Growth



The top municipal growth rates are exceptionally high, necessitating a cautious evaluation of our categorization methods. The importance of analyzing the median growth rates can provide a more representative and stable indicator of overall trends.

Growth Median

5 y	119.5%
10 y	169.3%
15 y	180.9%
20 y	260.4%

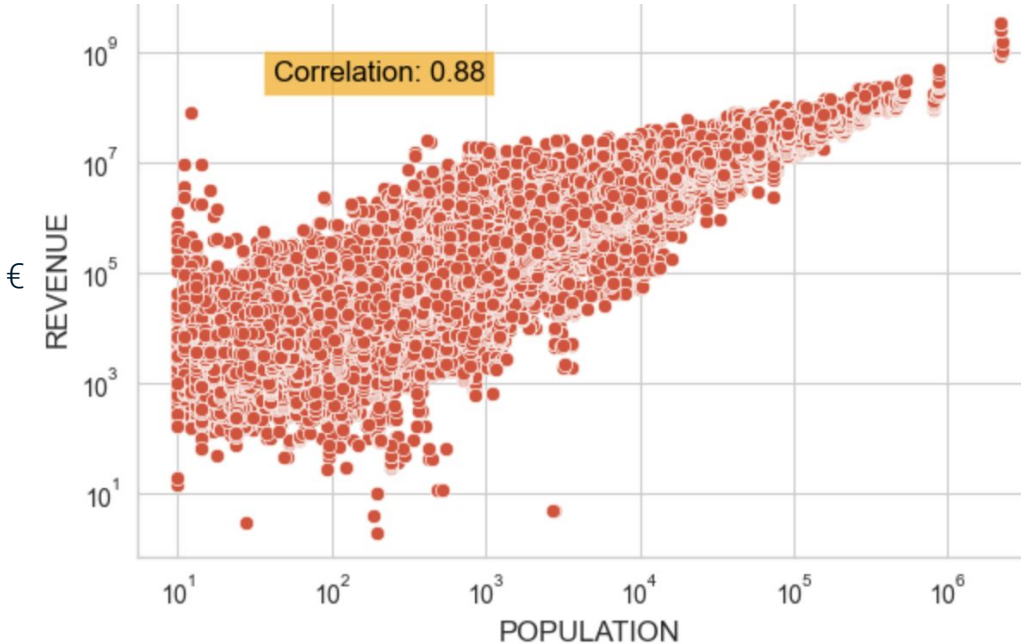
Revenue Growth Analysis

The analysis of municipal tax revenue growth over the past 5, 10, 15, and 20 years demonstrates **fiscal growth** across French municipalities. Over the last 20 years (2002-2022), a significant proportion of municipalities experienced very high growth in tax revenue, with growth rates surpassing 500%. The **median revenue growth shows a substantial increase from 119.5% over 5 years to 260.4% over 20 years**. This upward trend in median growth, alongside the high count of municipalities with substantial growth rates, underscores the success of tax policies and indicates robust economic expansion.

Reason: Augmentation of certain tax rate (FB), population growth ...

Correlations

Scatter Plots of Population vs Revenue (Log Scale)



Correlation Analysis

The analysis reveals a **strong positive correlation** (0.88) between population size (Z08) and tax revenue in French municipalities over the past 40 years. This indicates that **larger populations tend to generate higher tax revenues**, likely due to a broader tax base and increased economic activities. These findings suggest that strategies aimed at population growth could effectively boost municipal revenues. Moreover, the clear trend observed in the data shows **the importance of considering population size in fiscal planning** and policy development for the financial health of municipalities.

Significant Taxes

40 Years

Syndicat

36,784,060,330€

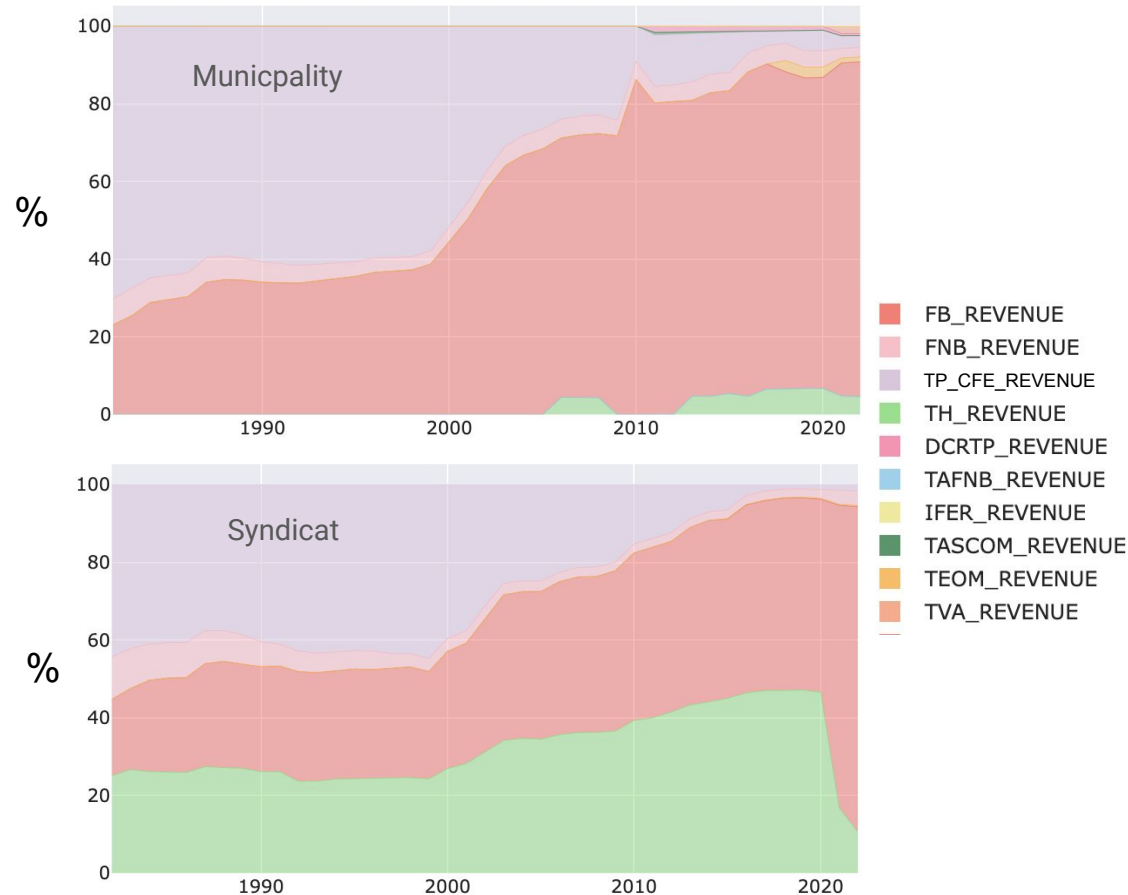
Municipality

701,838,293,000€

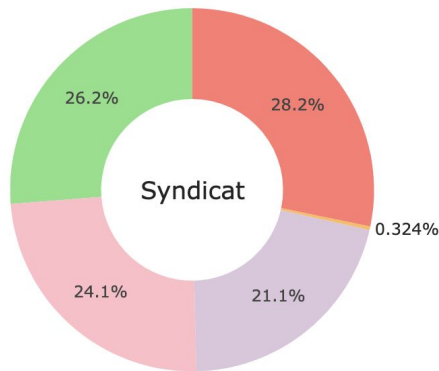
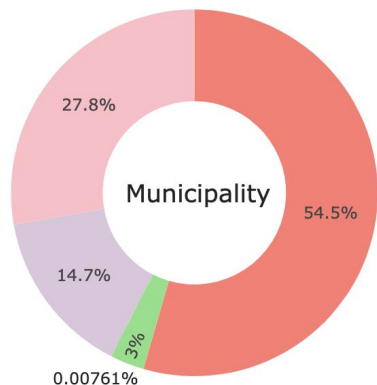
Significant Taxes History (Municipalities & Labour Unions)

Historical data indicates significant shifts in tax revenue compositions for both municipalities and labor unions. Initially, Professional Tax (TP_CFE) **was a notable revenue source** before 2010. After 2010, **Professional Tax became part of CET** (Cotisation Economique Territoriale), which includes both CFE and CVAE (Cotisation sur la Valeur Ajoutée des Entreprises). This shift reflects the significant tax reform eliminating the professional tax and introducing CET. Additionally, **TH (Taxe d'Habitation or Residence Tax) was a substantial revenue source for labor unions**. However, post-2020 reforms aimed at reducing the residence tax have led to a noticeable decline in TH_REVENUE. Conversely, there has been a marked increase in FB_REVENUE (Foncier Bati) for both municipalities and labor unions, indicating a shift towards greater reliance on property taxes.

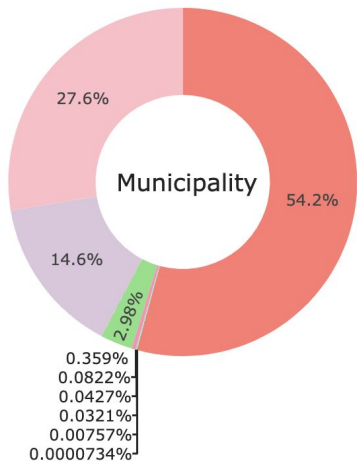
TP_CFE_REVENUE: TP (Professional Tax) before 2010 and CET (CFE + CVAE) after 2010



Significant Taxes



Labor Unions = Syndicat



- FB_REVENUE
- FNB_REVENUE
- CFE_REVENUE
- TH_REVENUE
- DCRTP_REVENUE
- TAFNB_REVENUE
- IFER_REVENUE
- TASCOM_REVENUE
- TEOM_REVENUE
- TVA_REVENUE

Significant Taxes Analysis (Municipalities & Labour Unions)

The analysis reveals that FB (Foncière Bâtie or Property Tax on Buildings) is **the most significant tax revenue source for both municipalities and labor unions**. For municipalities, FB consistently constitutes over **50% of total tax revenue**, as depicted in the top-left and bottom-left pie charts. Similarly, labor unions rely heavily on FB, which accounts for **28.2% of their total tax revenue**, as shown in the top-right pie chart. This consistency across both entities underscores the critical role of property taxes in local fiscal policies.

Significant Taxes Analysis Impact

The **reform of the Taxe d'Habitation (TH) in 2020**, which aimed to alleviate the fiscal burden on residents, has significantly impacted labor union revenues, as illustrated in the previous area plot. The decline in TH post-2020 reflects this reform's effects. Concurrently, the observed increase in FB suggests a policy shift towards higher property tax rates or an expanded taxable property base to compensate for the reduction in other tax revenues.

Professional Tax Reform

Taxe Professionnelle (TP) Before 2010

The *taxe professionnelle* (TP) was a French local tax **applied to businesses**, based mainly on **the rental value of property** used by the business and fixed equipment. It was a major source of revenue for municipalities, crucial for funding local services.

2010 reform and introduction of the CET

In 2010, business tax was abolished and replaced by the *Contribution Économique Territoriale* (CET), made up of two parts: the *Cotisation Foncière des Entreprises* (CFE) based on the **property used by a business**, and the *Cotisation sur la Valeur Ajoutée des Entreprises* (CVAE) which **targets the added value produced by the business**.

Introduction of IFER and DCRTP

In addition to the CET, the *Imposition Forfaitaire sur les Entreprises de Réseaux* (IFER) was introduced to specifically **tax companies operating networks** (such as telecommunications and electricity). The *Dotation de Compensation de la Réforme de la Taxe Professionnelle* (DCRTP) was also introduced **to partially compensate municipalities for the loss of revenue caused by the reform**.

Professional Tax Reform – General Analysis (TP: 1982–2010 and CFE and other: 2011–2022)

Professional Tax (TP) Before 2010

6,763,167,000 €

Contribution Economique Territoriales (CET),
including CFE and CVAE

1,587,654,000 €

Dotation à la Compensation de la Réforme de
la Taxe Professionnelle (DCRTP)

255,633,500 €

IFER

7,788,070 €

TVA

118,686,200 €



Abolition of the CVAE in 2021 and
2022, which implies payment of a
fraction of the TVA



Total – pre 2010

6,763,167,000 €



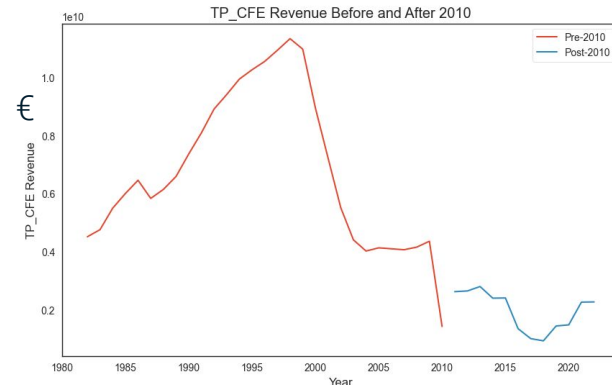
-71 %

(-4,793,406,000 €)



Total – post 2010

1,969,761,000 €



Professional Tax Reform - General Analysis

The elimination of the "Professional Tax" (TP) in 2010 led to a **significant reduction in municipal tax revenues**, with average yearly revenues dropping by 71%, from €6,763,167,000 pre-2010 to €1,969,761,000 post-2010. The introduction of the *Contribution Economique Territoriales* (CET), along with the IFER and DCRTP, **only partially compensated for this loss**. Different municipalities experienced varying impacts based on their dependency on TP revenues.

[Important] We compared over the entire pre period and post period what makes a significant drop. In order to reflect reality, if we compare, over the last 5 years of the pre period (2005–2010) this drop is less significant and reflects in a more relevant way the drop and the impact on municipal revenues.

3,710,142,000 €

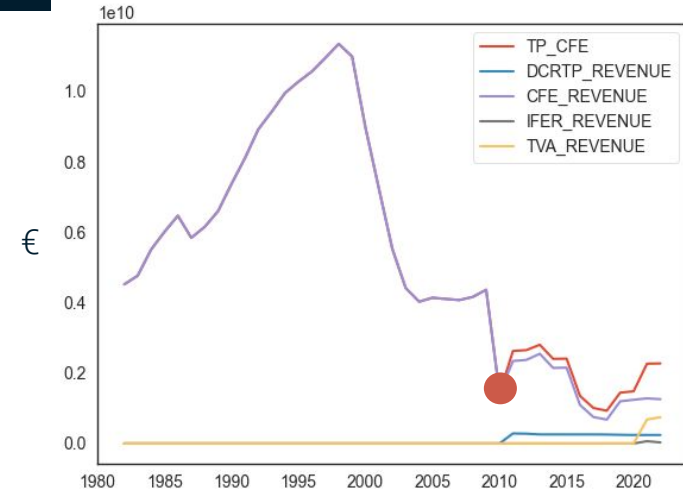


-47% (3,710,142,000 €)



1,969,761,000 €

Professional Tax Reform – Representation in revenue



Representation compared to the total revenue

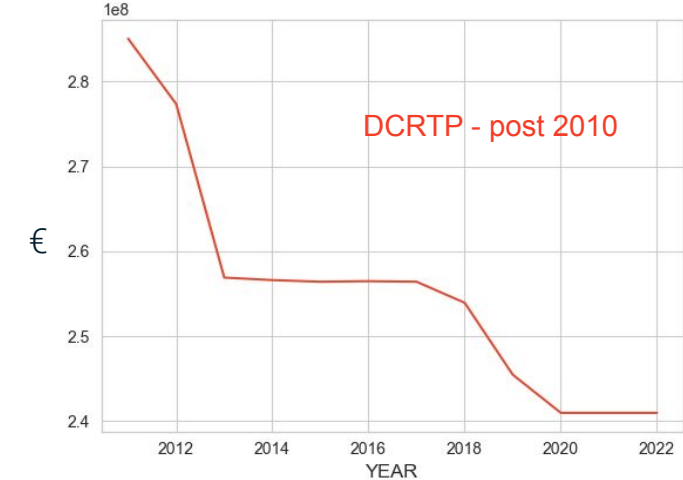
The abolition of the Professional Tax in 2010 marked a **significant shift** in the fiscal landscape of French municipalities. Prior to its elimination, the Professional Tax was a major for local finances, **contributing 47.3% of municipal revenue**. The tax's elimination necessitated a transition to the Territorial Economic Contribution (CET), which includes the Business Property Contribution (CFE), the Business Value Added Contribution (CVAE), and IFER. This **shift resulted in a substantial decrease in municipal income from business taxes**, as the CET and associated compensations **accounted for only 8.23% of municipal revenues**. Consequently, municipalities faced a more diversified but less stable revenue structure, leading to financial challenges.

Impact & Compensation

The impact of this policy change varied significantly among municipalities. **Larger municipalities or those with a high concentration of businesses were more adversely affected due to their greater reliance on the Professional Tax.**

The city of Paris has lost around €1.3 billion in revenue following the abolition of business tax.

Despite the introduction of compensation mechanisms, *Dotation de Compensation de la Réforme de la Taxe Professionnelle* (DCRTP), which **aimed to mitigate the impact, these measures were partial, only 17.9% of TP pre-2010** (even if it is not supposed to compensate the entire TP). Based on 2010 figures, the relative weight of compensations **decreased over time**, exacerbating fiscal pressures. To cope, municipalities had to explore alternative revenue sources, such as increasing local taxes on property (FB).



Prediction Model – Methodology (Prophet)



Data Preparation

Collected and organized yearly municipal tax revenue data into a DataFrame with 'YEAR' and 'REVENUE' columns, and applied the **Box-Cox transformation to stabilize variance and normalize the data.**

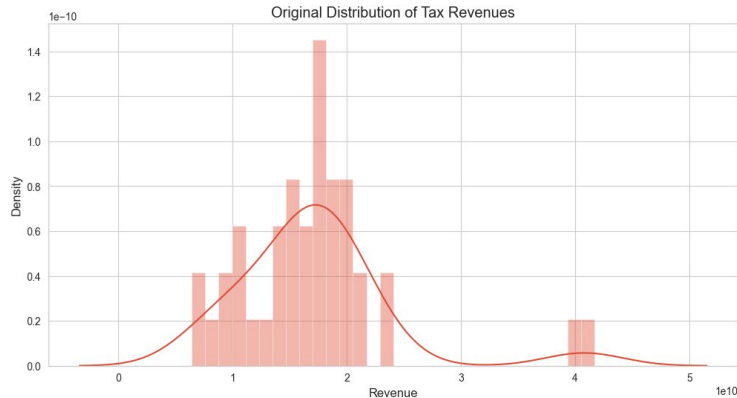
Model Training with Prophet

Initialized and trained the Prophet model on the transformed data to **capture yearly trend**, and used it to forecast future revenues over a specified period.

Cross-Validation

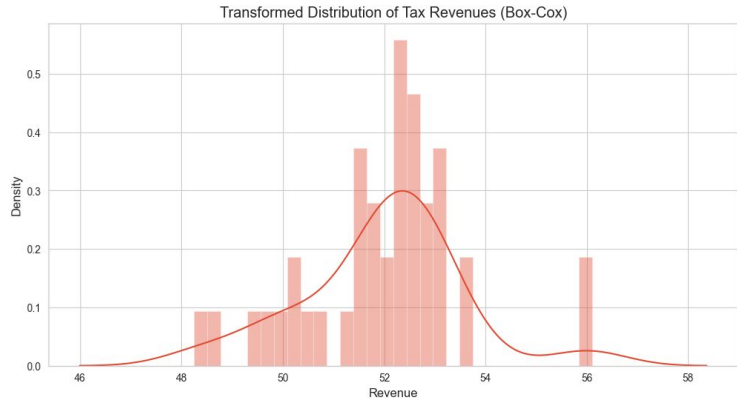
Performed cross-validation by dividing the dataset into multiple training and validation sets, **ensuring robust evaluation of model** performance, and calculated error metrics (MAE, MSE, RMSE) for each fold to assess predictive accuracy.

Prediction Model – Model (Prophet)



Box-Cox Transformation

Improves the performance and accuracy of the forecasting model by addressing issues of heteroscedasticity and non-normality in the time series data.

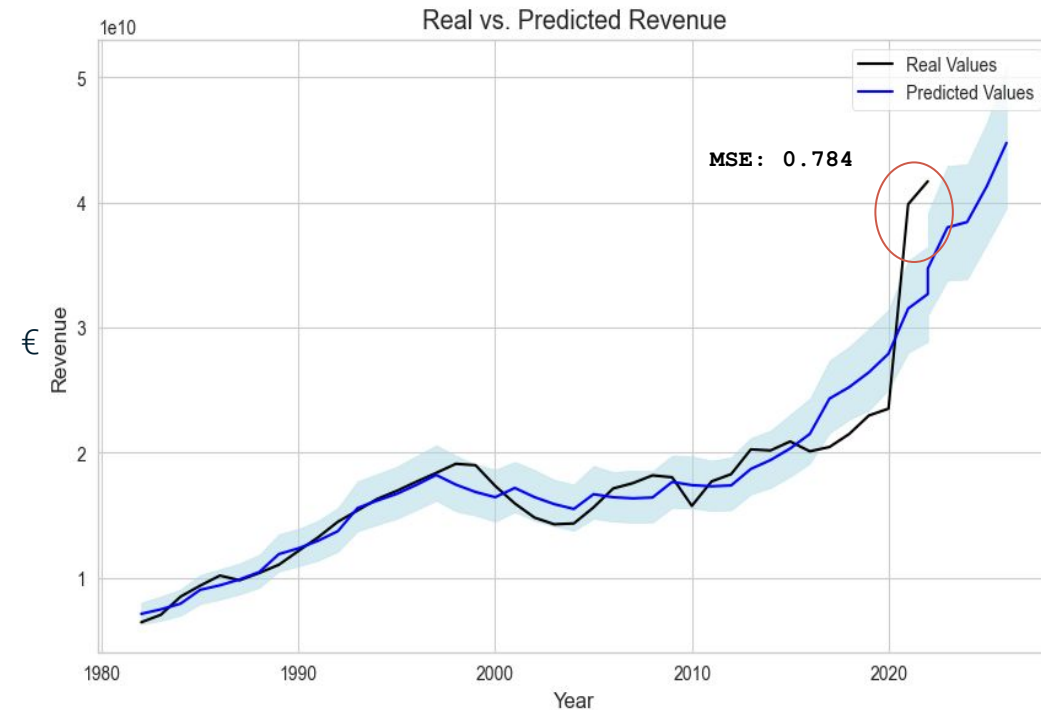


	horizon	mae	mse	rmse
0	363 days	0.269184	0.072460	0.269184
1	364 days	0.030556	0.000934	0.030556
2	728 days	0.204023	0.041626	0.204023
3	729 days	0.212357	0.045096	0.212357
4	1093 days	0.253089	0.064054	0.253089
5	1094 days	0.203115	0.041256	0.203115
6	1458 days	0.026372	0.000695	0.026372
7	1460 days	2.225239	4.951687	2.225239
8	1824 days	0.045941	0.002111	0.045941
9	1825 days	2.351725	5.530612	2.351725

Cross Validation

The cross-validation results indicate that the model **performs well for shorter horizons**, as evidenced by low MAE, MSE, and RMSE values, particularly around the 364-day (1 year) and 1458-day (4 years) marks. However, **the accuracy diminishes significantly for longer horizons**, such as 1460 days (4 years) and 1825 days (5 years), where the error metrics are substantially higher, suggesting potential challenges in long-term predictions.

Prediction Model – Model (Prophet)



Large Increase, not in the confidence interval (95%)

Model Prediction

The plot shows that the predicted revenue values (blue line) closely follow the real revenue values (black line), indicating that the Prophet model **has captured the overall trend** of the data well. The shaded area represents the confidence intervals, suggesting that while the model's predictions are generally accurate, there is some uncertainty, particularly in the long-term forecasts.

Predicting tax revenues for a municipality is **challenging due to frequent changes in reforms and policies**. Notably, in the years 2020, 2021, and 2022, there is a **very large increase in revenues**, which appears anomalous and **breaks the trend**, causing the predictions to **fall outside the confidence threshold**. Despite this anomaly, the model still provides valuable yearly trends, allowing us to imagine future revenues based on these predictions. *Retransforming the data back from the Box-Cox scale to the original scale allows for direct comparison between the real and predicted values*, providing a clear visualization of the model's performance.

Prediction Model – Methodology (XGBoost)



Gradient Boosting (XGBoost)

Data Preparation

Collected and organized yearly municipal tax revenue data into a DataFrame with 'YEAR' and 'REVENUE' columns, filled missing values assuming zero rates, and applied the Box-Cox transformation to **stabilize variance and normalize the data**.

Feature Engineering

Created revenue **growth rate features** for each tax type and total revenue by calculating the year-on-year percentage change.

Introduced population growth rate features where applicable, and calculated per capita tax revenue and the ratio of population to tax revenue for each tax type.

Adjusted tax revenues for inflation **using cumulative inflation adjustment factors**, developed economic impact features, and ensured all new features handled potential infinite or NaN values.

Added **lag values for all the revenue tax types to capture temporal dependencies** in the data.

Model Training with Gradient Boosting

Initialized the XGBoost regressor, set up a **parameter grid for hyperparameter tuning**, and employed **TimeSeriesSplit** for proper time-series cross-validation.

Cross-Validation

Performed cross-validation by iterating over the folds created by TimeSeriesSplit, recorded the years included in each training and validation fold, and evaluated model performance using mean squared error (MSE) for each fold.

Identified and printed the top **5 important features for each fold based on feature importance** scores from the XGBoost model, and selected the best hyperparameters based on the lowest validation MSE across all folds.

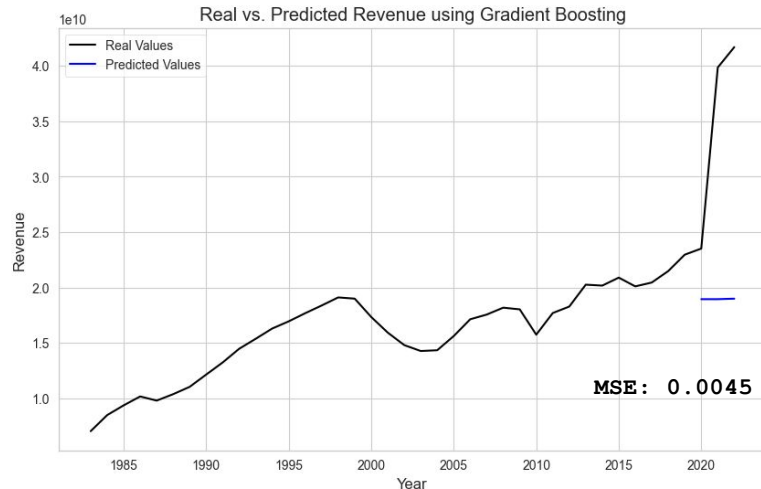
Prediction Model – Model (XGBoost)

Fold 1 MSE: 0.0014311314911017283
Fold 2 MSE: 0.00010856563104150463
Fold 3 MSE: 9.847552448232005e-05
Fold 4 MSE: 0.00023531903460869414
Fold 5 MSE: 0.000535760205701086



Cross Validation

The cross-validation results highlight a **generally strong performance of the model** across different folds, with lower Mean Squared Error (MSE) values observed in most cases. Specifically, the MSE values for Fold 2 (0.0001085656) and Fold 3 (0.0000984755) are quite low, indicating high accuracy. However, there is a noticeable increase in MSE in Fold 5 (0.0005357602), suggesting a **decline in performance for some subsets of the data**. Fold 5 refers to more recent data forecasts.



Model

The plot indicates that the model's predictions **significantly deviate from actual values**, particularly in recent years, suggesting poor performance. This discrepancy likely arises from substantial changes in input features not seen during training and the model's limitations with a small dataset. Consequently, the Gradient Boosting model struggles to generalize and accurately predict these new patterns.

Prediction Model – Comparison

Nature of the model

XGBoost: This is a gradient boosting algorithm that is primarily designed for structured/tabular data. While it can be used for time series forecasting, it treats the problem as a regression task and does not inherently model time-based dependencies unless specifically engineered to do so through feature engineering (like lag variables, rolling windows, etc.).

Prophet: Developed by Facebook, Prophet is specifically tailored for time series forecasting. It automatically models multiple seasonality patterns and trends in the data, which are common in time series, without the need for extensive manual feature engineering.

Trend Components

Prophet: It decomposes the time series into trend, seasonality, and holiday effects, directly incorporating these components into its model. This makes it robust to changes in trend and seasonal shifts.

XGBoost: Lacks this decomposition and would require separate modeling or feature inclusion to handle trends and changes in trends effectively.

Metrics

Prophet: Compared to cross-validation results Prophet performs well in future forecasting.
MSE (on real values) : 5.669354176993579e+19

XGBoost: On the contrary, the XGBoost model totally fails.
MSE (on real values) : 2.987562044099888e+20

Conclusion



The analysis reveals strong fiscal growth in French municipalities over the past two decades, marked by a significant **increase in growth tax revenue** and a **shift towards property taxes**. The abolition of the Professional Tax in 2010 led to a substantial revenue drop, partially mitigated by the introduction of the CET. Recent anomalies in revenue predictions underscore the challenges of forecasting amidst policy changes. **The introduction of the taxe d'habitation in 2023 further complicates the fiscal landscape.**

Insights

The reliance on **property taxes** has intensified, compensating for declines in other tax sources. The **strong correlation between population size and tax revenue highlights the importance of attracting and retaining residents**. The challenges posed by policy shifts, such as the abolition of the Professional Tax, emphasize the need for adaptive financial strategies and diversity in revenues with some arbitration and **risk analysis**.

Recommendations

&

Assumptions

Municipalities should diversify their revenue sources beyond property taxes and implement strategies to stimulate population growth. **An expanding population will increase the demand for housing, thereby boosting property values and, in turn, enhancing property tax revenues.** This creates a positive feedback loop, where increased population supports higher revenue, which can be reinvested to further attract residents.

Appendix – Column Mapping

```
{'POPULATION': ['POPULATION TOTALE (MUNICIPALE ET COMPTEE A PART) – Source saisies application FDL'],
'TH_REVENUE': ['TH – SOMME DES ALLOCATIONS COMPENSATRICES / COMMUNE',
'TH – COMMUNE / MONTANT REEL COMMUNAL AU PROFIT DE LA COMMUNE',
'TH – MONTANT REEL DE LA MAJORATION DES RESIDENCES SECONDAIRES',
'TH – Allocation compensatrice TH suppression THLV suite à passage à TLV – COMMUNE'],
'TH_SYNDICAT': ['TH – SYNDICATS ET ORG. ASSIMILES / MONTANT REEL',
'TH – SYNDICATS ET ORG. ASSIMILES / PRODUIT REEL DES LOCAUX VACANTS'],
'TAFNB_REVENUE': ['TAFNB – COMMUNE / MONTANT REEL NET'],
'FB_REVENUE': ['FB – SOMME DES ALLOCATIONS COMPENSATRICES / COMMUNE',
'FB – COMMUNE / MONTANT REEL'],
'FB_SYNDICAT': ['FB – Dotation abattement 50% VL EI (de droit) – total syndicat / Commune',
'FB – SYNDICATS ET ORG. ASSIMILES / MONTANT REEL'],
'TEOM_REVENUE': ['FB – TAXE D'ENLEVEMENT D'O.M. / TOTAL – MONTANT REEL'],
'TEOM_SYNDICAT': ['FB – TAXE INCITATIVE ENLEVEMENT DES ORDURES MENAGERES / MONTANT REEL / SYNDICAT'],
'FNB_REVENUE': ['FNB – COMMUNE / MONTANT REEL',
'FNB – SOMME DES ALLOCATIONS COMPENSATRICES / COMMUNE'],
'FNB_SYNDICAT': ['FNB – SYNDICATS ET ORG. ASSIMILES / MONTANT REEL'],
'CFE_REVENUE': ['CFE – COMMUNE / PRODUIT REEL NET',
'Part de CVAE au profit de la commune',
'CFE – SOMME DES ALLOCATIONS COMPENSATRICES / COMMUNE'],
'CFE_SYNDICAT': ['CFE – SYNDICATS ET ORG. ASSIMILES / PRODUIT REEL NET',
'CFE – Dotation abattement 50% VL EI (de droit) – total syndicat / Commune'],
'TASCOM_REVENUE': ['TASCOM au profit de la commune'],
'DCRTP_REVENUE': ['DCRTP / Commune'],
'TVA_REVENUE': ['Fraction TVA / Commune'],
'IFER_REVENUE': ['IFER TOTALE / COMMUNE'],
'FB_RATE': ['FB – COMMUNE / TAUX NET'],
'FNB_RATE': ['FNB – COMMUNE / TAUX VOTE'],
'CFE_RATE': ['CFE – COMMUNE / TAUX NET'],
'TAFNB_RATE': ['TAFNB – COMMUNE / TAUX NET'],
'TH_RATE': ['TH – COMMUNE / TAUX NET'],
'TEOM_RATE': ['FB – TAXE D'ENLEVEMENT O.M. / TAUX PLEIN – TAUX NET'],
'YEAR': ['ANNEE'],
'COMMUNE': ['COMMUNE'],
'DEPARTEMENT': ['DEPARTEMENT'],
'LIB_COM': ['Libellé commune'],
'LIB_DEP': ['LIBELLE DEPARTEMENT'],
'TEOM_BOOL': ['Bénéficiaire de la TEOM (C, I, P ou S)']}]
```

Appendix – Links to help you understand the challenge

Statistics per Regions:

<https://www.impots.gouv.fr/statistiques-impots-locaux>

Municipality Tax Rates:

<https://www.journaldunet.com/economie/impots>

Professional Municipality Tax:

<https://www.impots.gouv.fr/dgfip-statistiques-les-impots-locaux-des-professionnels-en-2023>

Municipality Tax list:

<https://www.collectivites-locales.gouv.fr/finances-locales/liste-des-taxes-et-impots-directs-locaux>