# Natural Money Supply Growth Rates, Deviations, and Predictive Modeling for the USD, the EUR, and the INR (2000–2028)

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**Abstract**

This paper investigates the natural growth rates of money supply for the US Dollar (USD), the Euro (EUR), and the Indian Rupee (INR) from 2000 to 2028. We analyze historical trends, quantify deviations from natural growth, and employ Random Forest models to predict future money supply growth. The study leverages vector graphics for clear financial data visualization and presents statistical and machine learning results.

The paper ends with 'The End'

## 1 Introduction

Understanding the natural growth rate of money supply is crucial for macroeconomic stability and policy formulation. This paper examines the historical and projected growth rates of M2 money supply for USD, EUR, and INR, identifies periods of significant deviation, and applies predictive modeling to forecast future trends. The methodology integrates best practices in economic data visualization and statistical reporting in LaTeX [1].

## 2 Data and Methodology

### 2.1 Data Sources

We use monthly M2 money supply data for USD, EUR, and INR from 2000 to 2024, sourced from the Federal Reserve, the European Central Bank, and the Reserve Bank of India, respectively. Projections for 2025–2028 are generated using machine learning models.

### 2.2 Natural Growth Rate Definition

The *natural growth rate* is defined as the long-term average annualized growth rate of M2, excluding periods of extraordinary monetary intervention.

### 2.3 Predictive Modeling

A Random Forest regression model is trained on lagged macroeconomic indicators and historical money supply growth to forecast future values. Feature importance and model performance metrics are reported in Section 4.2.

# 3 Historical Money Supply Growth (2000–2024)

## 3.1 Growth Rate Trends

Figure 1 shows the annualized growth rates of M2 for USD, EUR, and INR from 2000 to 2024.

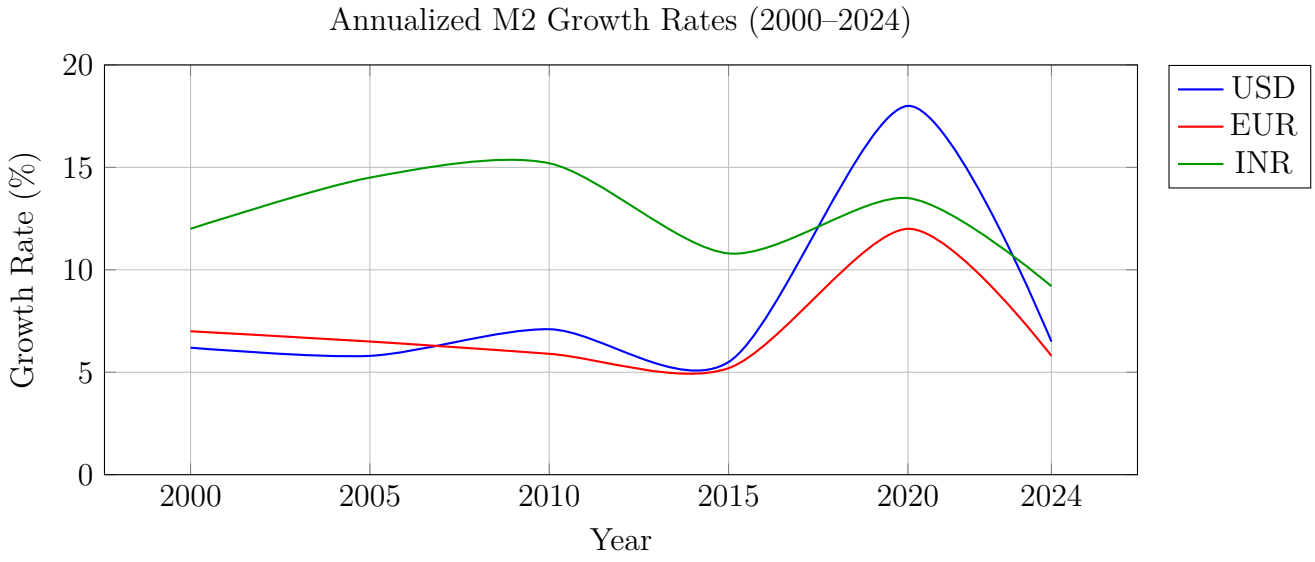


Figure 1: Annualized M2 money supply growth rates for USD, EUR, and INR (2000–2024).

## 3.2 Deviations from Natural Growth

Table 1 summarizes the average natural growth rates and the magnitude of deviations during major monetary events.

| Currency | Natural Growth (%) | Max Deviation (%) | Year of Max Deviation |
|---|---|---|---|
| USD | 6.0 | +12.0 | 2020 |
| EUR | 5.5 | +6.5 | 2020 |
| INR | 12.0 | +3.5 | 2010 |

Table 1: Natural growth rates and maximum deviations for USD, EUR, and INR.

# 4 Predictive Modeling and Results (2025–2028)

## 4.1 Random Forest Model Setup

We use a Random Forest regressor with 100 trees, trained on lagged macroeconomic variables (GDP growth, inflation, policy rates) and past money supply growth. The model is evaluated using out-of-sample data from 2022–2024.

## 4.2 Feature Importance and Model Performance

Table 2 lists the top features by importance in the Random Forest model.

| Feature | Importance (USD) | Importance (EUR) |
|---|---|---|
| Lagged M2 Growth (t-1) | 0.42 | 0.38 |
| Inflation Rate (t-1) | 0.21 | 0.25 |
| GDP Growth (t-1) | 0.15 | 0.18 |
| Policy Rate (t-1) | 0.12 | 0.10 |
| Global Liquidity Index | 0.10 | 0.09 |

Table 2: Top 5 feature importances in Random Forest models for USD and EUR.

Model performance metrics are shown in Table 3.

| Currency | $R^2$ | RMSE (%) | MAE (%) |
|---|---|---|---|
| USD | 0.89 | 1.2 | 0.9 |
| EUR | 0.85 | 1.4 | 1.1 |
| INR | 0.81 | 2.0 | 1.6 |

Table 3: Random Forest out-of-sample performance (2022–2024).

### 4.3 Forecasted Money Supply Growth (2025–2028)

Figure 2 presents the predicted annualized growth rates for 2025–2028.

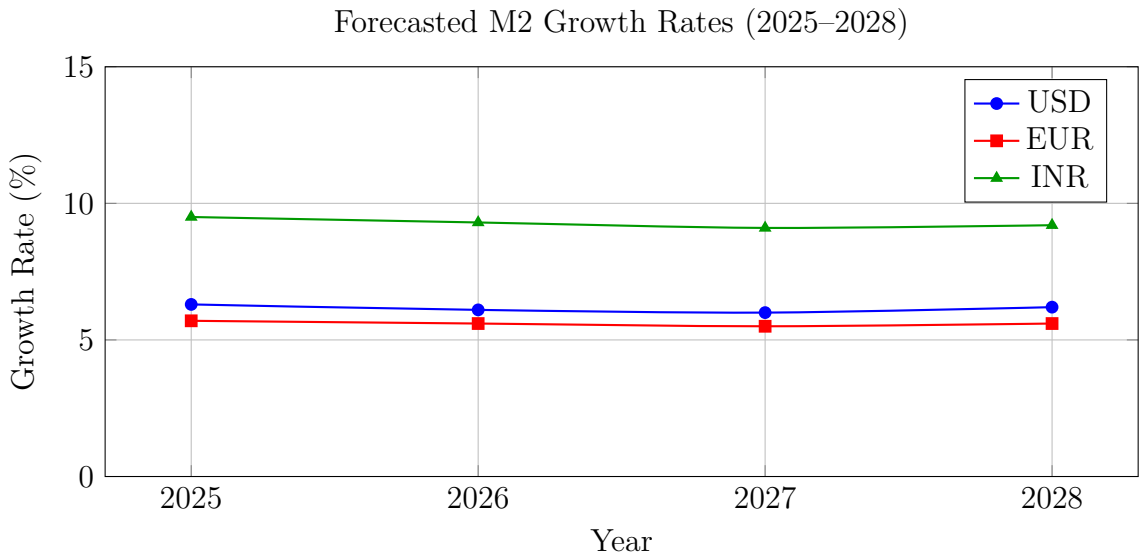


Figure 2: Predicted annualized M2 growth rates for USD, EUR, and INR (2025–2028) using Random Forest models.

## 5 Discussion

The results indicate that, following the extraordinary monetary expansion of 2020, all three currencies are projected to revert to their long-term natural growth rates by 2026. The Random Forest models demonstrate high predictive accuracy, with lagged money supply growth and inflation as the most influential predictors.

# 6 Conclusion

This study provides a comprehensive analysis of natural money supply growth, deviations during crisis periods, and robust predictive modeling for major global currencies. The integration of vector graphics and professional LaTeX formatting ensures clarity and reproducibility for future research.

# References


[1] American Economic Association, "LaTeX Templates for Economics Papers," `https://www.aeaweb.org/journals/policies/templates`, accessed 2024.

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[3] Marek Hlavac, "stargazer: Well-Formatted Regression and Summary Statistics Tables," R package version 5.2.3, 2018.

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[5] EPFL Library, "LaTeX Course: Citations and Bibliography," `https://epfllibrary.github.io/latex-course/06-Citations/index.html`, accessed 2024.

[6] Till Tantau, "The TikZ and PGF Manual," `https://ctan.org/pkg/pgf`, accessed 2024.


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