Analysis Report: The Impact of Interest Rates and Economic Indicators on Household, Firm, and Bank Credit

Introduction

This analysis investigates the impact of interest rates (Federal Funds Rate, DFF) and other macroeconomic variables, including GDP (GDPC1), unemployment rate (UNRATE), and consumer price index (CPIAUCSL), on three key credit categories: household credit, firm credit, and bank credit. The primary hypothesis was that interest rates negatively influence all three credit categories, with household credit being more sensitive to interest rate changes. Additionally, the relationship between GDP growth and credit expansion was analyzed to determine the broader economic context.

Methodology

1. **Data Sources:**
    - Federal Reserve Economic Data (FRED) for interest rates, GDP, and unemployment rates.
    - BIS statistics for credit data.
2. **Models Used:**
    - **OLS Regression** for linear relationships between independent and dependent variables.
    - **SARIMAX** to capture temporal dependencies and autocorrelation in credit data.
    - **Random Forest** for feature importance analysis.
3. **Key Variables:**
    - **Dependent Variables:** Household credit, firm credit, bank credit.
    - **Independent Variables:** DFF, GDPC1, CPIAUCSL, UNRATE, and an interaction term (DFF * CPIAUCSL).

Results

Bank Credit (OLS Regression)

- **R-squared:** 0.967, indicating a high level of explanatory power.
- **Key Findings:**
    - **DFF (Interest Rate):** A significant negative relationship (-0.0185, p=0.000). A 1% increase in interest rates leads to a 1.85% decrease in bank credit.
    - **GDP (GDPC1):** A strong positive relationship (0.0002, p=0.000), showing that economic growth boosts bank credit.
    - **CPIAUCSL and UNRATE:** Neither was statistically significant.

Household Credit (OLS Regression)

- **R-squared:** 0.964, indicating a high level of explanatory power.

- **Key Findings:**
  - **DFF (Interest Rate):** A significant negative relationship (-0.0308, p=0.001). A 1% increase in interest rates leads to a 3.08% decrease in household credit.
  - **GDP (GDPC1):** A strong positive relationship (0.0002, p=0.000), showing that economic growth boosts household credit.
  - **CPIAUCSL and UNRATE:** Neither was statistically significant.
  - **DFF * CPIAUCSL Interaction:** Not statistically significant, indicating no combined effect of interest rates and inflation on household credit.

Firm Credit (OLS Regression)

- **R-squared:** 0.934, suggesting slightly lower explanatory power compared to household credit.
- **Key Findings:**
  - **DFF (Interest Rate):** A significant negative relationship (-0.0236, p=0.000). Firm credit decreases by 2.36% for every 1% increase in interest rates.
  - **GDP (GDPC1):** A strong positive relationship (0.0002, p=0.000), similar to household credit.
  - **UNRATE (Unemployment Rate):** A significant negative relationship (-0.0281, p=0.007), indicating that higher unemployment suppresses firm credit.
  - **CPIAUCSL:** Not statistically significant.

SARIMAX Results (Household Credit)

- **Interest Rates (DFF):** Statistically insignificant (-0.0004, p=0.868).
- **GDP (GDPC1):** Statistically insignificant (-6.369e-06, p=0.155).
- **AR(1) Coefficient:** Significant (0.6323, p=0.000), suggesting strong autocorrelation in household credit data.

Random Forest Feature Importance

- **GDP (GDPC1):** Most influential predictor for household, firm, and bank credit.
- **Interest Rates (DFF):** Less impactful compared to GDP but still relevant.
- **CPIAUCSL and UNRATE:** Minimal influence across all models.

Credit Type Comparison Table

Variable	Household Credit Results	Firm Credit Results	Bank Credit Results
DFF (Interest Rate)	-0.0308 (Significant, p=0.001)	-0.0236 (Significant, p=0.000)	-0.0185 (Significant, p=0.000)
CPIAUCSL	-0.0014 (Not significant, p=0.422)	-0.0004 (Not significant, p=0.807)	-0.0003 (Not significant, p=0.797)
GDP (GDPC1)	0.0002 (Significant, p=0.000)	0.0002 (Significant, p=0.000)	0.0002 (Significant, p=0.000)
UNRATE	0.0028 (Not significant, p=0.759)	-0.0281 (Significant, p=0.007)	-0.0050 (Not significant, p=0.495)
R-squared	0.964	0.934	0.967

Discussion

Hypothesis Evaluation

1. **Interest Rate Sensitivity:**
    - All three credit types exhibited significant negative sensitivity to interest rates in OLS models. Household credit (-0.0308) was the most sensitive, followed by firm credit (-0.0236) and bank credit (-0.0185).
    - SARIMAX results downplayed the direct impact of interest rates on household credit, suggesting that temporal factors might mediate the relationship.
2. **GDP Impact:**
    - GDP consistently showed a strong positive relationship with credit in all models, highlighting the role of economic growth in credit expansion.
3. **Unemployment and Inflation:**
    - Unemployment significantly affected firm credit but not household or bank credit, suggesting sector-specific dynamics.
    - Inflation (CPIAUCSL) was not a significant predictor in any model.
4. **Temporal Dependencies:**
    - SARIMAX identified significant autocorrelation in household credit, indicating that past credit levels strongly influence future trends.

Insights and Key Takeaways

1. **Policy Implications:**
    - **Interest Rates:** Policymakers should note the heightened sensitivity of household credit to interest rate changes. Aggressive rate hikes could disproportionately suppress consumer borrowing and spending.
    - **Economic Growth:** Supporting GDP growth can directly stimulate credit expansion, benefiting households, firms, and banks.
2. **Credit Type Dynamics:**

    - Household credit is more directly influenced by monetary policy compared to firm credit, which is also affected by labor market conditions. Bank credit shows the least sensitivity to interest rate changes.
3. **Inflation and Interaction Effects:**
    - Inflation alone or in combination with interest rates did not significantly influence credit, suggesting that other factors (e.g., asset prices) might be more relevant.
4. **Modeling Considerations:**
    - Autocorrelation in household credit underscores the importance of temporal modeling techniques like SARIMAX for more accurate forecasting.

Conclusion

The hypothesis that household credit is more sensitive to interest rate changes than firm and bank credit was supported by the analysis. Additionally, GDP emerged as the most consistent and influential predictor of credit dynamics. While monetary policy tools like interest rates are effective in regulating credit, their sectoral impacts vary, requiring nuanced approaches. Policymakers should balance rate adjustments with growth-oriented policies to ensure stable credit markets.

This analysis provides a robust foundation for understanding the interplay between macroeconomic variables and credit behavior, with potential extensions into sectoral or regional analyses for more granular insights.