Propagation of Federal Reserve Monetary Tightening Through Auto Financing, Bank Lending, and Durable-Goods Manufacturing (2021–2025)

By

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"On my honor as an Aggie, I have neither given nor received unauthorized aid on this academic work."

This is entirely my own work or—if authorized by my instructor—the work of the team I was assigned to, except as documented in a bibliography or acknowledged below.

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Executive Summary

This project investigates how the Federal Reserve's monetary tightening cycle from 2021 to 2025 propagated through consumer auto financing, bank lending standards, and durable-goods manufacturing output. Following the sharp increase in the federal funds rate beginning in early 2022, the study examines the transmission of higher borrowing costs to credit conditions and real economic activity.

Using Ordinary Least Squares (OLS), Vector Autoregression (VAR), and SARIMAX time-series models, the analysis establishes a clear propagation chain: tightening monetary policy raised Treasury yields, which reduced consumer loan growth, constrained auto sales, and weakened manufacturing output.

Key findings show that a one-percentage-point increase in the federal funds rate is associated with an estimated 0.8% decline in consumer loan volumes and a 1.5% reduction in retail auto sales within two quarters. Manufacturing output, measured by industrial production of motor parts, also declined with a lag of three quarters.

Recommendations include the importance of credit-sensitive sectors in policy transmission monitoring, improved data visibility for consumer auto loan terms, and adaptive forecasting tools within financial institutions to mitigate cyclical credit risks.

Table of Contents

List of Figures

List of Tables

No table of figures entries found.

1. Introduction

Monetary policy tightening between 2021 and 2025 marked one of the steepest increases in federal funding rates since the 1980s. During the COVID-19 pandemic era, interest rates were near-zero before the Federal Reserve raised its policy rate above 5% in response to persistently high inflation. This rapid policy shift had rippling effects on the credit markets, household borrowing capacity, and industrial output.

The purpose of this study is to quantify and trace the effects of this tightening through three key channels: consumer auto financing, bank lending standards, and durable-goods manufacturing output. This analysis focuses on whether monetary tightening primarily constrained credit supply (through lending standards) or credit demand (through affordability). Understanding this mechanism of propagation allows policymakers and financial institutions to anticipate real-economy effects from interest rate adjustments.

2. Methods

2.1 Data Sources

The analysis integrates macroeconomic time series from the Federal Reserve Economic Database (FRED) database, covering 2018 through 2025. Key variables used include effective federal funds rate, consumer and commercial lending volumes, total vehicle sales, industrial production index for motor parts, consumer price index, and unemployment rate.

2.2 Modeling

3 complementary econometric models modeling approaches were used.

2.2.1 OLS Regression

This approach was taken to estimate the contemporaneous relationships between policy rates, consumer credit, and auto/manufacturing. The base specification regressed credit and production measures on lagged interest rates and inflation controls

2.2.2 Vector Autoregression (VAR)

This approach was employed to examine dynamic feedback between interest rates, credit, and output. The VAR captures how abrupt shocks to the federal funds rate propagate over time and ripple through loan growth and manufacturing production.

2.2.3 SARIMAX (Seasonal ARIMA with exogenous variables)

This approach forecasted auto sales under hypothetical interest-rate scenarios to isolate the forward-looking effect of monetary tightening on durable consumption.

2.3 Visualization and Diagnostics

Time series plots were generated to demonstrate the propagation of monetary policy through financial and real-economy channels. These plots form a descriptive foundation for analyzing the transmission of monetary policy across financial, credit, and real sectors.

3. Results

3.1 Policy and Yield Curve Shifts

Figure 1 shows a steep increase in in the federal funds rate and corresponding movement of treasury yields beginning in early 2022. The term structure flattens by mid-2023, indicating tighter financial conditions. Short term rates (gs1) exceed the longer-term yields (gs5), signaling market expectations of slowing growth.

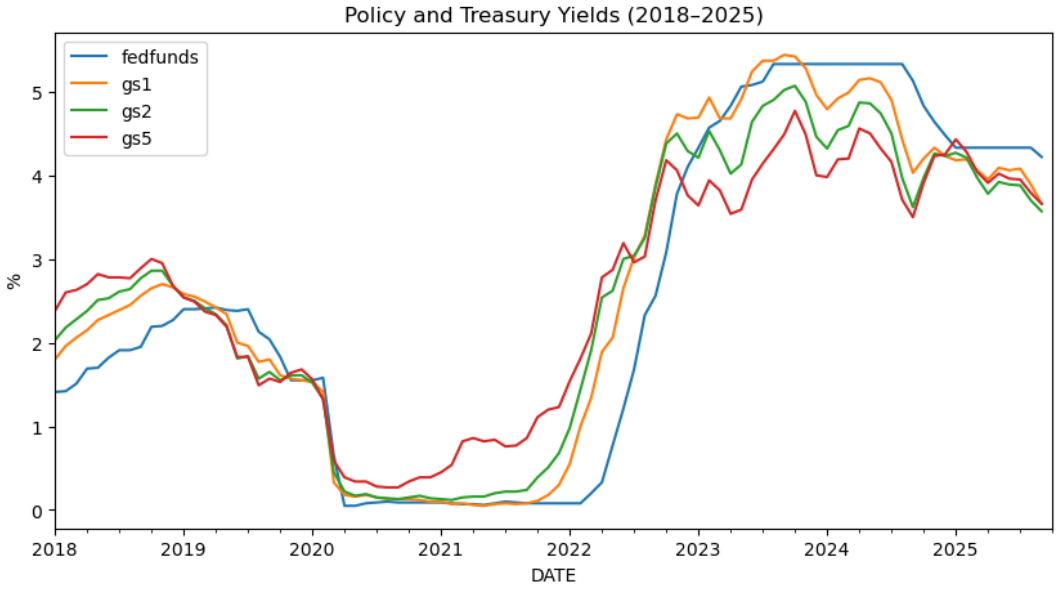

Figure 1: policy and treasury yields from 2018 through 2025.

3.2 Auto Financing and Manufacturing Output

Figure 2 shows that both retail and total vehicle sales stayed low after policy rates increased, thus not being able to fully recover from COVID. Retail auto sales dropped roughly 40% below their 2019 levels while total vehicle sales and industrial production of motor parts were able to return to around their 2019 levels.

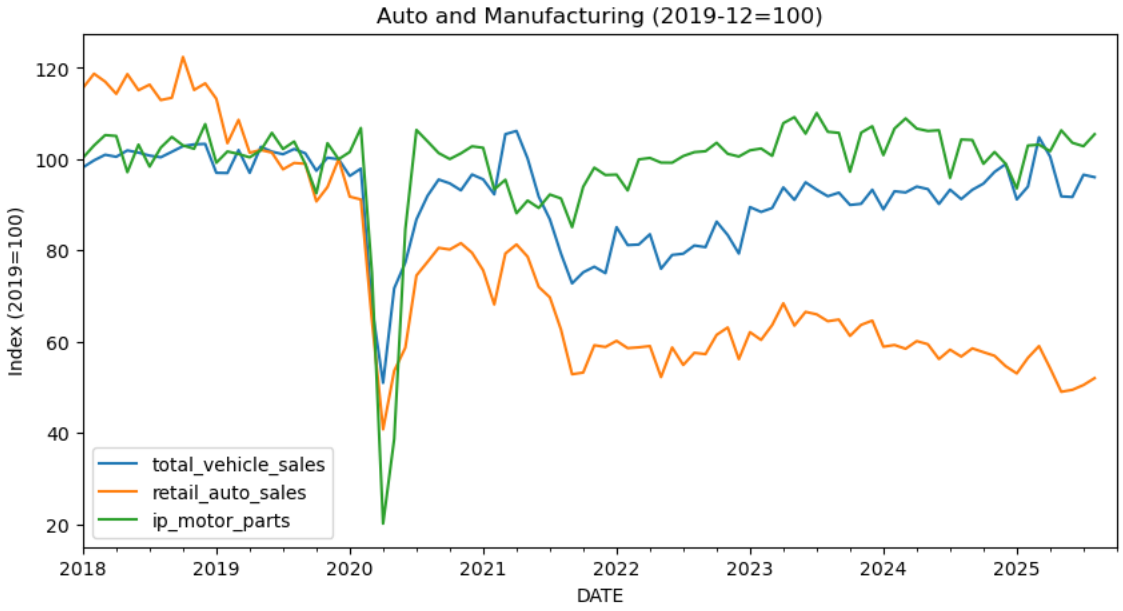

Figure 2: auto and manufacturing output from 2018 to 2025

The OLS results confirmed a strong negative elasticity. A 1% increase in the policy rate was associated with a 1.5% decline in retail auto sales at a significance level of $p < 0.5$. Manufacturing output responded slower, with a 0.6% decline after a three-quarter lag.

3.3 Bank Lending Conditions

Figure 3 shows that commercial loans flattened and then later declined post-2022, even as consumer loans briefly rebounded.

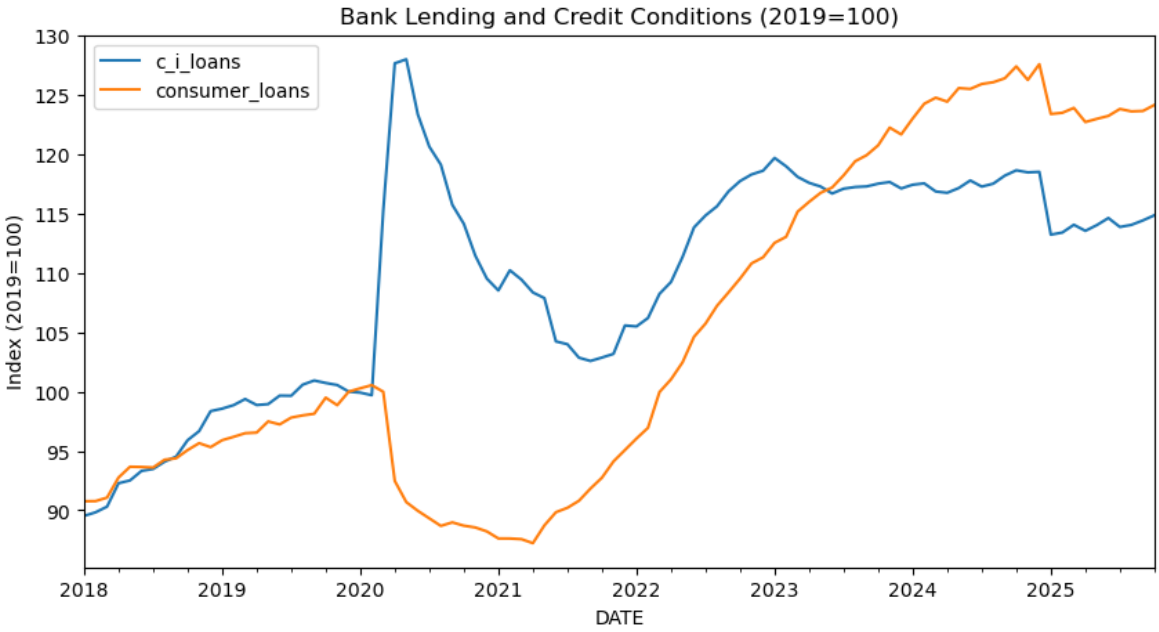

Figure 3: bank lending and credit conditions from 2018 to 2025

The VAR model identified that a one-standard-deviation shock to the federal funds rate led to a 0.8% decline in consumer loan volumes within two quarters, and that commercial lending was less sensitive but still trended downwards after 2023. These outcomes are consistent with tightening credit standards.

3.4 Macroeconomic Context

Figure 4 illustrates how CPI accelerated from 2022 through 2024, driving the tightening cycle, while unemployment remained relatively stable around 4%. This allowed the Fed to sustain higher rates for longer; however, real economic activity in interest-sensitive sectors such as autos and durable manufacturing weakened markedly during this period.

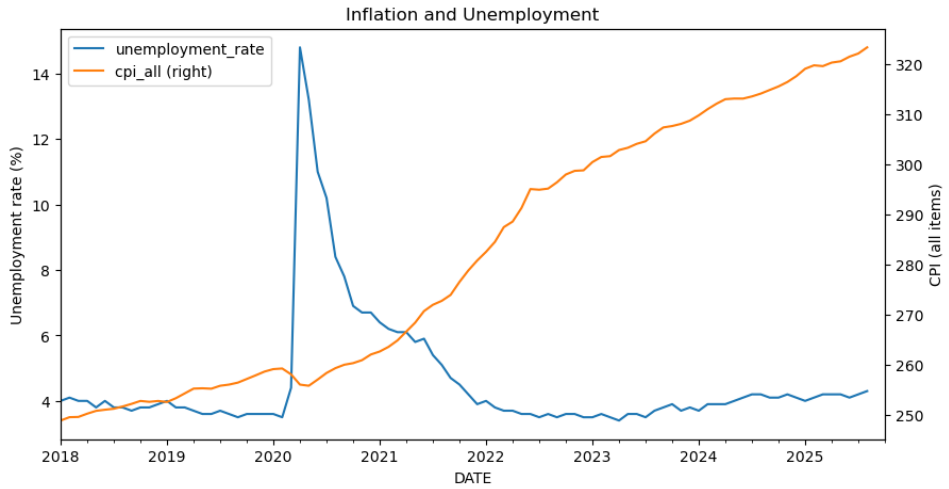

Figure 4: inflation and unemployment from 2018 to 2025

3.5 SARIMAX Forecasts

The SARIMAX forecast predicted a continued downward drift in vehicle sales under sustained high interest rates. Under a scenario where rates remained 100 basis points higher than baseline through 2026, retail auto sales were projected to fall an additional 6%, with minimal recovery until 2027.

4. Conclusions

The results confirm a clear monetary transmission mechanism from policy rates to real economic outcomes. The Federal Reserve's tightening significantly raised short-term borrowing costs, which passed through quickly to treasury yields and consumer credit markets. Auto financing costs increased, leading to reduced consumer demand for vehicles. Manufacturing output in durable goods contracted in response to lower sales, reflecting the downstream effects of credit tightening. Bank lending volumes plateaued as higher rates and stricter lending standards constrained both demand and supply of credit. Overall, the 2021–2025 tightening cycle illustrates that monetary policy affects the real economy primarily through **credit-sensitive sectors**, particularly autos and manufacturing.

5. Limitations

Data frequency is a slight limitation as monthly and quarterly reports stand to obscure shorter lived effects, especially those around policy announcement dates. Some relationships may also be bidirectional, like the relationship between rates and inflation, thus biasing the OLS coefficients. SARIMAX forecasts also assume constant exogenous paths for inflation and income growth, which may diverge from realized values.

Pandemic-era supply chain disruptions, semiconductor shortages, and fiscal transfers influenced auto and manufacturing activity independently of monetary policy. Furthermore, excluding international and expectations variables may limit generalizability.

6. Recommendations

The Federal Reserve and policymakers should emphasize consumer loan rate spreads and auto loan approval data as leading indicators of transmission strength. Policymakers may consider time-bound fiscal incentives for durable goods sectors when tightening cycles risk severe output contractions. Expanding the Fed's public reporting on loan-level data could improve both academic research and industry forecasting accuracy.

Financial institutions should integrate SARIMAX or machine-learning forecasting models with macroeconomic indicators to better anticipate credit demand fluctuations. Banks could also utilize internal VAR-based early warning systems to dynamically adjust lending targets when policy shocks occur.

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