Strategy Report

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1 Standardisation Methodology

1. **Consistent Date Frequency:** All dates in the dataset were cleaned and represented on a monthly basis with the same range maintained across different sources. When a date was repeated multiple times in the same month of a year, the latest date was chosen.
2. **Unified Time Index:** Every source table was aligned to a common DateTimeIndex in month-end format.
3. **Snake Case Column Names:** All column names were converted to snake case format, with lowercase letters and spaces replaced by hyphens.
4. **Unit Harmonisation:** Percentage rates were maintained as numeric percent values instead of actual numeric values (e.g., 5% is represented as 5 instead of 0.05).
5. **Missing Value Treatment:**
   - *For Policy Rates:* NaN values were forward filled until updates by RBI were mentioned in the dataset.
   - *For SDF:* Since SDF was only introduced from 2022 onwards: (a) A binary flag "sdf_active" was created to show 0 or 1 if SDF was active or not. (b) A column named "sdf_filled" was created with 0s filled before it began and the actual values from 2022 onwards.

2 Predictive Variables for Stock Return

Eight economic indicators were selected to capture real-life demand, financial conditions, and effects of monetary policy changes:

Variable	Description	Intuition
YoY Sales	12-month % change in national auto sales	Rising sales signal stronger end-market demand which leads to higher revenue expectations and positive stock reaction.
Lag-1 YoY Sales	Previous month's YoY sales	Captures delayed price response when demand data are digested slowly or released mid-month.
Real Repo Rate	Nominal repo – CPI Combined inflation	Measures the true cost of capital; a lower real rate makes auto financing cheaper, boosting volume and margins.
Lag-3 Real Repo	Real repo three months earlier	Measures the true cost of capital; a lower real rate makes auto financing cheaper, boosting volume and margins.
Policy Surprise	Month-to-month change in the repo rate	Positive jumps often tighten liquidity and depress cyclical stocks; negative jumps do the opposite.
Liquidity Corridor Width	MSF – Repo Rate	Wider corridor implies looser liquidity and greater bank lending appetite—generally supportive for cyclicals like autos.
SDF Regime Flag	Binary: 0 before April-2022 and 1 after	Captures the structural shift when the Standing Deposit Facility replaced Reverse Repo as the floor rate.
Effective SDF Rate	SDF Regime Flag × Actual SDF Value	Introduces the actual SDF rate only once the facility exists; models its direct influence on short-term funding costs.

3 Statistical Test Results

Statistical analysis was conducted with detailed graphs in technical_assessment.ipynb:

1. **Static Pearson Correlations:** Corridor shows strongest positive correlation with next-month returns (+0.21). YoY_sales and Lag-1 YoY Sales are most negative (≈ –0.26 / –0.24), suggesting contrarian behaviour.

2. **Granger-Causality Tests (lags 1-4):** YoY_sales and Lag-1 YoY Sales Granger-cause returns at lag 1 ($p \approx 0.04$), indicating demand data contain predictive information.
3. **Rolling 24-Month Correlations:** From 2022 onward, real repo and corridor climb above +0.25 and remain positive; policy stance became a reliable pro-cyclical driver. YoY Sales & Lag-1 YoY Sales remain stably negative (–0.15 to –0.35).
4. **Cross-Correlation Function (CCF) Tests:** Additional CCF analysis performed with graphs in the ipynb file.

4 Signal Selection

Three primary signals selected based on comprehensive statistical analysis:

1. **Liquidity-Corridor Width:** Largest positive static correlation with next-month return (+0.21) and rolling-24-month ρ ¿ +0.25 after 2022.
2. **Lag-1 YoY Auto-Sales:** Strong negative correlation ($\approx$ –0.24) and Granger-causal at lag 1 ($p \approx 0.04$).
3. **Policy Surprise:** Cross-correlation analysis reveals repo cuts lead positive returns by $\approx$ 2–4 months; hikes lead negatives. Static $\rho \approx$ –0.16 confirms direction.

These three variables—liquidity stance, contrarian demand pulse, and discrete policy shocks—collectively explain the bulk of statistically significant relationships, making them the most defensible predictors for Tata Motors' returns.

5 Model Deployment

Two regression models were tested and compared:

Model	R^2	RMSE
RidgeCV	0.63	144
Gradient Boosting Regressor (GBR)	0.66	138

Extension to stock-return prediction: The same macro drivers—liquidity stance (Corridor and Real Repo) and demand pulse (Lag-1 YoY Sales)—affect valuation multiples and earnings revisions; they are therefore reused (at daily frequency) in the trading-signal blend of the coding challenge.

6 Fundamental Validation

1. **Corridor (MSF − Repo):** Looser liquidity ↓ financing costs ↑ dealer credit, supports EBIT margins.
2. **YoY Sales Lag-1:** Falling sales ↓ utilisation & pricing power ⇒ squeezes next-quarter margins (model's dominant weight).
3. **Δ Repo (Surprise):** Cuts ease loan/interest burden which widen margins; no recent shock neutral impact.

Model forecasts next-quarter EBIT margin 1.5%, down $\approx$ 4 ppts from the last reported 5.9%, driven chiefly by the weak lagged-sales signal.