I created an OLS regression model to forecast non-vehicle core goods inflation (m/m NSA) for August 2025 utilizing Adobe Digital Price Index (ADPI) MoM Topline Inflation as an estimate for month over month percent change in core goods prices excluding vehicles. The index scrapes prices across the internet for 18 categories of goods. The following is the model:

$$\Delta\pi_t = \alpha + \beta_1\Delta\pi_{t-1} + \beta_2\Delta\pi_{t-2} + \beta_3\Delta\pi_{t-3} + \beta_4 FedFunds_{t-6} + \beta_5 Unem_{t-3} + \beta_6 prod_{t-1} + \beta_7\Delta FedFunds_{t-3} + \gamma_{m(t)} + \epsilon_t$$

Where,

- $\Delta\pi_t$: m/m change in ADPI topline inflation in period t
- $\Delta\pi_{t-k}$ : k-month lag of m/m ADPI topline inflation
- $FedFunds_{t-6}$ : the fed funds rate 6 months ago (this allows time for the monetary transmission mechanism to work through the economy)
- $Unem_{t-3}$ : the unemployment rate 3 months ago (consumers gradually adjust demand as unemployment environment changes)
- $prod_{t-1}$ : industrial production one month ago (changes in supply work quickly)
- $\Delta FedFunds_{t-3}$ : a change in the fed funds rate, lagged 3 months (captures sentiments)
- $\gamma_{m(t)}$ : month fixed effects for the calendar month of t (captures seasonal patterns in inflation)
- $\alpha$ : intercept
- $\epsilon_t$ : error term

The data are from January 2020 through July 2025 (the latest date available from Adobe). My one-month ahead forecast for non-vehicle core goods (m/m NSA) is the following:

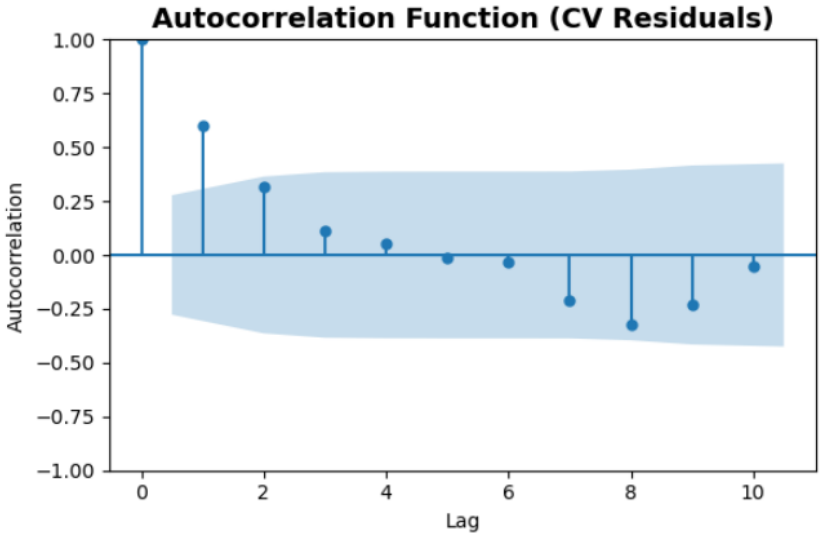
```
================================================
August 2025 Forecast (OLS Final Model):
  Prediction: 0.58%
  95% Prediction Interval: [-0.93%, 2.10%]
  Direction: UP ⬆️

Model trained on: 61 observations
RMSE estimate: 0.7734% (from 85/15 validation)
================================================
```

I performed a sanity check to reassure that my forecast is reasonable by constructing my own estimate of non-vehicle core goods using actual BLS data for the month of August. I used BLS CPI index for all commodities less food and energy and the CPI index for new and used vehicles as well as their respective CPI relative importance weights to try and backout the measure of interest. This method implies that actual change in non-vehicle core goods (m/m NSA) for August 2025 was 0.54%.

**Statistical Checks**

I calculated the mean error using a walk-forward validation (the time-series equivalent of cross-validation) and found a mean error of 0.26%. This suggests that the model is approximately unbiased, as the mean error is near the ideal value of 0.0. The ACF plot reveals lag-1 autocorrelation in the residuals indicating that the model leaves some predictable patterns in the errors. Thus, the residuals are not white noise, violating the Gauss-Markov assumption of uncorrelated errors.




I tested ARIMAX models (AR(1) and AR(3)) to address this issue. While ARIMAX eliminates autocorrelation, it consistently underperforms in out-of-sample validation (RMSE: 0.92-0.95% vs OLS: 0.77%), suggesting overfitting given the limited sample (n=61). Given the forecasting objective and limited sample size, I prioritized the simpler OLS model for predictive accuracy over satisfying diagnostic assumptions.

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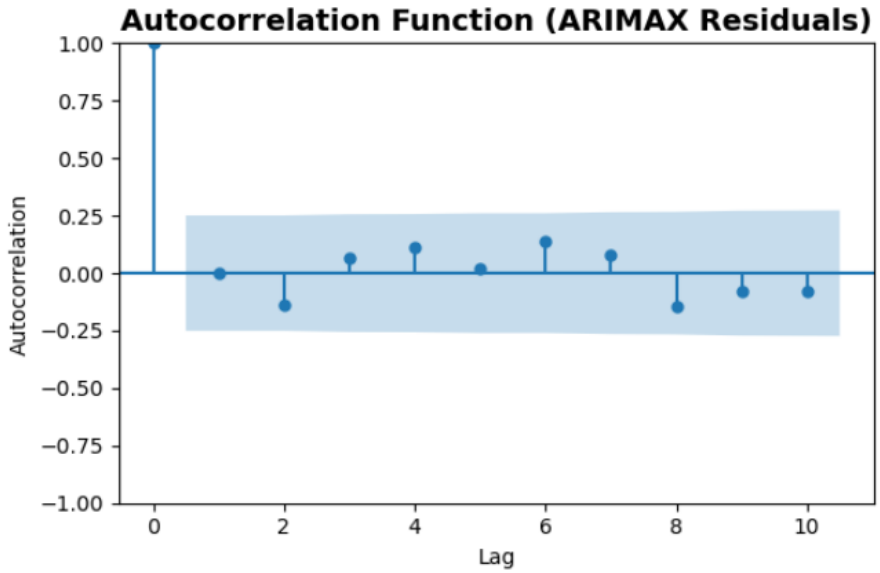
AUGUST 2025 FORECAST (ARIMAX MODEL)
      Prediction: 0.24%
      95% PI: [-0.98%, 1.47%]
      Direction: UP ⬆️

Model Validation:
  • RMSE: 0.92%
  • No autocorrelation (Ljung-Box p > 0.78)
  • Training observations: 61
============================================================
```


Autocorrelation Function (ARIMAX Residuals)
Autocorrelation
Lag
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
−0.75
−1.00
0
2
4
6
8
10