Local Demand Momentum

Using a six-week local trend to respond differently during seasonal acceleration and decline

STUDY QUESTION

Can recent seasonally normalized demand be used to estimate not only the current level, but also the local rate of change?

Executive Summary

A recent rolling mean can adapt to the current demand level, but it tends to lag when demand is changing quickly. The forecasting architecture therefore estimates a local linear trend across the previous six seasonally normalized observations, giving progressively greater influence to the most recent weeks.

This allows the model to react differently during a spring ramp-up than during a late-season decline. The 2026 out-of-time sensitivity check provides useful evidence about where that behavior helped and where a simpler recent-level benchmark adapted faster.

Local Trend Specification

```
L_t = (-4*r[t-6] - r[t-5] + 2*r[t-4] + 5*r[t-3] + 8*r[t-2] + 11*r[t-1]) / 21
```

Endpoint estimate from a local linear trend across the previous six normalized observations.

Why the Weights Matter

The weights increase toward the most recent week. Rather than treating the last six observations as a flat average, the estimator projects the local level at the forecast boundary. This is designed to capture the direction and speed of change in the normalized demand series.

Because the inputs are already divided by the seasonal curve, the local trend is intended to measure current-year momentum rather than simply rediscovering that spring is usually stronger than winter.

Development Evidence

2024 rolling-origin model	MAE	RMSE	Bias	Correlation
Adaptive seasonal K2 + 6-week trend	5.22	7.65	-0.51	0.598
Recent 4-week mean	5.51	7.82	+0.29	0.559
Recent 6-week mean	6.38	8.69	+0.33	0.420

2026 Phase Sensitivity

The 2026 check used an overlap-weighted approximation because the supplied Monday–Sunday target weeks did not match the frozen Jan 1–7, Jan 8–14 calendar used by the model. The phase comparison should therefore be treated as directional rather than definitive.

2026 phase	Adaptive MAE	Recent 4-week MAE	Interpretation
Rising season (W01–W20)	1.27	1.47	Seasonal slope adjustment added value
Declining season (W21–W36)	1.92	1.80	Recent-level baseline adapted slightly faster after peak

MODEL-DEVELOPMENT LESSON

The momentum component appears particularly useful during the rising seasonal ramp, while post-peak decline remains a candidate area for refinement.

Business Interpretation

This component addresses a practical forecasting failure mode: a flat moving average may be accurate when demand is stable but slow when the business is entering or exiting its peak season. Local momentum provides a way to incorporate the rate of change without abandoning the interpretable seasonal structure.

Key Takeaways

Core method	Fit a six-week local trend to seasonally normalized recent demand.
Why it helps	The model can respond to acceleration and decline rather than only the current average level.
Evidence	The adaptive architecture beat recent rolling means in development and performed better during the 2026 rising-season approximation.
Open issue	The recent four-week baseline adapted slightly faster during the 2026 post-peak decline.

Limitations and Next Step

The source evidence evaluates the full adaptive seasonal architecture, not a separately deployed momentum-only model. The six-week window and endpoint trend should therefore remain subject to future revalidation as more annual cycles become available.

A future refinement could test asymmetric or regime-specific adaptation after the seasonal peak, but only if it improves genuine out-of-time forecasts.

Portfolio-Ready Summary

SUGGESTED HEADLINE

Modeling local demand momentum instead of relying on a flat moving average

I estimated a six-week local trend on seasonally normalized demand so the forecast could respond differently when demand was accelerating, peaking, or declining. The approach improved development performance versus rolling averages and showed its strongest relative value during the rising 2026 seasonal ramp, while also revealing a post-peak refinement opportunity.