

DIVE Analysis by DN9 Team

D: Surface Discovery: A strong weekly seasonal pattern emerged, with Sunday achieving the highest average daily sales and Saturday close behind, while Thursday recorded the lowest. This represents a nearly 64% drop in sales from Sunday to Thursday, underscoring weekends as the most critical sales window. Interestingly, Wednesday sees the highest number of promotions (4.09 on average), yet sales remain only moderate. In contrast, weekend days drive higher sales despite fewer promotions. This mismatch suggests that consumer shopping behavior, not promotions usually drive volume, and that aligning promotional activity with peak shopping days could significantly improve returns.

I: Deeper Investigation: Looking into regional and store-type dynamics, differences in promotional effectiveness become apparent. While Pichincha-A leads in raw average sales, locations like Manabi-A and Pastaza-C exhibit strong positive correlations between promotions and sales (e.g., Manabi-A at 0.82). In contrast, Loja-D and Santo Domingo-C show much weaker correlations (<0.3), suggesting less promotional influence in those areas. Shifting promotional campaigns to high-correlation locations could improve campaign efficiency. For example, reallocating 20% of total promotional inventory from low-response areas to top responders like Pastaza-C could drive gains in promoted sales volumes and increase weekly revenue. Sales anomalies, such as those with z-scores above 2.5, typically align with year-end holidays, quarter closings, or notable weekends, reinforcing the importance of calendar-based demand. August 2017 forecasts mirror this seasonal pattern, with weekends again performing well. At the product level, Grocery dominates sales every day of the week, peaking at 4,920 on Sundays. Beverages, produce, cleaning, and dairy also follow a weekend-heavy trend, while a consistent midweek slump appears across most categories. This could be due to paycheck cycles, school schedules, or cultural shopping routines, all hypotheses worth testing to improve promotion strategies.

V: Model Limitations and Risks: The ARIMA model assumes that past sales patterns will persist, not accounting for holidays, weather events, economic shifts, or changes in store operations. It doesn't incorporate holiday or event indicators, and it doesn't account for short-term drivers like promotions or markdowns, which can skew forecasts. Structural changes like store openings, closings, or rebranding are outside the model's current scope. While the overall fit is reasonable, forecast accuracy may decline if future behavior diverges from historic norms. To improve long-term reliability, the model will need ongoing retraining and enrichment with external variables such as weather data, competitor pricing, and promotional calendars.

E: Strategic Recommendations: Here are some strategic recommendations for store managers:

- Align promotions with peak shopping days: Although Wednesdays see the most promotions, reallocating just 15% of those promotions to Sundays or Saturdays when customer traffic is highest could drive an estimated 3–5% uplift in weekend sales.
- Target promotions by location: Focus marketing resources on regions and store types with high promo-sales correlations, such as Manabi-A, Pastaza-C, and Azuay-D. Monitor promo-to-sales conversion rates in these areas to optimize campaign performance.
- Incorporate external and operational datasets: Create a centralized event calendar to flag sales anomalies for review and planning. Augment forecasting models with weather, holiday schedules, staffing levels, inventory data, and delivery timelines to better align labor and supply chain decisions with demand fluctuations.

Action Plan

This action plan operates DIVE insights by outlining potential strategies to improve sales alignment, campaign efficiency, and forecasting with measurable metrics and mitigation plans.

Align Promotions and Inventory with Weekend Demand: Capitalize on weekend sales peaks by aligning inventory and promotions accordingly.

Implementation:

- Increase inventory levels by 20–30% from Friday to Sunday to prevent stockouts
- Shift ~5–10% of promotional offers from weekends to weekdays

Success Metrics:

- Stockout rate reduction on weekends
- Weekend revenue growth (target: $\geq 10\%$ uplift)
- Promo-to-sales conversion rate improvement

Risk Mitigation:

- Conduct weekly inventory audits to match sales trends
- Run A/B tests to measure promotion sensitivity for both weekends and weekdays
- Adjust based on store capacity and supply chain limits

Focus Campaigns on High-Impact Store Types and Regions Increase efficiency of promotional spending by targeting high-response areas.

Implementation:

- Launch regional promotions in stores with promo-sales correlation > 0.8
- Reallocate promotional inventory from low-response types to top performers

Success Metrics:

- Regional promo ROI vs. baseline (Sales lift in targeted stores)
- Conversion rate in high-correlation zones

Risk Mitigation:

- Conduction of regional readiness checks (staff, stock levels)
- Roll out pilot campaigns in phases

Calendar Logging and Forecast Enrichment: Improve future planning by capturing anomalies and incorporating external drivers

Implementation:

- Maintain a product sales log to document sales events (weather, outages, promotions)
- Build and maintain an event calendar with inputs like holidays, staffing, and schedules
- Support model retraining quarterly with updated data

Success Metrics:

- Reduction in forecast error (e.g., MAPE or RMSE)
- % of anomalies pre-identified via calendar or log
- Staff compliance rate for logging unusual events

Risk Mitigation:

- Monthly promotion audits and log reviews
- Staff cross-training on event logging
- Expand data sources (e.g., weather APIs, national calendars)

Cost Optimization:

To ensure sustainable analytics practices, teams must optimize not only retail operations but also cloud resource usage:

| Area | Strategy | Expected Benefit | Monitoring Approach |
|-----------------------------------|--|---|--|
| Promotion Spend Efficiency | Shift ~5–10% of promotional offers from weekends to weekdays | Increase revenue by 3–5% without increasing spend | Track weekly promo-to-sales conversion rates |
| Inventory Management | Align restocking to forecasted peaks (e.g., 20–30% more on weekends) | ↓ Stockouts, ↓ spoilage, ↑ sales efficiency | Monitor daily stockouts and wastage |
| Cloud Pipeline Efficiency | Use custom Dataflow + BigQuery ML instead of prebuilt templates | ↓ \$15–30/run (est. 30–60% cut vs. templates) | Review Dataflow job logs and quotas |
| Resource Scaling | Limit max workers and enable autoscaling for low-traffic times | ↓ Idle costs ~25% during off-peak hours | Analyze Cloud Monitoring usage charts |
| Storage Optimization | Archive raw data monthly, store only needed intermediate outputs | ↓ GCS costs by ~\$10–15/mo per GB archived | Set lifecycle rules for Cloud Storage |
| Model Retraining Cadence | Retrain quarterly or when forecast error exceeds threshold | ↑ Forecast Accuracy, ↓ cost from misaligned decisions | Compare forecast vs. actual sales monthly |

Notes:

- Estimated BigQuery costs assume standard pricing (\$5 per TB processed) and average query sizes based on historic lab usage. Real-world usage may vary.
- Promotion and inventory strategies are designed to shift—not increase—spending, aiming for more efficient sales conversion.
- Cloud resource optimizations (e.g., autoscaling, lifecycle rules) rely on correct implementation of IAM roles and pipeline scheduling.
- Quarterly model retraining balances forecast accuracy with compute costs. Retraining frequency may need adjustment during volatile periods (e.g., holidays).
- Cost reductions are directional estimates and depend on consistent monitoring and operational discipline.

Data Visualizations:

