

Weekend-Drivenness and Peak-Hour Concentration Across Retail Store Cohorts

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Abstract

Weekend traffic lifts almost every retail store, but unevenly: the biggest weekend surges come from mid-size and standard 9-hour-window stores, while small and short-window stores peak the most — different tier leaders. Across 5 781 complete location-days at 191 cohort locations (open-hours-only capture, true local time), 86% of the 71 well-covered stores with comparable weekday *and* weekend coverage are weekend-driven (these 71 are 37% of the 191-cohort set; all cohort contrasts stand as observed point-estimates with no significance testing or confidence intervals): standard 9-hour-window stores are *all* weekend-driven (31/31, mean ratio 2.40 $\times$) and mid-size stores average 2.40 $\times$, whereas large stores average 1.49 $\times$ and long-window stores just 1.28 $\times$. Peak-hour concentration varies by cohort too, though with different leaders: small and short-window stores pack 62.6% and 59.9% of the day’s visitors into the top three hours (the single peak hour carrying 28.1% and 25.7%), against 46.7%/45.9% for large and long-window stores. The Gini hourly-concentration index — a 0–1 measure of how evenly a day’s visitors are spread across open hours — runs from 0.24 (large) to 0.36 (small); a store’s *top-3 share* is the fraction of its daily visitors arriving in its three busiest hours, and its *open-window span* is how many open hours it records per day.¹ All figures are *observed* footfall from the canonical observed entrance-line series, reproduced by the project’s reproducible analysis pipeline into its canonical results file; no forecast values appear.

1 Problem & Motivation

The base paper established the aggregate *when* of retail visitation: a single hour carries, on average, 21.8% of a day’s visitors, and weekends average 1.79 $\times$ weekdays among well-covered stores — in the base paper, the equal-weight mean of per-store weekday/weekend daily-total ratios over the $n=70$ subset with both weekday and weekend complete days, not the pooled, traffic-weighted aggregate lift, which is larger ($\sim 2.5\times$). This paper re-derives that contrast on its own, slightly larger $n=71$ snapshot. Two questions follow that the aggregate hides. *First*, the weekend ratio is a mean over very different stores — is the weekend surge uniform, or are some stores essentially weekday businesses? *Second*, the peak-hour number is an average over very different schedules — do small stores concentrate their traffic more or less than large ones, and does a short trading window force more concentration? Answering these per-store and per-cohort questions is what makes the insight *actionable*: a retailer wants to know not only that “weekends are busy” but that *its* format — size tier, open-window span — is weekend-driven and peak-compressed to a degree that staffing and promotion scheduling should reflect.

¹Building on the base retail-visitation paper, whose overall weekend/weekday finding is a mean weekend daily total 1.79 $\times$ the weekday total — the equal-weight mean of per-store weekday/weekend daily-total ratios over the $n=70$ pairwise-coverage subset; the pooled, traffic-weighted aggregate weekend lift is larger, $\sim 2.5\times$ — this paper re-derives that contrast on its own, slightly larger $n=71$ snapshot and treats the weekend lift as an object of study.

Externally, both the aggregate contrast and its cohort decomposition sit in an established footfall literature. [1] classify footfall signatures and volumes across UK activity centres, and [2] quantify how the temporal variation of retail footfall varies with micro-location characteristics — together establishing that the analytically interesting object is the structured heterogeneity of footfall across centres and contexts, not only the average day-shape. The questions here carry that heterogeneity lens down to the store-format level (size tier, open-window span, open-hour tier) on our own observed line-count data, which are graded *our own measured* throughout.

Forecast vs. observed. As in the base paper, everything here is *observed* entrance-line footfall from the canonical visitor series; no forecast rows enter any figure or number.

2 Method

We reuse the corrected pipeline from the base paper unchanged (its data preparation and local-time handling), and add the new metrics in a companion analysis script.

2.1 Data preparation (reused)

The canonical window for each location is the modal contiguous local-hour tuple across its days (open hour o_l , close hour c_l , span $s_l = c_l - o_l + 1$), exactly as §2 of the base paper. We restrict to complete location-days (the recorded within-window hour set equals the full s_l span) and to the cohort of locations with span $s_l \geq 4\text{h}$ and at least 7 complete days. Two data-handling rules are replicated from the base pipeline: *value-based* daily totals use all complete location-days (including zero-total days), while *share-based* concentration uses only location-days with a defined hourly share (dropping zero-total days), matching the base pipeline’s approach exactly. Timestamps are `timestampz` in UTC; all hour-of-day/dow values are taken from each store’s timezone-converted local wall-clock, never round-tripped through UTC.

2.2 Weekend-drivenness (per store)

For each location with at least one complete weekday and one complete weekend day, define $\rho_l = \text{weekend daily total}_l / \text{weekday daily total}_l$. A store is *weekend-driven* ($\rho_l > 1$), *weekday-driven* ($\rho_l < 1$), or *balanced* ($\rho_l = 1$). We report the distribution of ρ_l and its breakdown by cohort tier. We carry forward the base paper’s coverage caveat: ρ_l is computable only for the $n=71$ locations with *both* weekday and weekend complete days, and the weekend complete-day counts remain far fewer than weekday; the ratios are therefore observed on that subset, with n reported everywhere.

2.3 Peak-hour concentration (per store-day)

On each complete, non-degenerate location-day, the hourly share $p_{l,t} = v_{l,t} / \sum_{t'} v_{l,t'}$ gives the *peak-hour share* $\max_t p_{l,t}$, the *top-2* and *top-3* hourly-share sums, and a per-day *Gini* of the hourly shares across the open-hours window ($0 =$ perfectly even, higher = more concentrated) — the classical Gini concentration index (Lorenz-order tradition; [4] reviews the index’s formal concentration properties) applied to within-day hourly shares measured on our own observed entrance-line series. Sensor-based estimation of hourly high-street footfall is an established measurement tradition [3]; the concentration metrics here summarise exactly such an hourly series, computed from our own data. We summarise these across store-days, overall and per cohort tier. The top- k hourly-share sum has a mechanical relation to the open-window length — fewer open hours raise the floor and ceiling on

the top- k share — so cohort differences in top- k share are partly a span artefact and are reported alongside span, never alone as a purely behavioural contrast.

2.4 Cohort definition & robustness

We split stores into defensible, operationally meaningful cohorts:

- **Store size tier** — terciles of each store’s mean daily total (open-hours capture): *small*, *medium*, *large*.
- **Open-window span tier** — *short* ($< 9\text{h}$), *standard* (9h , the modal span), *long* ($> 9\text{h}$).
- **Open-hour tier** — *early_open* ($o_l \leq 9$), *standard* ($o_l = 10$), *late_open* ($o_l > 10$).

Every comparison is labelled strictly as *observed*; these cohorts are descriptive, not predictive, and none assumes continuity beyond the recorded window.

3 Data

3.1 Source

Identical to the base paper: production analytics PostgreSQL, read-only, via the platform’s analysis-only access; the canonical observed entrance-line visitor series joined to the location registry for each store’s local timezone.

3.2 Scope and coverage (run dated 2026-09-08)

Quantity	Value
Raw observed hourly visitor rows (with timezone)	72 935
Raw locations (with timezone)	230
Cohort locations (span $\geq 4\text{h}$, ≥ 7 complete days)	191
Complete location-days analysed (share basis)	5 781
weekday / weekend complete days	5 353 / 428
Locations with weekday <i>and</i> weekend coverage (ρ_l)	71

The cohort here (191) is slightly larger than the base paper’s frozen 186 because the live feed has grown since the base snapshot (drift of this kind is expected); the base paper is unchanged. The weekend vs. weekday complete-day asymmetry (428 weekend vs. 5 353 weekday) is retained from the base paper and motivates reporting every ρ_l -based claim with $n=71$.

4 Results

4.1 Weekend-drivenness: near-universal, but concentrated

Across the $n=71$ locations with comparable weekday *and* weekend coverage, 86% (61/71) are weekend-driven ($\rho_l > 1$), 14% (10/71) weekday-driven, and none balanced (Table 1, Fig. 1). The per-store ratio distribution is heavily right-skewed: median $1.56\times$ (IQR $1.26\text{--}1.97$), 90th percentile $3.06\times$, and a long tail of strongly weekend-driven stores.

The weekend surge is *not uniform* — it concentrates in specific cohorts (Fig. 2). By **store size tier**, *medium* stores are the most weekend-driven (mean ratio $2.40\times$; 95% weekend-driven, 20/21),

followed by *small* ($1.61\times$; 81%) and *large* ($1.49\times$; 83%). By **open-window span tier**, the result is striking: every *standard* (9-hour) store in the coverage subset is weekend-driven (100%, 31/31; mean $2.40\times$), versus *short* (82%, $1.45\times$) and *long-window* stores (72%, $1.28\times$). By **open-hour tier**, *early*-opening stores are the most weekend-heavy (mean $1.98\times$; 89%).

Read together: the average weekend boost of $\sim 1.8\times$ from the base paper is real but not a universal constant — it is carried disproportionately by mid-size and standard-window stores, while large and long-window stores are comparatively flatter (closer to weekday traffic).

Table 1: Weekend-drivenness by cohort (per-store ratios ρ_i , $n=71$ locations with both weekday and weekend complete days; from the project’s generated cohort table).

Cohort	n	Mean ratio	Median ratio	% weekend-driven
Overall	71	1.80	1.56	85.9
small (size)	21	1.61	1.69	81.0
medium (size)	21	2.40	1.79	95.2
large (size)	29	1.49	1.42	82.8
short (span)	11	1.45	1.71	81.8
standard (span)	31	2.40	1.80	100.0
long (span)	29	1.28	1.29	72.4

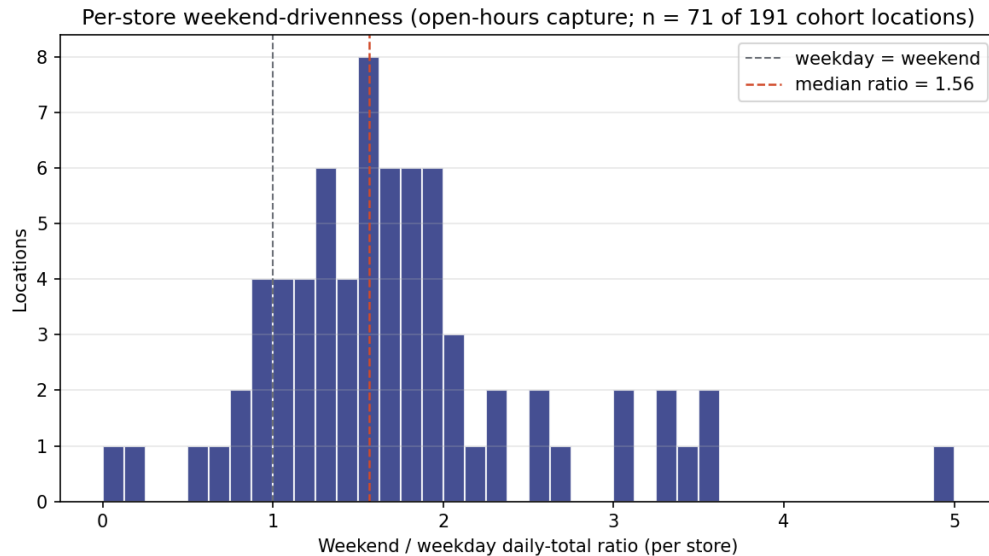


Figure 1: Distribution of per-store weekend/weekday daily-total ratio ($n=71$ of 191 cohort locations; open-hours capture). Grey dashed line: weekday==weekend (parity). Red dashed line: median ratio 1.56. Fewer than 15% of stores are below parity.

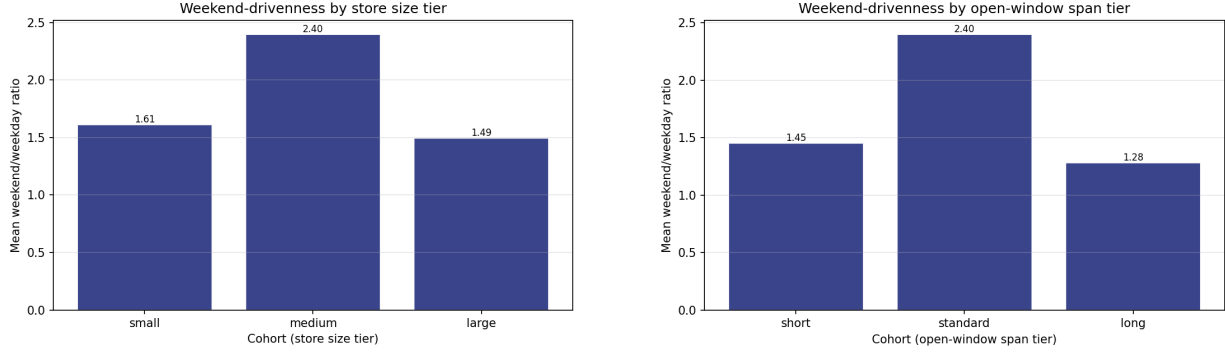


Figure 2: Mean weekend/weekday ratio by store size tier (left) and by open-window span tier (right). Standard-window stores average $2.40\times$; long-window stores $1.28\times$.

4.2 Peak-hour concentration: strongest where traffic is smallest

Across the 5 781 complete location-days the overall pattern from the base paper is confirmed — this paper’s snapshot reads a mean peak-hour share of 21.7%; top-3 hours 52.9%; median 19.6%; Gini 0.29; modal peak hour 15:00 (the base paper prints 21.8% / 53.1% on its own, marginally different snapshot). But concentration is strongly cohort-dependent (Table 2, Fig. 3).

By **store size tier**, smaller stores are markedly more time-compressed: *small* stores carry 28.1% of a day’s visitors in the single peak hour and 62.6% in the top three (Gini 0.36; modal peak 12:00); *medium* stores 21.1%/52.1% (Gini 0.28; 14:00); *large* stores 17.7%/46.7% (Gini 0.24; 15:00). By **open-window span tier**, *short*-window stores are the most compressed (peak 25.7%; top-3 59.9%; modal 14:00), *standard* stores 21.1%/52.2% (15:00), and *long*-window stores the most spread (peak 18.0%; top-3 45.9%). The Gini rises for long windows (hours are more numerous but unevenly weighted), so we report it alongside, not instead of, the top-3 share. The top-3 share itself is partly mechanical on open-window length (fewer open hours raise its floor and ceiling), so the small-vs-large top-3 gap (62.6% vs. 46.7%; 59.9% vs. 45.9%) is not purely behavioural until span is held constant — partly a span artefact; reported alongside span.

Table 2: Peak-hour concentration by cohort (complete location-days; from the project’s generated concentration table).

Cohort	n_{loc}	n_{days}	Peak%	Top-3%	Gini	Modal h
Overall	191	5781	21.7	52.9	0.29	15:00
small (size)	64	1724	28.1	62.6	0.36	12:00
medium (size)	63	1592	21.1	52.1	0.28	14:00
large (size)	64	2465	17.7	46.7	0.24	15:00
short (span)	48	1856	25.7	59.9	0.29	14:00
standard (span)	74	2321	21.1	52.2	0.27	15:00
long (span)	69	1604	18.0	45.9	0.30	16:00

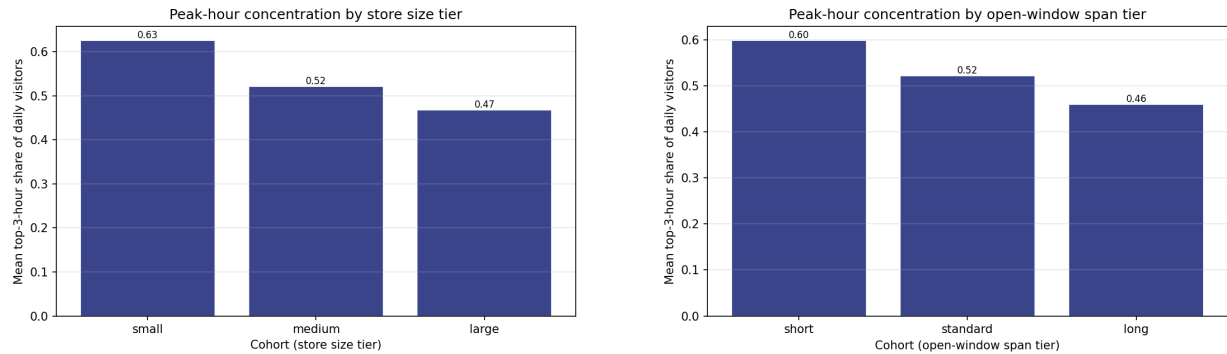


Figure 3: Mean top-3-hour share of daily visitors by store size tier (left) and open-window span tier (right). Small and short-window stores pack ~ 60 – 63% of the day into three hours; large and long-window stores ~ 46 – 47% .

4.3 Headline

“Weekends lift almost every store, but they lift mid-size, standard-window stores the most — while small, short-window stores are the most peak-compressed.” Concretely: 86% of well-covered stores are weekend-driven; standard 9-h stores are 100% weekend-driven at $2.4\times$; and small stores do $\approx 28\%$ of a day’s traffic in a single hour and $\approx 63\%$ in three. Peak-hour and weekend planning are therefore *format-specific*.

5 Validation & Quality

5.1 Quality controls

- **Reproducibility.** Every number in this paper is produced by the project’s analysis script from the canonical observed visitor series into the canonical results file (the new weekend-drivenness and peak-concentration sections); figures and tables are generated by that same script. It reuses the timezone-converted local wall-clock handling and the exact complete-day/cohort filters of the corrected base pipeline, not a parallel re-derivation.
- **Observed, not forecast.** Only the canonical observed visitor series enters any figure or number; model forecast tables are excluded. All comparisons are labelled *observed*.
- **Zone-counter and open-hours rules.** Per-zone counters are never summed into location totals; daily totals and hourly shares use open-hours capture only.
- **Coverage guard + n-scope.** Every weekend-drivenness claim reports $n=71$ (the pairwise coverage subset) with the weekend/weekday complete-day asymmetry (428 vs. 5353) disclosed; concentration claims use 5781 complete location-days. Zero-total days are handled exactly as the base pipeline (excluded from share-based measures).

5.2 Limitations

1. **Weekend coverage asymmetry.** ρ_l rests on only 71 locations with both weekday and weekend complete days; cohort-tier n ’s are small at the margins (e.g. short span $n=11$). Pronouncements are strongest where n is largest (size and span tiers).

2. **Empirical windows.** Open-hours windows are recovered from the modal contiguous hour tuple (the platform’s store-hours registry is not populated for this set), not an authoritative schedule — as in the base paper.
3. **Crossing counts, not people.** Figures are entrance-line crossings; share and ratio patterns are unaffected by the uniform counting convention.
4. **Cohort is observed, not predictive.** Size/span tiers describe the recorded network; they imply no out-of-sample forecast.

6 Discussion

Together, the two results give a coherent *format-specific* picture of retail footfall. The weekend surge is pervasive — 86% of the $n=71$ well-covered stores are weekend-driven, a subset equal to 37% of the 191-cohort set — yet patterned: the stores an operator might expect to be “week-end tourism” destinations are actually the more work-day-spread, larger, longer-window stores, while the weekday-heavy work-a-day formats flip upward, most for standard-window stores, only modestly for short-window ones. These cohort contrasts (e.g. short-span $n=11$; standard 31/31, “100%”) are observed point-estimates with no significance testing or confidence intervals. Peak-hour concentration runs broadly alongside drivenness — the more weekend-driven and the more peaked formats both stand apart from the large and long-window stores — but the tier leaders differ across the two families. Because the peak-hour concentration series is weekday-dominated (5 353 of 5 781 complete store-days, $\sim 93\%$), the weekend peak-hour share is *not* separately measured here; a small standard-window store’s “Saturday peak window” is therefore an *inference* — combining the observed weekend-drivenness ($\rho_l > 1$) with the observed weekday concentration — not a measured weekend share. Where that inference points, it identifies a tight, high-intensity staffing and promotion target. This is directly actionable for staffing, promotion timing, and capacity, and it is a crisp, defensible retail insight: *which stores are weekend-driven and how peaked is their day*.

6.1 Relevance to the platform’s question-answering

Retailer questions such as “is my store weekend-driven?” and “how many hours of a day make up most of my traffic?” can now be answered per cohort from observed data rather than assumption — a per-store ρ_l and a per-store top-3/Gini concentration are simple, reproducible features.

6.2 Future work

Decompose ρ_l and peak concentration by merchant format/region (the late-hours tail seen in the base paper); add per-zone dwell measurements (read per zone, never summed into totals) to see whether concentration in *entries* mirrors dwell; and track cohort-tier stability over a longer window once more weekend data accrue to thicken the $n=71$ subset.

References

- [1] C. L. Mumford, C. Parker, N. Ntounis, and E. D. W. Dargan. *Footfall signatures and volumes: Towards a classification of UK centres*. Environment and Planning B: Urban Analytics and City Science, 2020. doi:10.1177/2399808320911412. Peer-reviewed. Classifies footfall signatures and volumes across UK activity centres — establishes that footfall structure varies systematically across centres, the aggregate question this paper decomposes by store format.

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- [4] M. Bonetti, C. Gigliarano, and U. Basellini. The Gini concentration index for the study of survival. In *Gini Inequality Index*, Chapman & Hall/CRC, pages 107–124, 2021. doi:10.1201/9781003143642-6. Peer-reviewed (edited-volume chapter). Reviews the Gini index’s formal concentration properties — the chapter’s application domain is survival data, but the index itself is domain-general; it is applied here to within-day hourly shares.
- [5] Indivd Analytics Research. *Entrance-Line Visitation Patterns in Retail: When Do People Come, How Concentrated, and How the Week Breathes*. Companion paper, this project. Internal sibling paper; source-and-method anchoring only.
- [6] Indivd Analytics. *Data catalog*: the observed visitor metric, open-hours capture, and the platform’s data-quality rules. Internal source-and-method documentation; anchors the measurement layer.