

Portfolio Recovery Asymmetry in Nominal Sales: A Representativeness Audit of Pak Elektron Limited, Pakistan

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Abstract

Pak Elektron Limited reported 2025 gross sales 26.5% above its 2022 level. That increase coexisted with substantial shortfalls in two disclosed product categories. This study examines Portfolio Recovery Asymmetry (PRA), a reference-dependent condition in which aggregate nominal sales exceed a specified baseline while some comparable constituents remain below it. An embedded case study uses eight full-year category series for 2022-2025, covering 99.01% of reference-year company gross sales; unresolved reconciliation residuals limit quantitative representativeness claims to the matched panel. The audit combines an exact portfolio identity with weighted dispersion, the sales weight and depth of directional disagreement, observed regain timing, and contribution reconciliation. In 2025, the matched index reached 127.8, yet 27.3% of reference-year sales weight remained below baseline. Power transformers reached an index of 141.4 in 2024 before falling to 71.7 in 2025. Directional disagreement persists under alternative weights, every single-category omission, and bounded 5% perturbations of reference and endpoint sales. Rebasing exposes a material qualification: all eight categories exceed their 2023 sales in 2025. PRA therefore depends on the substantive comparison being made. The contribution is a reproducible protocol for checking whether a headline sales trajectory supports category-level statements. It neither measures operational resilience nor identifies the causes of divergence. Its practical use is to locate decisions that require constituent evidence before resources are committed.

Keywords

Nominal Sales, Aggregate Representativeness, Portfolio Analysis, Manufacturing Performance, Baseline Sensitivity

1. Introduction

A manufacturer can report higher sales while parts of its business remain below an earlier level. The total may be correct, but a manager deciding where to add capacity needs to know which products generated the increase. Consolidation answers a question about the company. It does not, by itself, answer the same question for every product category.

Pak Elektron Limited (PEL) illustrates the distinction. Its investor briefing reports gross sales of PKR 66.028 billion in 2022, PKR 48.324 billion in 2023 and PKR 83.530 billion in 2025. The 2025 company total exceeds the 2022 level by 26.5%. Over those same endpoints, power-transformer sales declined from PKR 10.389 billion to PKR 7.451 billion, and switchgear declined from PKR 7.483 billion to PKR 6.025 billion (Pak Elektron Limited, 2026: pp. 12-13). Describing the whole portfolio as having regained its earlier sales position would conceal these differences.

This paper uses Portfolio Recovery Asymmetry (PRA) for a reference-dependent condition in which an above-reference nominal-sales aggregate coexists with below-reference constituents. The word recovery is confined to this comparison. Sales above the reference do not establish restored physical output, delivery reliability, profitability or supply-chain capability. A change in selling prices or product mix can raise nominal sales without a corresponding increase in units sold.

The underlying aggregation problem is established. Research on segment disclosure explains why business-level information matters to users of consolidated accounts (Berger & Hann, 2003; Botosan & Stanford, 2005; Ettredge et al., 2005). Resilience research also distinguishes performance at product, firm and network levels. Ivanov (2026), for example, examines why improvements at one level need not translate into equivalent outcomes at another. The purpose here is to turn that measurement caution into a transparent audit that can be performed when only a short sales panel is available.

Two research questions guide the analysis. RQ1 asks how the eight disclosed PEL categories differed in their nominal-sales trajectories over 2022-2025. RQ2 asks how well the aggregate describes those categories when direction, magnitude, timing, weighting and reference choice are examined separately. The contribution is an integrated, reproducible audit protocol that links a headline sales claim to its supported category-level interpretation. It combines reconciliation, directional exposure, shortfall depth, regain timing and reference sensitivity in one decision-oriented sequence. The index identity, dispersion measures and arithmetic decompositions remain conventional descriptive tools; the study does not claim a new estimator or a causal explanation of the observed divergence.

2. Conceptual Basis and Contribution

2.1. The Level at Which a Claim Is Supported

Supply-chain resilience addresses how organizations and their supply arrangements sustain or restore performance during disruption. Foundational accounts

place organizational capabilities and interorganizational relationships within that problem (Christopher & Peck, 2004; Pettit et al., 2010; Ponomarov & Holcomb, 2009). Reviews subsequently organize a much wider set of capabilities and performance measures than annual financial totals alone can represent (Ali et al., 2017; Bruckler et al., 2024; Han et al., 2020). This literature supplies the reason to respect measurement boundaries; it does not validate nominal sales as a complete measure of resilience.

The relevant problem is aggregation and decomposition. A positive change in total sales can combine increases in some categories with decreases in others. The accounting identity is valid while a common-direction description of all constituents may fail. PRA therefore examines the sign, size and timing of constituent changes relative to a stated reference. It makes no group-to-individual inference and requires no reversal of an estimated statistical association.

Representativeness has a specific meaning in this study. Directional representativeness asks whether the aggregate's side of a chosen baseline is shared by the disclosed categories. Magnitude representativeness asks whether their distances from that baseline are sufficiently similar for a particular decision. The first can be assessed exactly for the observed data. The second needs a decision-specific tolerance. A small category on the opposite side defeats a claim about every category, although its economic relevance may be limited. Table 1 locates the audit among adjacent approaches.

Table 1. Adjacent approaches and the role of the PRA audit.

Approach	Question addressed	Relation to this study
Resilience measurement	Which capabilities or performance dimensions matter?	Defines construct boundaries; requires evidence beyond nominal sales.
Segment disclosure	What business-level information is visible?	Provides the information base for constituent comparison.
Weighted spread and shortfall	How dispersed are values and how large are deviations?	Supplies established descriptive calculations.
PRA audit	Which category-level statements does this sales aggregate support?	Combines identity, direction, magnitude, timing and sensitivity.

Sources: Han et al. (2020), Bruckler et al. (2024), Berger and Hann (2003), and the protocol defined here. This is a scoped comparison, not an exhaustive literature review.

2.2. Position Relative to Existing Approaches

Segment disclosures make differences visible, but users must still decide what those differences mean for a temporal performance statement. Studies of disclosure and the information environment provide the closest accounting connection (Berger & Hann, 2003; Botosan & Stanford, 2005; Ettredge et al., 2005). The PRA audit begins with the disclosed series and organizes the next steps: reconcile the

aggregate, identify disagreement, inspect its size and timing, and qualify the statement being made.

Corporate diversification and flexible manufacturing provide plausible explanations for differing category paths. Portfolio composition can offset losses without an active transfer of resources, while redeployable resources or flexible capacity may change actual operating responses (Amit & Livnat, 1989; Fine & Freund, 1990; Sakhartov, 2022). A sales decomposition cannot distinguish those mechanisms. In particular, a gain in appliance sales cannot establish that PEL redeployed transformer capacity, labour or procurement resources into appliances.

These distinctions motivate future comparisons. Categories with different demand cycles or project schedules may diverge more than categories exposed to a common consumer market. A project category may also cross its baseline briefly when a large contract is recognized. The PEL data permit these possibilities to be discussed, but they contain neither the timing detail nor a counterfactual required to test them causally.

3. Data and Case Design

3.1. Case Selection and Observation Window

The study treats PEL as an embedded descriptive case, with product categories as the internal units. The case-study rationale is analytical usefulness rather than statistical representativeness (Flyvbjerg, 2006; Yin, 2018). PEL discloses appliance and power-equipment categories under one corporate boundary, providing a useful comparison between groups with visibly different sales paths. Selection was informed by the availability and variation of the disclosures. Consequently, the case cannot estimate how frequently PRA occurs in manufacturing.

The analysis uses the FY2022-FY2025 columns of the investor briefing dated 19 May 2026. Each column represents the full January-December reporting year, ending on 31 December of the labelled year; the exchange profile confirms a December fiscal year-end (Pakistan Stock Exchange, n.d.). The FY2025 column is presented as reported historical results, not a forecast or management target. FY26 Q1 amounts and the separate projected-growth column are excluded (Pak Elektron Limited, 2026: pp. 12-13). This identifies the presentation basis; it does not imply independent audit assurance over each product row.

The reference-selection rule is to choose the earliest complete year in the common disclosed panel for which all retained category sales are positive, before calculating directional disagreement. Applied to this panel, the rule selects 2022. The endpoint is the latest complete historical year in the same table, 2025. This is a reproducible rule for the present audit, not a claim of prospective preregistration. It does not establish 2022 as an undisturbed or normal operating year. All other references are diagnostic comparisons, specified in Section 4.4.

3.2. Source Roles and Reconciliation

The primary data are the gross-sales amounts on PDF page 13 of the briefing (Pak

Elektron Limited, 2026). They are management-reported category figures, expressed in PKR million. The slide's heading mentions volume and revenue, but the table itself labels the monetary series as gross sales. The analysis follows that table label. Other appliances corresponds to the source row labelled Others; its internal product mix is not observable.

Table 2 reproduces all 32 category-year observations and the company totals used in the calculations. The eight-category sum differs from company gross sales by PKR 654 million in 2022, PKR 29 million in 2023, minus PKR 6 million in 2024 and minus PKR 1 million in 2025. These are reconciliation residuals. Negative residuals show why they should not be modelled as a ninth product category. No balancing values are allocated to the observed categories.

Table 2. Source sales panel and company reconciliation in PKR million.

Category or total	2022	2023	2024	2025
Refrigerators	17,655	13,419	20,178	26,389
Split air conditioners	9506	4647	11,362	15,484
Deep freezers	2727	1385	3582	6187
Other appliances	4325	2848	4959	5789
Distribution transformers	11,008	9024	6995	11,854
Power transformers	10,389	7123	14,690	7451
Energy meters	2281	3908	3523	4352
Switchgear	7483	5941	4325	6025
Matched total	65,374	48,295	69,614	83,531
Company gross sales	66,028	48,324	69,608	83,530
Company less matched	654	29	-6	-1
Coverage (%)	99.01	99.94	100.01	100.00

Source: Pak Elektron Limited (2026: p. 13). The first four rows are Appliances; the next four are matched Power. Other appliances retain the source category Others. Values are management-reported gross sales; residuals remain unallocated. Each year is the full January-December period. FY2025 is reported historical data; FY26 Q1 and projected growth are excluded.

The matched portfolio covers 99.01% of the reported 2022 company total and is marginally above the reported total in 2024 and 2025. Coverage here is an arithmetic ratio, not certification that all definitions or rounding conventions have been reconciled. The briefing's four Power rows sum to PKR 31.161 billion in 2022, compared with its reported Power total of PKR 31.814 billion. The nested analysis therefore refers to matched Power, rather than treating its index as the division's reported index.

Coverage is sufficient only for the scope of the claim. A statement that the company aggregate represents every category requires an exhaustive, non-overlapping category mapping on a common reporting basis, with the residual reconciled to identified items or documented rounding. If an approximate company-level claim

is intended, a decision-specific tolerance must be stated before interpretation, and identified omitted items or reconciliation adjustments must be bounded tightly enough that no permitted allocation changes the claimed direction or exceeds that tolerance. A near-100% coverage ratio alone meets neither requirement: a small net residual can conceal offsetting discrepancies.

Here the residuals remain unexplained, so P, D, Q and G describe only the matched panel; 27.3% is not an estimate of all-company discordant exposure. A residual material to the intended claim prevents extending matched-panel magnitudes to the company. The narrower conclusion that the company increase does not describe every disclosed category needs only a comparable observed counterexample, rather than exhaustive coverage. Power transformers and switchgear supply those counterexamples. The company total and its change remain separately reported and explicitly reconciled.

PACRA's rating report supplies a different form of evidence. It attributes approximately 68% of Appliances revenue growth in calendar 2024 chiefly to a 53% volume increase and describes roughly 13% Power revenue growth as mainly price-related, with slightly lower volume ([The Pakistan Credit Rating Agency Limited, 2025](#)). Those are division-level statements on PACRA's reporting basis. They are kept separate from the briefing's category calculations. PBS production tables provide national physical-output context, with a July-June reporting period, and cannot be substituted for PEL's category sales or quantities ([Pakistan Bureau of Statistics, 2024](#)). Neither source is used to create a category-level deflator.

3.3. Verification and Reproducibility

All 32 category-year amounts were checked against the public briefing table, and the manuscript diagnostics were recalculated from those inputs. The same eight row labels span all four annual columns in the retrospective table. This establishes label continuity within that table, not proof that the underlying product composition or recognition policies were unchanged. The matched-panel interpretation is therefore conditional on substantive category comparability, especially within Others and the transformer categories. Supplementary Material S1 records the original labels and their manuscript equivalents.

Supplementary Material S1 contains the input CSV files, a source ledger, calculation code, machine-readable results, figure-generation code, and checksums. The code performs no network requests and can reproduce the analysis from those inputs. It checks the portfolio identity, reconciliation, neutral-aggregate handling and the endpoint sensitivity claims. This establishes computational reproducibility conditional on the transcribed data. It does not establish independent audit assurance over management's category disclosures.

4. Audit Method

4.1. Index and Portfolio Identity

Let $S(i, t)$ be nominal gross sales for category i in year t . Reference sales $S(i, 0)$

must be positive, and endpoint sales must be nonnegative. Categories must refer to a common reporting period and a sufficiently comparable monetary construct. The category index and reference-year sales weights are given in Equation (1):

$$RI_{it} = 100 \frac{S_{it}}{S_{i0}}, w_{i0} = \frac{S_{i0}}{\sum_j S_{j0}} \quad (1)$$

The reference-weighted portfolio index is exactly the index of the matched sales total, as shown in Equation (2):

$$P_t = \sum_i w_{i0} RI_{it} = 100 \frac{\sum_i S_{it}}{\sum_i S_{i0}} \quad (2)$$

$P(t)$ can therefore be checked directly against the sum of the input amounts. It is distinct from the company index whenever the matched rows do not fully reconcile with company sales. Holding weights at the reference year preserves the economic exposure present at that date.

4.2. Dispersion and Directional Disagreement

The weighted population standard deviation in Equation (3) describes how far category indices lie from their matched portfolio mean:

$$D_t = \sqrt{\sum_i w_{i0} (RI_{it} - P_t)^2} \quad (3)$$

$D(t)$ is expressed in index points. The observed categories form the finite portfolio under examination; they are not treated as a random sample of interchangeable manufacturing units. A large D need not imply opposite directions: every category could exceed its reference by a different amount.

To identify direction, define $g(\text{delta}, x)$ as +1 when x exceeds $100 + \text{delta}$, -1 when x is below $100 - \text{delta}$, and zero otherwise. Delta is a nonnegative neutral-band width expressed in index points. When the aggregate is outside that band, let $A(t, \text{delta})$ be the set of categories whose sign is opposite to the aggregate's sign. Its sales weight Q and weighted distance G are given in Equation (4):

$$Q_{t,\delta} = \sum_{i \in A_{t,\delta}} w_{i0}, G_{t,\delta} = \sum_{i \in A_{t,\delta}} w_{i0} |RI_{it} - 100| \quad (4)$$

Neutral categories are excluded from $A(t, \text{delta})$. Thus $Q = 0$ means that no observed category lies strictly opposite to the non-neutral aggregate; it does not by itself show that every category shares its sign. A claim of common direction also requires checking that no category is neutral. G/Q is undefined when $Q = 0$.

The denominator of Q is reference-year matched sales, not category count or current sales. G is measured in weighted index points. Where Q is positive, G/Q is the mean distance from the reference among discordant exposure. If the aggregate lies within the neutral band, Q and G are reported as not applicable. A neutral aggregate cannot provide the direction against which disagreement is defined. The numerical implementation uses a $1e-10$ index-point guard solely to avoid floating-point classification at a boundary.

PRA in its above-reference form requires $P(t) > 100$ and $Q(t, 0) > 0$. The same Q and G calculations can describe disagreement when the aggregate is below baseline, but that is the symmetric diagnostic case. With an above-reference nominal-sales aggregate and $\delta = 0$, G has a straightforward accounting interpretation: it equals 100 times the total nominal-sales shortfall of below-baseline categories divided by reference-year matched sales. It is a normalized shortfall, rather than a new estimator. Reporting Q beside it separates the extent of affected exposure from the depth of its shortfall.

4.3. Timing and Alternative Weighting

First baseline regain is the first annual observation above 100 following an observed below-baseline year. Sustained regain means that every later available annual observation remains above 100. At least one observation after first regain is required to assess that persistence. An endpoint-only regain is classified as persistence unobserved. Annual observations also cannot establish uninterrupted performance between reporting dates.

Equal weights provide a category-count perspective. Current-sales weights describe exposure at the endpoint, after growth and decline have changed the composition. For each lens, the weighted mean and dispersion are recomputed before Q is evaluated. Only the reference-weighted mean has the matched-total identity in Equation (2). G remains on the reference-weighted basis in the manuscript. Alternative weighting lenses answer different questions and are not pooled into a composite score.

4.4. Sensitivity and Bounded Perturbations

The audit evaluates every single-category omission, with the remaining reference weights renormalized. It also reports weighted mean absolute deviation, Gini and Theil T as alternative descriptions of spread. These checks reveal dependence on a category or a dispersion measure; they cannot establish independence from the choice of reference year.

Supplementary Material S1 supplies the exact formulas and calculation code for weighted mean absolute deviation, Gini and Theil T. These use reference-sales weights and the matched mean. No significance tests or sampling confidence intervals are attached to this finite descriptive portfolio.

Following the rule in Section 3.1, 2022 remains the primary reference. The 2023 comparison describes change since the within-panel low, 2024 describes the latest year-to-year change, and the category-specific 2022-2024 mean smooths the available pre-endpoint observations. Each diagnostic recomputes its own reference-sales weights. These are distinct comparison questions, not competing estimates of a single recovery state. The pooled reference includes the contraction and rebound and cannot substitute for a longer pre-contraction history.

Two reporting scenarios multiply each 2022 and 2025 amount by a factor between $1 - b$ and $1 + b$, using $b = 0.02$ or 0.05 . All reference weights and ratios are

recalculated. These are stipulated scenarios, with no asserted empirical distribution of reporting error. For a positive index x , the interval implied by this box is given in Equation (5):

$$x^t \in \left[\frac{1-b}{1+b}x, \frac{1+b}{1-b}x \right] \quad (5)$$

The same bound holds for P because it is a ratio of positive totals. Thus, certain directional conclusions can be checked over the entire permitted box, without assigning probabilities to the perturbations. For illustration of the internal distribution, S1 also runs 50,000 independent uniform draws at each band using NumPy PCG64 and seed 20260912. Its quantiles are scenario summaries, not confidence intervals. Category or year dependence in actual reporting errors is not estimated.

Neutral-band sensitivity is treated separately. For fixed observed indices, the minimum of the aggregate's distance from 100 and the smallest such distance among discordant categories marks the first band width at which the existing Q can change or become undefined. This is a tolerance-band limit. It is not a general distance to the nearest possible change in Q under arbitrary data perturbations, since an initially concordant category could move into disagreement. **Figure 1** summarizes the audit sequence.

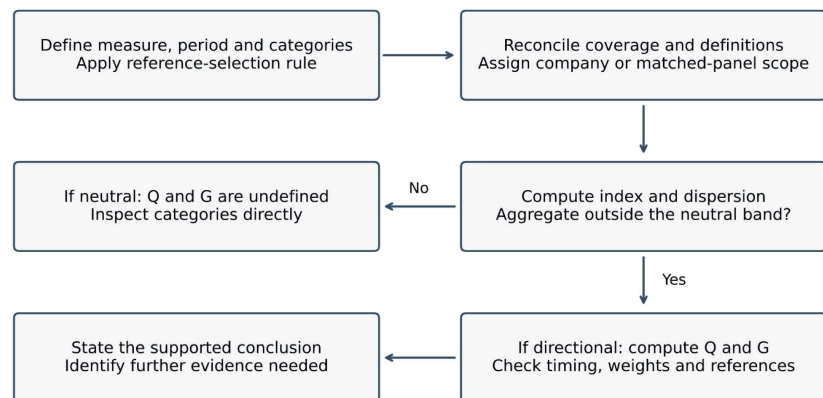


Figure 1. Audit sequence. Coverage, aggregate direction and sensitivity determine which constituent statements are supported. D denotes dispersion, Q discordant sales weight, and G weighted directional gap.

5. Results

5.1. Aggregate Nominal-Sales Increase and Different Category Paths

Company gross sales fell 26.8% between 2022 and 2023 before exceeding the 2022 reference in 2024. The company index runs 100.0, 73.2, 105.4 and 126.5 across the four years. The matched index is 100.0, 73.9, 106.5 and 127.8. Both describe an above-reference nominal-sales endpoint, while preserving their different denominators.

Figure 2 shows the category trajectories. The four Appliances categories fall below their 2022 levels in 2023 and exceed those levels in both 2024 and 2025. Power follows several paths. Energy meters remain above baseline throughout the

post-reference window. Distribution transformers first regain the baseline in 2025, leaving no subsequent annual observation with which to assess persistence. Switchgear remains below baseline in all three years.

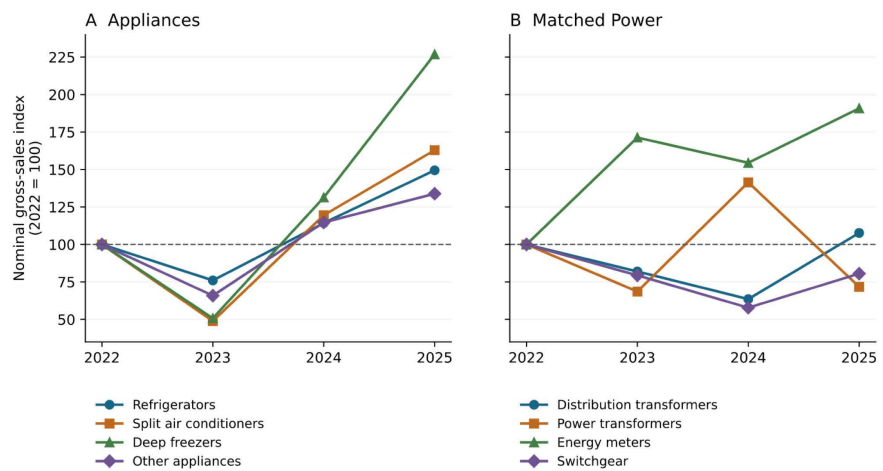


Figure 2. Category sales trajectories from the briefing panel. The dashed line marks the 2022 reference. Distinct markers preserve identification in grayscale. Source: calculations from [Table 2](#).

Power transformers provide the clearest reversal. Their index rises from 68.6 in 2023 to 141.4 in 2024, then falls to 71.7 in 2025. Nominal sales therefore declined 49.3% from 2024 to 2025. An endpoint comparison alone would miss the interim regain, while the 2024 crossing alone would overstate its persistence. The data establish the annual sales sequence; they do not identify whether order timing, prices, production or another mechanism generated it.

5.2. Breadth and Depth of Disagreement

Table 3 presents the main diagnostic results. Dispersion increases from 21.7 index points in 2023 to 41.0 in 2025. Directional disagreement does not move in the same way. In 2023, only energy meters lie opposite to the below-baseline portfolio, representing 3.5% of reference sales. In 2024, when the aggregate is above baseline, distribution transformers and switchgear account for 28.3% discordant exposure. In 2025, the discordant categories are power transformers and switchgear, together accounting for 27.3%.

Table 3. Main diagnostics with 2022 reference-sales weights.

Year	<i>P</i>	<i>D</i>	<i>Q</i> (%)	<i>G</i>	<i>G/Q</i>
2023	73.9	21.7	3.5	2.49	71.3
2024	106.5	30.5	28.3	10.97	38.8
2025	127.8	41.0	27.3	6.72	24.6

P is an index with 2022 = 100. *D*, *G* and *G/Q* are index-point measures; *G* weights the gap by reference sales. *Q* is shown as a percentage but used as a fraction in *G/Q*. Delta = 0 throughout this table.

The 2025 shortfall in those two categories totals PKR 4.396 billion, giving $G = 6.72$ weighted index points. Dividing by Q yields a mean below-baseline distance of 24.6 points for the discordant exposure. Although total dispersion grows after 2024, G falls from 10.97 to 6.72. The measures describe different features of the portfolio, and their divergence is substantive information rather than an inconsistency.

All three weighting lenses retain directional disagreement in 2025 (**Table 4**). Reference weighting gives $Q = 27.3\%$, equal weighting gives 25.0%, and current weighting gives 16.1%. The lower current-weight share reflects the reduced sales importance of the two declining categories. It should not be interpreted as independent evidence that their reference-year shortfalls were small. The equal and current means, at 140.5 and 140.9, are weighted means of category indices rather than alternative company growth estimates.

Table 4. Weighting sensitivity with means recomputed for each lens.

Year	Weighting lens	Mean index	D	Q (%)
2023	Reference sales	73.9	21.7	3.5
2023	Equal category	80.3	36.3	12.5
2023	Current sales	80.2	28.8	8.1
2024	Reference sales	106.5	30.5	28.3
2024	Equal category	112.1	32.4	25.0
2024	Current sales	115.2	26.7	16.3
2025	Reference sales	127.8	41.0	27.3
2025	Equal category	140.5	50.0	25.0
2025	Current sales	140.9	40.5	16.1

Only reference-sales weighting reproduces the index of the matched monetary total. The equal and current means answer different analytical questions. $\Delta = 0$.

5.3. Internal Comparison between Appliances and Matched Power

The nested results in **Table 5** clarify the importance of the benchmark aggregate. Appliances moves from an index of 65.2 in 2023 to 157.4 in 2025. Its categories share the aggregate's direction in each year, so $Q = 0$ throughout. Dispersion nevertheless grows from 4.8 in 2024 to 22.3 in 2025 as deep-freezer sales pull further ahead.

Table 5. Nested diagnostics within Appliances and matched Power.

Portfolio	Year	P	D	Q (%)	G
Appliances	2023	65.2	12.3	0.0	0.00
Appliances	2024	117.2	4.8	0.0	0.00
Appliances	2025	157.4	22.3	0.0	0.00

Continued

Matched Power	2023	83.4	25.4	7.3	5.22
Matched Power	2024	94.8	40.7	40.7	17.79
Matched Power	2025	95.3	31.0	42.6	9.36

Weights are renormalized within each four-category portfolio using its 2022 sales. Because matched Power has $P < 100$, its discordant categories lie above baseline. Delta = 0.

Matched Power remains below its 2022 total in every post-reference year. In 2025 its index is 95.3 and Q is 42.6%. Here the discordant exposure comprises distribution transformers and energy meters, which are above baseline while the matched Power aggregate is below it. This differs from the company-wide calculation, whose above-reference matched nominal-sales aggregate makes power transformers and switchgear discordant. Q must always be interpreted together with the aggregate direction and the category set.

The internal comparison shows that the protocol can distinguish common direction from conflicting direction within the same company. It is an illustration of discrimination between observed configurations. The groups were not randomly assigned, and this comparison does not validate a causal model or demonstrate performance on an independent sample.

5.4. Where the Company Increase Originated

Between 2022 and 2025, six categories add PKR 22.553 billion to sales. Power transformers and switchgear offset PKR 4.396 billion of that amount, and the change in the reconciliation residual contributes minus PKR 0.655 billion. Their sum is the company increase of PKR 17.502 billion (**Figure 3**). Refrigerators and split air conditioners together supply 65.2% of gross positive contributions.

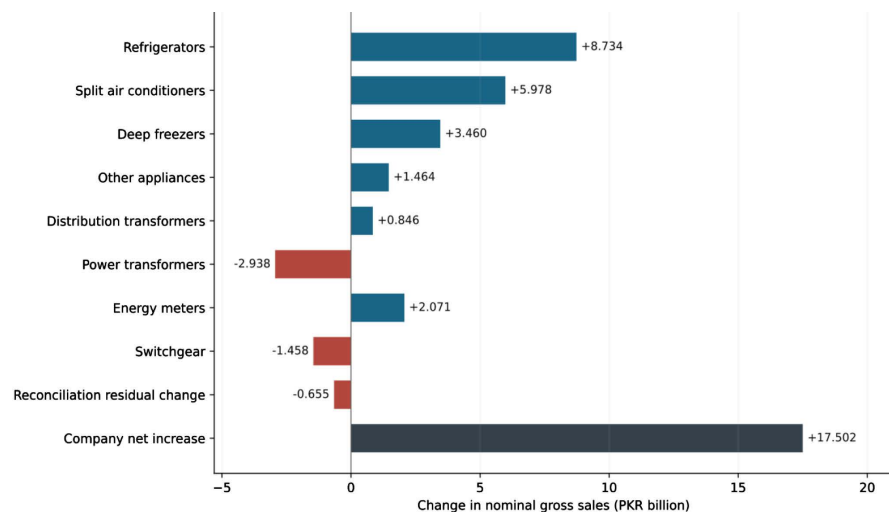


Figure 3. Accounting contributions to the 2022-2025 company gross-sales change. Positive contributions sum to PKR 22.553 billion; category offsets and the residual change reconcile them to PKR 17.502 billion. Source: **Table 2**.

The sum of squared positive-contribution shares is 0.258, compared with 0.167 if all six positive contributors had equal shares. This describes concentration among gains. It is not a competition-policy measure or an estimate of managerial risk. The accounting bridge establishes where the reported net change arose, without attributing the gains to a strategy or estimating what would have occurred without them.

5.5. Reference Choice Changes the Conclusion

Table 6 and **Figure 4** make baseline dependence explicit. Compared with 2023, the 2025 matched portfolio reaches 173.0 and every category is above its reference, giving $Q = 0$. Dispersion is still substantial, at 82.3 index points. The statement that all categories recorded higher nominal sales than in 2023 is supported; the statement that all regained their 2022 level is not.

Table 6. The 2025 result under alternative references.

Reference	<i>P</i>	<i>D</i>	<i>Q</i> (%)	<i>G</i>	Discordant categories
2022	127.8	41.0	27.3	6.72	Power transformers; Switchgear
2023	173.0	82.3	0.0	0.00	None
2024	120.0	38.8	21.1	10.40	Power transformers
2022-2024 mean	136.7	41.9	17.6	5.37	Power transformers

Each row recomputes category ratios and weights from its own reference sales. The pooled reference averages each category over 2022-2024; it is not a pre-contract estimate. Delta = 0.

Using 2024 as the reference produces a 2025 index of 120.0 and $Q = 21.1\%$, entirely associated with power transformers. Relative to the category-specific 2022-2024 mean, the index is 136.7 and $Q = 17.6\%$, again associated with power transformers. These comparisons do not supersede the 2022 question. They show why the reference must remain part of the claim and why no baseline-invariant PRA label can be assigned to this company.

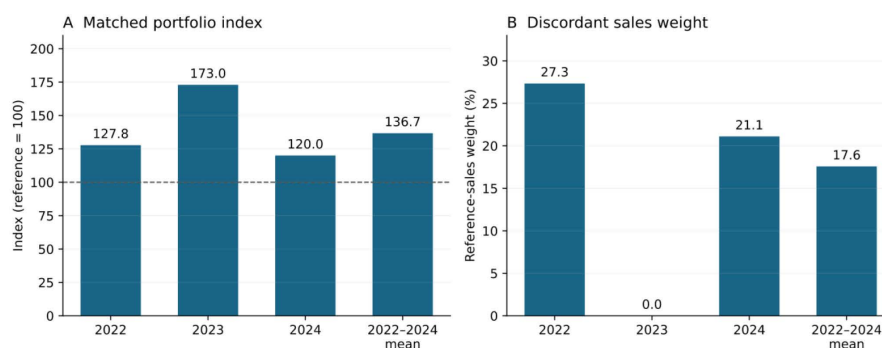


Figure 4. Baseline sensitivity of the 2025 matched portfolio. Panel A reports the index for each reference; panel B reports discordant reference-sales weight. The 2023 comparison has $Q = 0$ despite substantial dispersion. Source: **Table 6**.

5.6. Robustness within the Stated Reference

For the 2022 reference, every 2025 single-category omission preserves an above-reference matched nominal-sales aggregate and positive Q . After renormalization, P ranges from 119.7 to 138.4, D from 35.9 to 45.4, and Q from 13.6% to 37.5%. This particular endpoint conclusion does not depend on either discordant category alone. Earlier years are less stable: removing energy meters eliminates 2023 disagreement, and removing power transformers takes the 2024 matched index just below 100. Those results are retained in S1 rather than generalized from the stronger 2025 endpoint.

Weighted mean absolute deviation rises from 11.94 to 25.61 to 35.40 index points across 2023-2025. Weighted Gini rises from 0.122 to 0.153 to 0.177, and Theil T from 0.036 to 0.044 to 0.052. These descriptive alternatives support the reported increase in spread. Their agreement adds no new observations or sampling precision.

The full 5% perturbation box places P between 115.6 and 141.2. Even at their highest permitted indices, power transformers reach only 79.3 and switchgear 89.0. Both remain below 100 while the matched aggregate stays above it. Positive directional disagreement therefore persists throughout this stipulated box, including correlated perturbations within the same bounds. Distribution transformers can cross below 100 under some permitted combinations, changing the extent of disagreement.

In the 50,000-draw 5% scenario, the 1st-99th percentile ranges are 122.9 - 132.8 for P , 37.1 - 45.5 for D and 26.2% - 44.9% for Q . Every draw retains an above-reference nominal-sales aggregate and positive Q , consistent with the deterministic bounds. The 2% scenario yields the same directional conclusion. These results establish robustness to the specified amount changes; they do not address category redefinition, an incorrect reporting basis or reference-year choice.

At the observed values, Q is unchanged for a neutral-band width below 19.484 index points. At that width switchgear enters the neutral band. The aggregate itself becomes neutral at 27.774 points, after which Q is undefined under the protocol. These are arithmetic thresholds, not recommended managerial tolerances.

6. Interpretation and Decision Use

6.1. What Can Be Inferred from the Case

The empirical result is specific: PEL's above-reference 2025 nominal-sales aggregate relative to 2022 does not describe the direction of every matched category. Dispersion, discordant sales weight and shortfall depth reveal different aspects of that mismatch. The trajectory check adds the power-transformer reversal, while rebasing separates recovery from the 2023 low from regain of the 2022 level.

This extends the practical use of disaggregation by requiring the analyst to state which lower-level interpretation the aggregate is meant to support. It remains a modest methodological contribution. Existing measures already quantify weighted spread and shortfall; combining them does not establish a new theory of

corporate resilience. The value of the protocol is that its calculations, denominators and permissible statements can be checked from a small, visible input table.

Several explanations remain compatible with the observed paths. PACRA's contrasting division commentary cautions against interpreting all nominal growth as quantity growth. Different customer markets or contract schedules could also contribute. The briefing supplies no matched category-level price series or order-timing panel with which to rank these explanations. Neither manufacturing localization nor technology-partnership effects can be inferred from the sales pattern.

6.2. Linking Information to a Decision

The audit flags where a decision requires closer examination; it does not select a capacity level or allocate capital. In a hypothetical planning exercise, a manufacturer applying company-wide sales growth to every production line could expand a category whose own sales remain below baseline. The appropriate follow-up would examine its order book, utilization and contribution margin before committing equipment. The sales audit identifies the category to examine, not the correct investment.

A procurement decision illustrates a different use. A multi-year materials agreement based on an unusually strong project year could create excess commitments if the following year's orders fall. The relevant review would compare contract schedules and committed demand. PEL's observed transformer reversal motivates such a question, but no claim is made that PEL entered an unsuitable agreement.

Information is worth obtaining when the expected reduction in decision loss exceeds its cost (Howard, 1966). For a simplified binary decision, let π be the probability of a consequential error, M its loss, r the fraction of that expected loss a review can avert, and C the review cost. Under the stated assumptions, review is beneficial when Equation (6) holds. Unlike a perfect-information shortcut, this expression allows the review to be incomplete or ineffective. It also requires that delay and implementation costs be included in C where relevant.

$$r\pi M > C \quad (6)$$

For illustration only, if review costs 0.5% of a commitment, a wrong decision loses 10%, and review can avert half of that expected loss, the break-even error probability is 10%. With complete prevention it would be 5%. PRA supplies none of these decision parameters. They must come from the organization's decision setting. Table 7 links the observed diagnostic states to questions that additional information could resolve.

Table 7. Diagnostic states and the evidence needed for a decision.

Observed state	Supported interpretation	Follow-up evidence
Q = 0, with limited spread	No observed category is strictly opposite to the aggregate; neutral categories may be present.	Check neutral-category status and whether the measure and window suit the decision.
Q = 0, with substantial spread	Absence of opposite directions does not imply similar magnitudes.	Inspect category scale, prices, volumes and margins.

Continued

Above-reference nominal-sales aggregate and $Q > 0$	The aggregate direction cannot describe every observed category.	Review discordant categories before a common resource decision.
Regain followed by reversal	The observed regain did not persist.	Examine order timing and additional reporting periods.
Neutral aggregate or unclear coverage	A directional summary is undefined or its scope uncertain.	Inspect categories directly and reconcile definitions.

Materiality and review costs depend on the decision. These are prompts for investigation, not estimates of optimal resource allocations.

7. Limitations and Further Research

The data constrain the meaning of the result. The category panel comprises nominal gross sales over four years, with no matched prices, sold quantities, margins, order books or service outcomes. Separate corporate disclosures may contain selected production or capacity statistics, but those do not provide an automatically aligned quantity series for the eight sales rows. A low nominal-sales index cannot identify impaired productive capability, and a high one cannot establish that capability has recovered.

The reference is another substantive limitation. A single project-heavy year may provide an unusual benchmark. The alternative comparisons demonstrate that the direction of the conclusion changes when the 2023 low becomes the reference. A longer history would support a more defensible choice of normal operating conditions, although it would still require an explicit decision about which comparison matters. The present perturbation checks cannot substitute for that evidence.

The categories themselves are reporting aggregates. Other appliances may contain products with different growth paths, and changes within any category are unobserved. Arithmetic coverage near 100% therefore does not prove product-level completeness or stable economic composition. Future replication should document category definitions, reclassifications, gross-versus-net reconciliation and price-quantity relationships before extending the protocol to finer claims.

External and decision validity remain open. PEL was selected because the available data make divergence observable; one case cannot establish prevalence, predictive usefulness or a typical managerial payoff. A multi-firm panel could examine how often Q and G add information beyond conventional segment growth tables and whether the added information changes decisions. Such a study should compare prespecified decision rules, record the costs of reviewing constituents and assess outcomes on firms or periods not used to develop the rules.

Finally, the protocol may be unsuitable where units are incomparable, reference sales are zero, reporting periods differ materially or category definitions cannot be reconciled. New and discontinued businesses need explicit treatment outside a positive-reference matched panel. When the aggregate is near the selected neutral band, direct category inspection is preferable to assigning it a forced direction. Source links are recorded with retrieval dates, but the supplementary package

guarantees calculation from its supplied inputs rather than permanent access to third-party documents.

8. Conclusion

PEL's 2025 company gross sales were 26.5% above their 2022 level, yet power transformers and switchgear remained below that reference. They represented 27.3% of reference-year matched sales and a combined nominal shortfall of PKR 4.396 billion. The finding survives alternative weighting, each single-category omission and the stated 5% perturbation bounds.

It also has a clear limit: all eight categories exceed their 2023 values in 2025. Portfolio Recovery Asymmetry is consequently a property of a specified portfolio, measure, reference and endpoint. The audit makes those choices visible and tests the category-level statements a headline total is being asked to support. Where the statements fail, the next step is targeted examination of the affected categories using evidence appropriate to the decision.

Ethics

The research examines public organizational disclosures and official statistics. It involved no recruitment, interviews or participant-level personal information.

Data Availability

Supplementary Material S1 accompanies this manuscript. It provides the matched sales inputs, source ledger, reproducible Python analysis, diagnostic outputs, publication figures and checksums. The data are transcribed public disclosures, not a proprietary or independently audited category dataset.

Generative AI Assistance

OpenAI ChatGPT assisted with language and structural revision, checking calculations, preparing code and figures, and reviewing reference consistency. The author is responsible for reviewing the final text, source use, calculations and interpretations before submission. AI-generated text is not treated as empirical evidence.

Conflicts of Interest

The author previously held senior regional commercial responsibilities at Panasonic in the Middle East and Africa. This professional proximity may have influenced case selection or interpretation. The analysis uses public documentary inputs and does not use PEL internal records or non-public Panasonic information. Accounting calculations are separated from proposed strategic explanations. The author declares no additional competing interests.

References

Ali, A., Mahfouz, A., & Arisha, A. (2017). Analysing Supply Chain Resilience: Integrating

- the Constructs in a Concept Mapping Framework via a Systematic Literature Review. *Supply Chain Management: An International Journal*, 22, 16-39. <https://doi.org/10.1108/scm-06-2016-0197>
- Amit, R., & Livnat, J. (1989). Efficient Corporate Diversification: Methods and Implications. *Management Science*, 35, 879-897. <https://doi.org/10.1287/mnsc.35.7.879>
- Berger, P. G., & Hann, R. (2003). The Impact of SFAS No. 131 on Information and Monitoring. *Journal of Accounting Research*, 41, 163-223. <https://doi.org/10.1111/1475-679x.00100>
- Botosan, C. A., & Stanford, M. (2005). Managers' Motives to Withhold Segment Disclosures and the Effect of SFAS No. 131 on Analysts' Information Environment. *The Accounting Review*, 80, 751-772. <https://doi.org/10.2308/accr.2005.80.3.751>
- Bruckler, M., Wietschel, L., Messmann, L., Thorenz, A., & Tuma, A. (2024). Review of Metrics to Assess Resilience Capacities and Actions for Supply Chain Resilience. *Computers & Industrial Engineering*, 192, Article ID: 110176. <https://doi.org/10.1016/j.cie.2024.110176>
- Christopher, M., & Peck, H. (2004). Building the Resilient Supply Chain. *The International Journal of Logistics Management*, 15, 1-14. <https://doi.org/10.1108/09574090410700275>
- Ettredge, M. L., Kwon, S. Y., Smith, D. B., & Zarowin, P. A. (2005). The Impact of SFAS No. 131 Business Segment Data on the Market's Ability to Anticipate Future Earnings. *The Accounting Review*, 80, 773-804. <https://doi.org/10.2308/accr.2005.80.3.773>
- Fine, C. H., & Freund, R. M. (1990). Optimal Investment in Product-Flexible Manufacturing Capacity. *Management Science*, 36, 449-466. <https://doi.org/10.1287/mnsc.36.4.449>
- Flyvbjerg, B. (2006). Five Misunderstandings about Case-Study Research. *Qualitative Inquiry*, 12, 219-245. <https://doi.org/10.1177/1077800405284363>
- Han, Y., Chong, W. K., & Li, D. (2020). A Systematic Literature Review of the Capabilities and Performance Metrics of Supply Chain Resilience. *International Journal of Production Research*, 58, 4541-4566. <https://doi.org/10.1080/00207543.2020.1785034>
- Howard, R. (1966). Information Value Theory. *IEEE Transactions on Systems Science and Cybernetics*, 2, 22-26. <https://doi.org/10.1109/tssc.1966.300074>
- Ivanov, D. (2026). Comparative Analysis of Product and Network Supply Chain Resilience. *International Transactions in Operational Research*, 33, 2358-2376. <https://doi.org/10.1111/itor.13612>
- Pak Elektron Limited (2026). *PEL Investor Briefing [Corporate Presentation]*. Pakistan Stock Exchange. <https://dps.psx.com.pk/download/document/277427.pdf>
- Pakistan Bureau of Statistics (2024). *Production Data for Computation of Quantum Index of Large Scale Manufacturing Industries (QIM), 2023-24 [Table 2]*. <https://www.pbs.gov.pk/wp-content/uploads/2020/07/Table-2-23-24-1.pdf>
- Pakistan Stock Exchange (n.d.). *Pak Elektron Limited (PAEL) [Company Profile]*. <https://dps.psx.com.pk/company/PAEL>
- Pettit, T. J., Fiksel, J., & Croxton, K. L. (2010). Ensuring Supply Chain Resilience: Development of a Conceptual Framework. *Journal of Business Logistics*, 31, 1-21. <https://doi.org/10.1002/j.2158-1592.2010.tb00125.x>
- Ponomarev, S. Y., & Holcomb, M. C. (2009). Understanding the Concept of Supply Chain Resilience. *The International Journal of Logistics Management*, 20, 124-143. <https://doi.org/10.1108/09574090910954873>
- Sakhartov, A. V. (2022). Corporate Diversification and Risk: Portfolio Effects and Resource Redeployability. *Strategy Science*, 7, 317-329. <https://doi.org/10.1287/stsc.2021.0154>
- The Pakistan Credit Rating Agency Limited (2025). *Pak Elektron Limited: Rating Report*.

<https://www.pacra.com/api/rating-report/MTQ1MTc%3D>

Yin, R. K. (2018). *Case Study Research and Applications: Design and Methods* (6th ed.). SAGE Publications.