On the impact of inventory accuracy improvements on sales

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About us

Christoph Glock

- Professor Chair: Technical University of Darmstadt, Germany
- Specialises in Inventory Optimisation and Warehousing Management

Yacine Rekik

- Professor Chair: EM-Lyon Business School, France
- Specialises in Inventory Optimisation and Tracking (e.g. RFID) Technologies

Aris A. Syntetos

- Panalpina Chaired Professor: Cardiff Business School, Cardiff University, UK
- Specialises in Statistical Forecasting, Demand Classification & Inventory Optimisation.

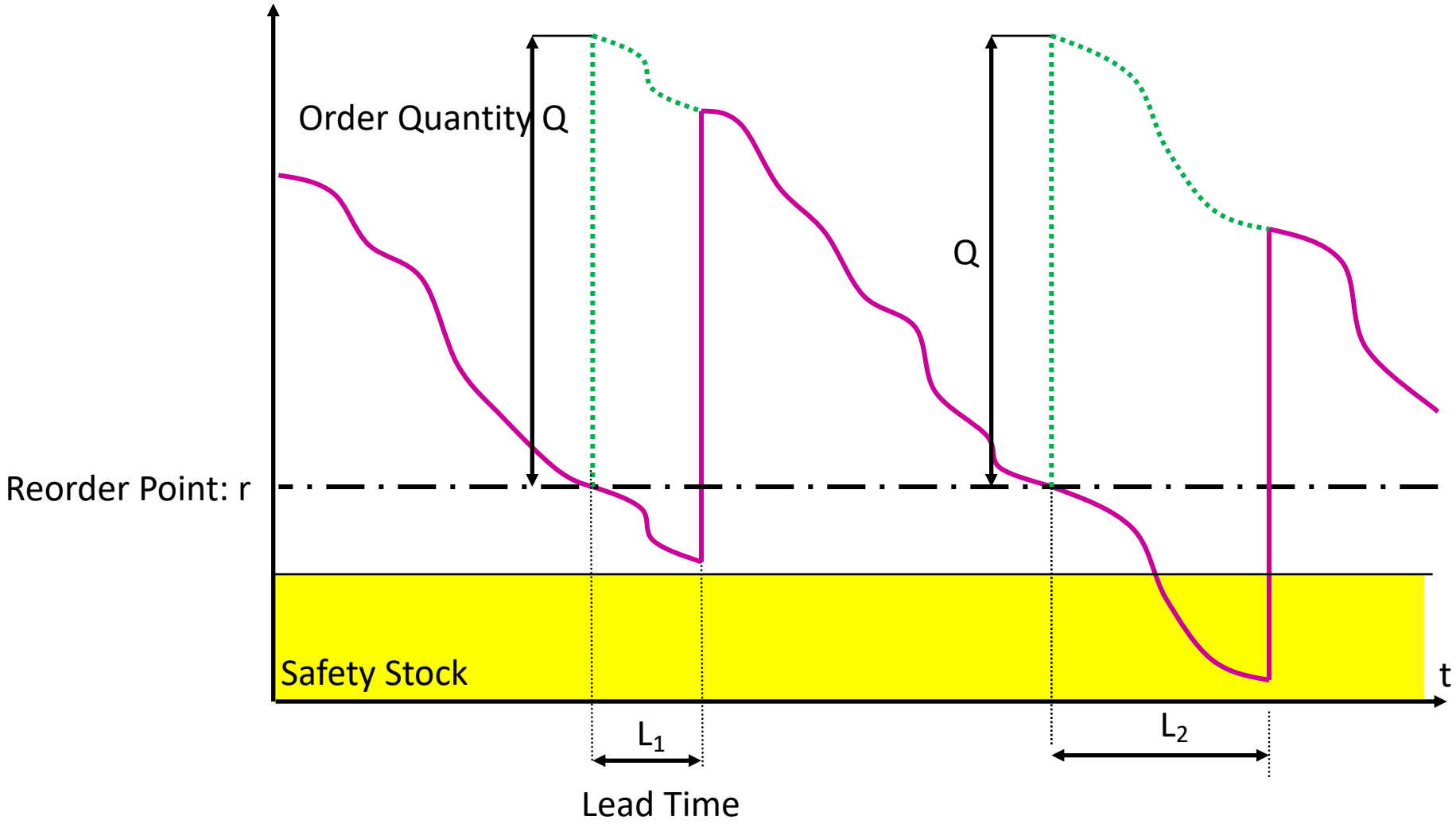
Background and objectives

- **Inventory inaccuracies: major issue in retailing and apparel industry.**
- **Physical stock is (typically) less than what we think it is.**
  - Most reasonable assumption in retailing. Generally, stores are negative in terms of stock.
  - Thus, reconciling inventories may only lead to an increase in sales.
  - (*We will see later that positive stock discrepancies are also possible, still leading though to reduced sales!*)
- **The problem has been established; we are not here to argue for its existence.**

Background and objectives

- **But rather:**
  - Assess the implications of the problem, or rather the implications of fixing the problem (phase 1);
  - Assess alternative ways of fixing the problem itself (phase 2).
- **Phase 1: What is the impact on (increased) sales if inventory accuracy is increased by x%?**
  - How does inventory accuracy develop over time after a stock take?
  - Is there an optimal number of stock takes? Do too many stock takes negatively influence inventory accuracy?
  - What exactly constitutes this problem of inventory discrepancies?
- **Phase 2 (upon clearly establishing the implications): what are the strategies to be employed (algorithmic driven, new identification technologies, counting, etc.) to fight the route causes of the problem?**

Error free (*r,Q*) inventory policy



Impact of errors on the (*r,Q*) inventory policy

This is the **visible** stock behavior: POS (Real Demand) + Replenishment

Expected error free stock level

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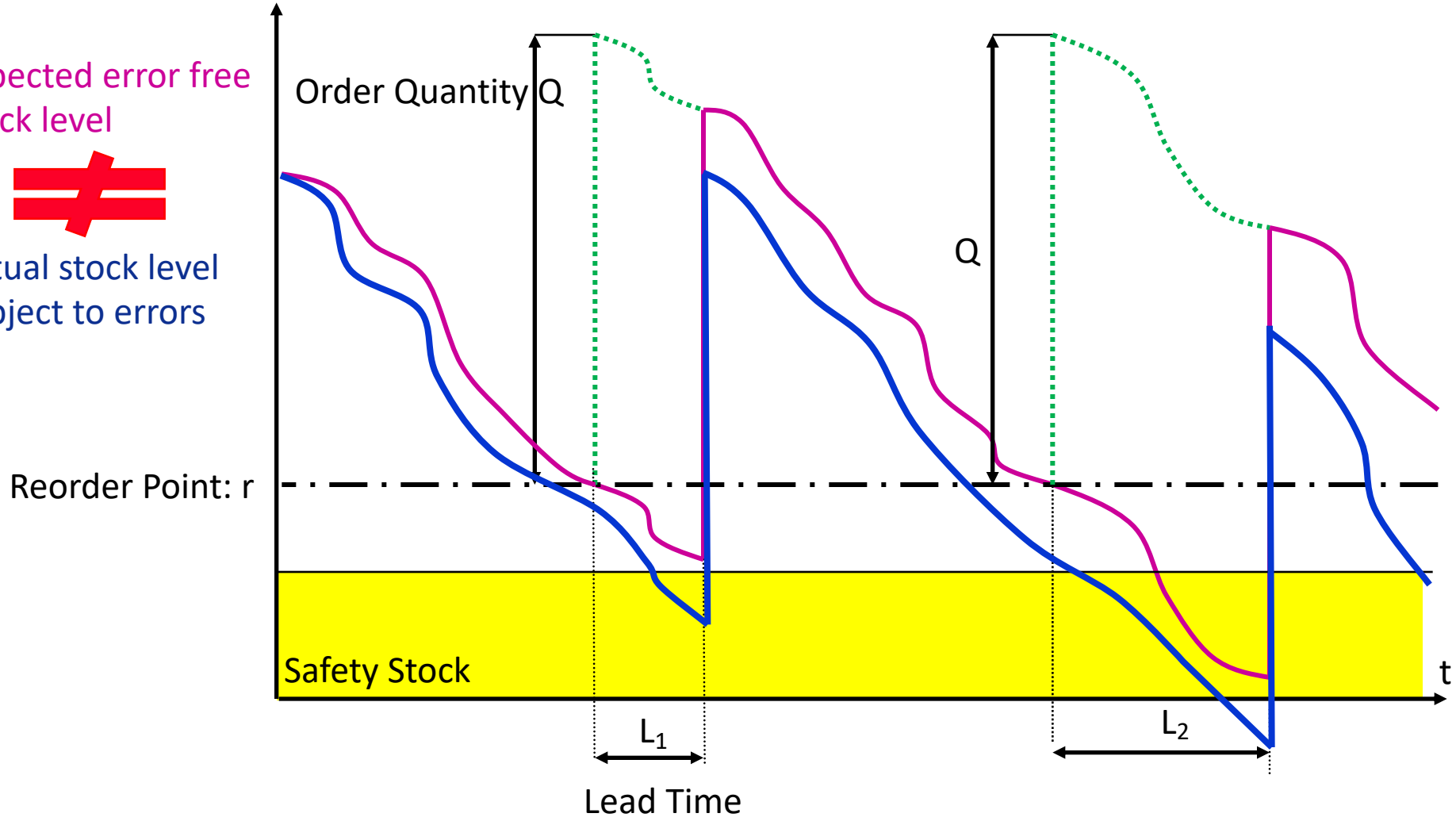
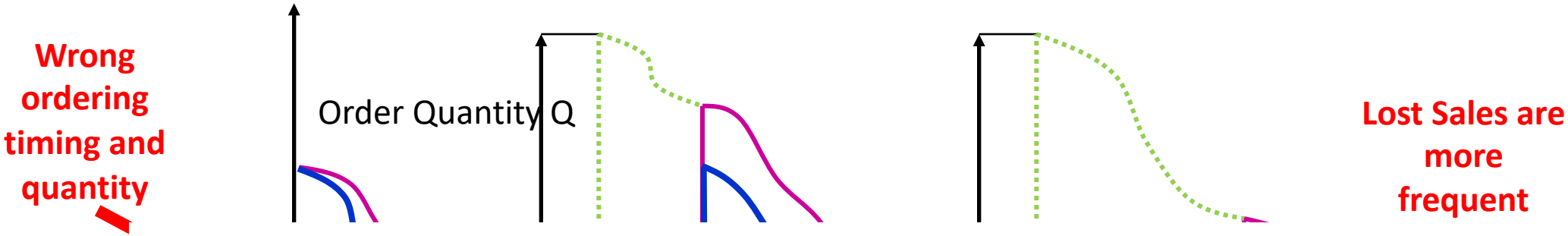
Actual stock level subject to errors



This is the **invisible** stock behavior: POS (Real Demand) + Replenishment **+ Skrink (Ghost Demand)**

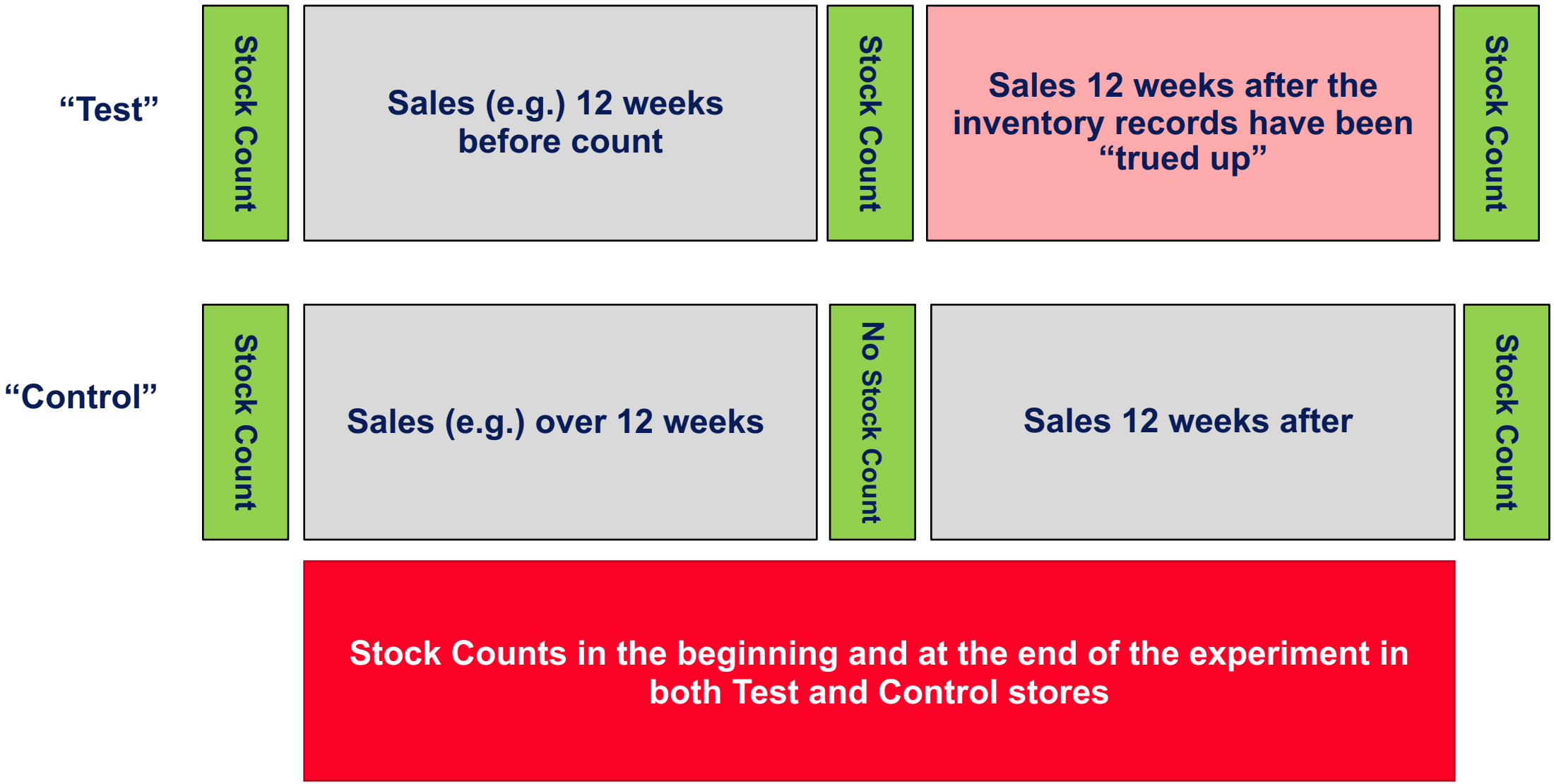
Impact of errors on the (*r*,*Q*) inventory policy



Errors act as "ghost" demand decreasing the stock level without generating a revenue:

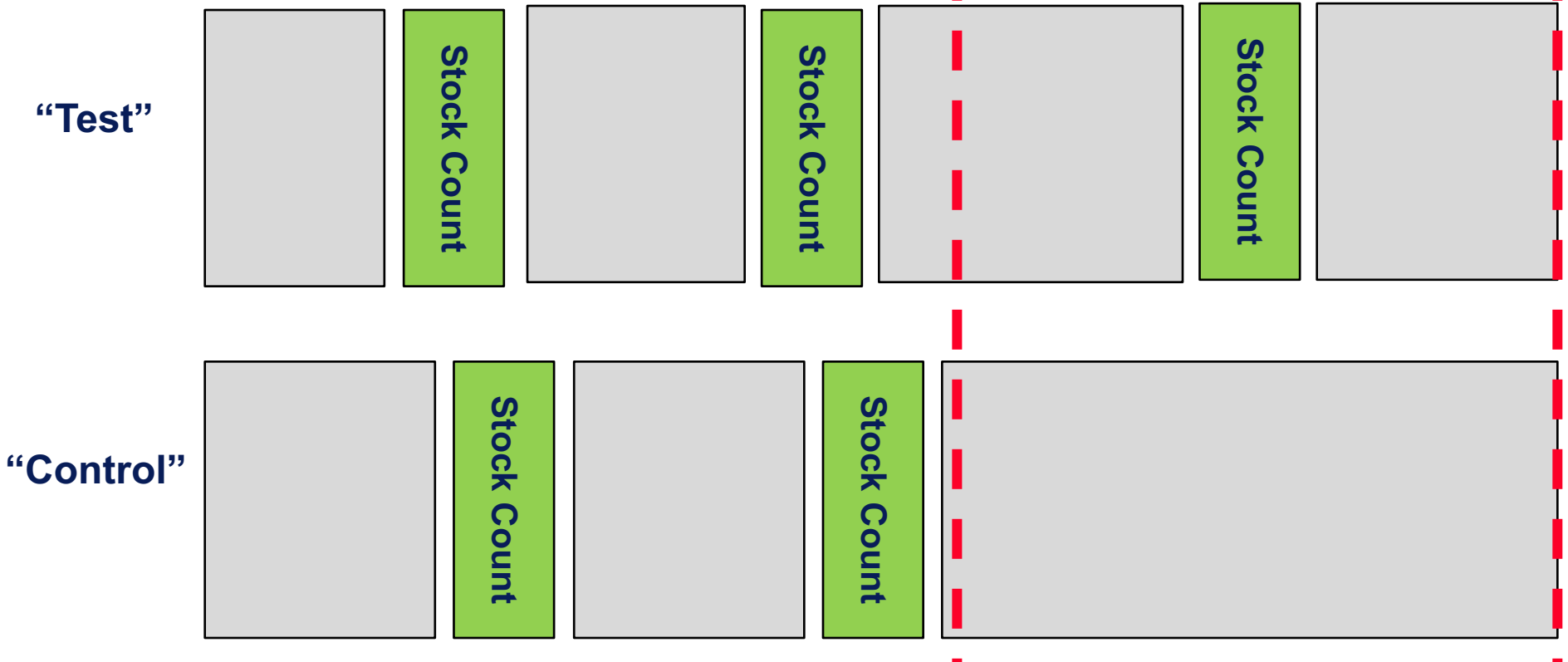
Inventory is controlled based on some visible wrong information, whereas sales are satisfied based on some correct but invisible information

Experiment I: original / ideal experiment



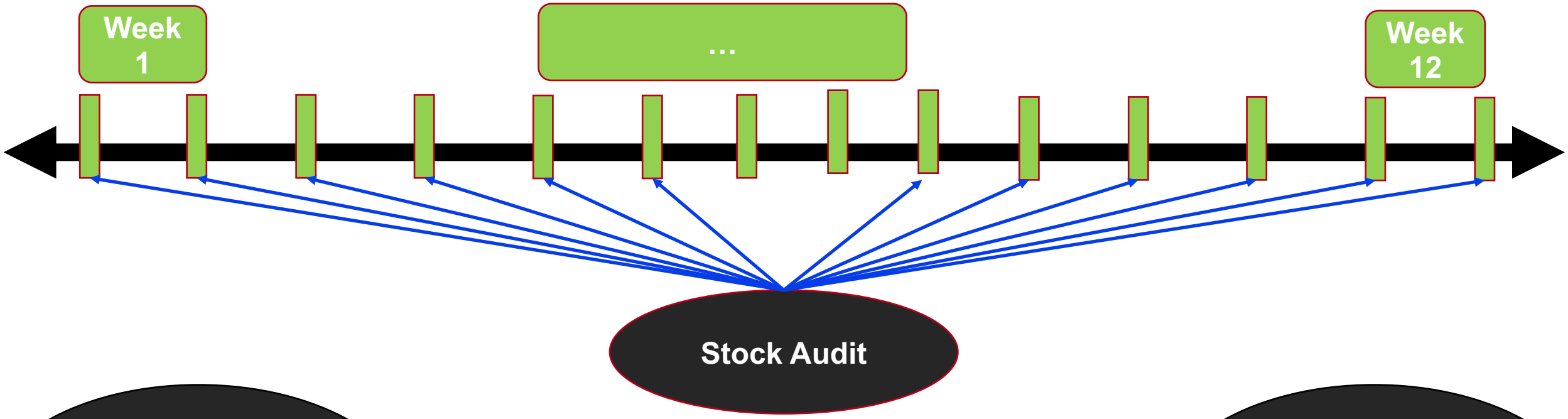
Experiment II: retailers with frequent period

In addition, several cases of Experiment I can be deduced from Experiment II



A comparison of sales on a same period of time, with different stock audit tasks in Test and Control stores

Experiment III: weekly stock audit



Computer Discrepancy: what was found vs. what is shown in the computer before the audit

Computer and Counted Physical stock during the audit are contrasted with what they should be (last counted physical stock + stock input – stock output)

Physical Discrepancy: what was found vs. what should be in the stock given last week's audit and stock movements

Empirical analysis

- **Currently working with 8 Retailers across Europe:**
  - NDAs have been signed and we are in various phases with regards to data transfer and analysis;
  - 4 Grocery retailers (supermarkets), 2 Apparel retailers and 2 other;
  - Customised reports to be produced for all participating retailers.
- **Initial results:**
  - 4 Grocery retailers (a, b, c and d)
  - +600,000 SKUs
  - 80 stores examined (40 test VS. 40 control)
  - We are still working on the best possible way to present descriptive statistics without unintentionally disclosing individual retailer information (and identity)
  - We present the (initial) results for the 4 Grocery retailers.

PART I: GENERAL INSIGHTS

(apply to all retailers)

Result 1

Independently of the experimental setting, inventory record inaccuracies are an important issue for all participating companies: across all grocery retailers, between 46% and 73% of the audited SKUs are subject to inaccuracies even if a stock take is performed very frequently (as in Experiment II, or even each week as in Experiment III)

Result 1

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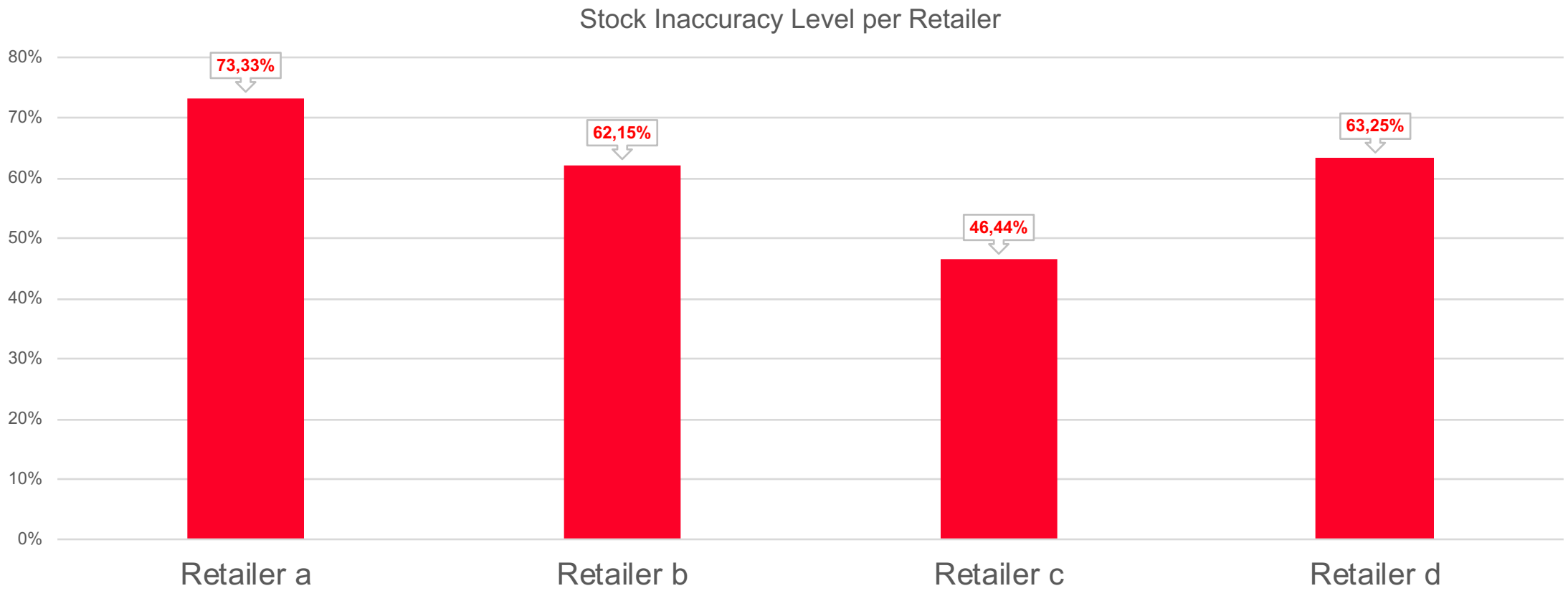
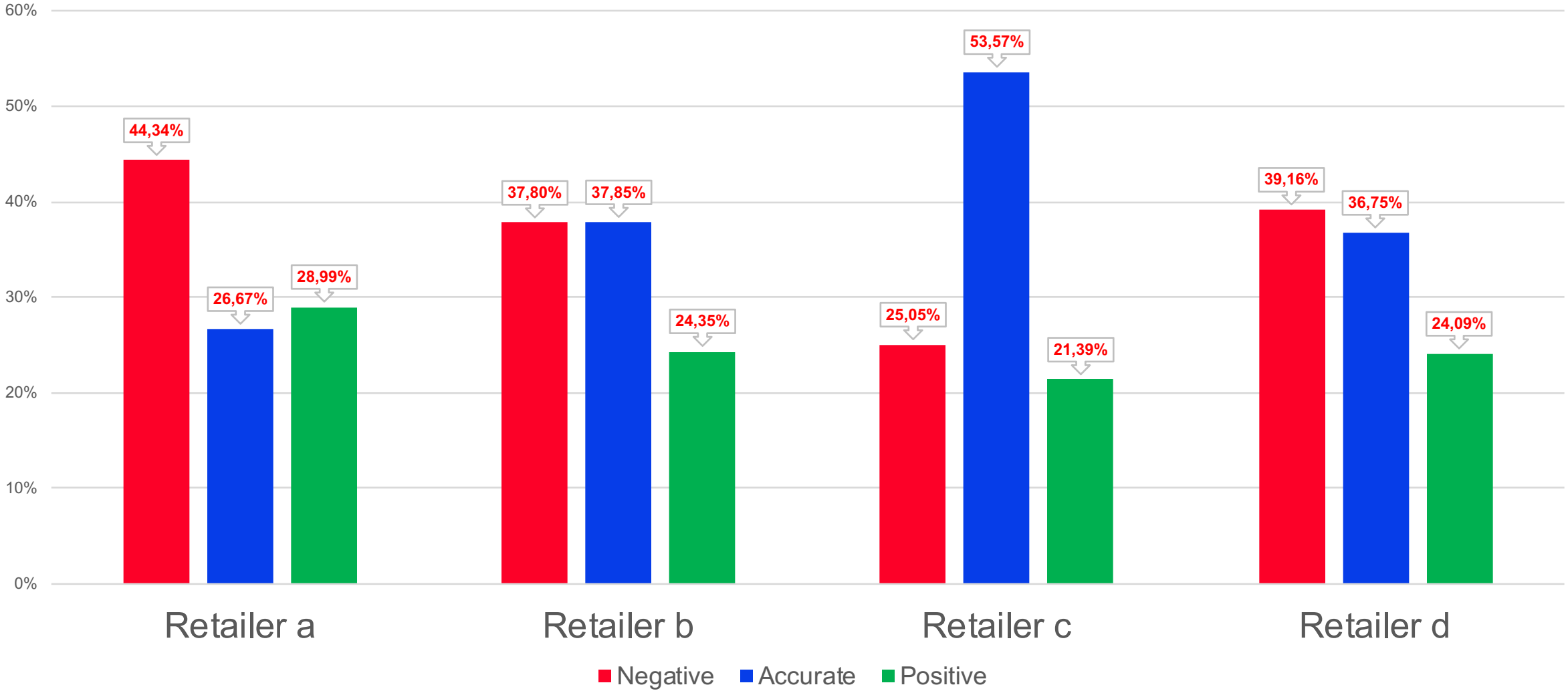


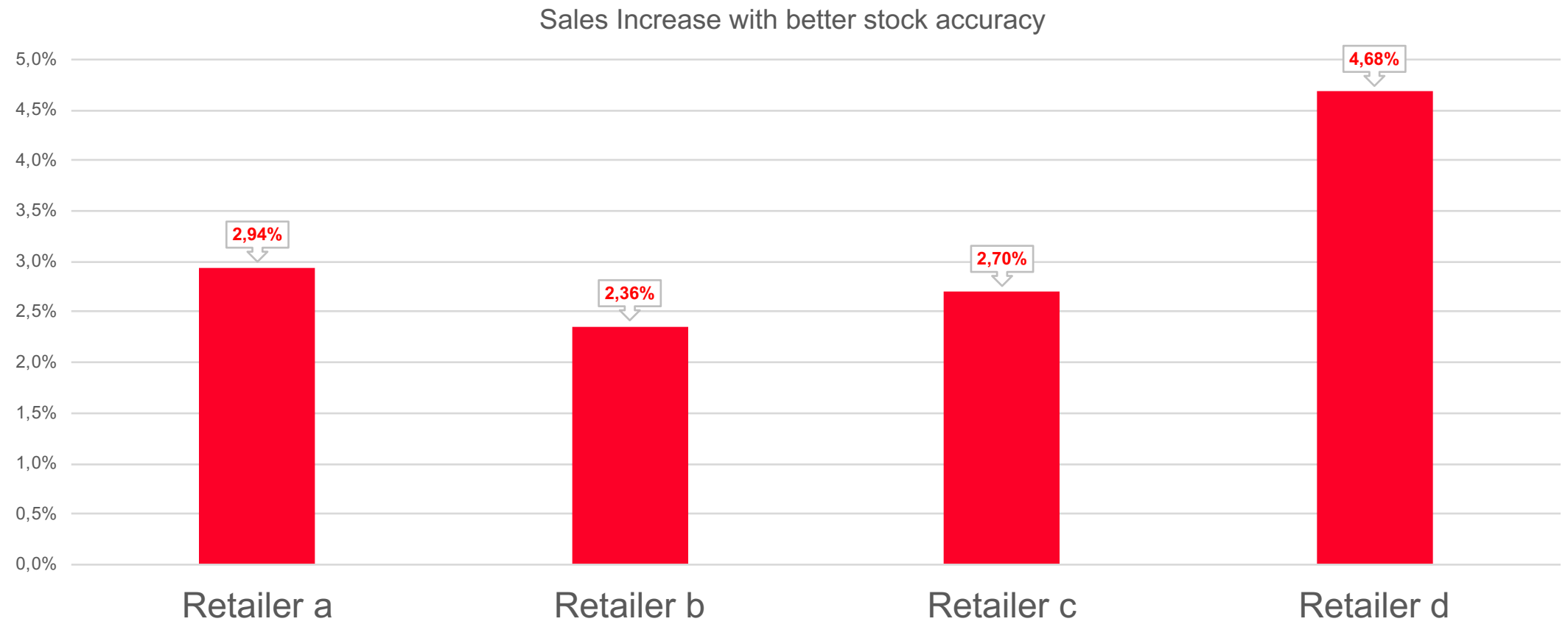
Result 1: inventory record inaccuracies constitute an important issue

It is not only a matter of shrinkage: positive discrepancy is not negligible and generally is caused by Information System (IS) manipulations and errors

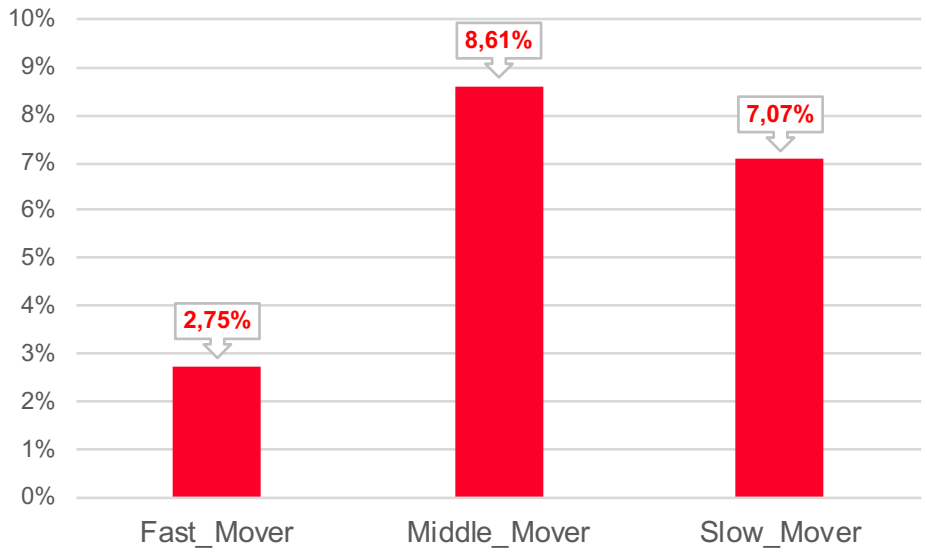


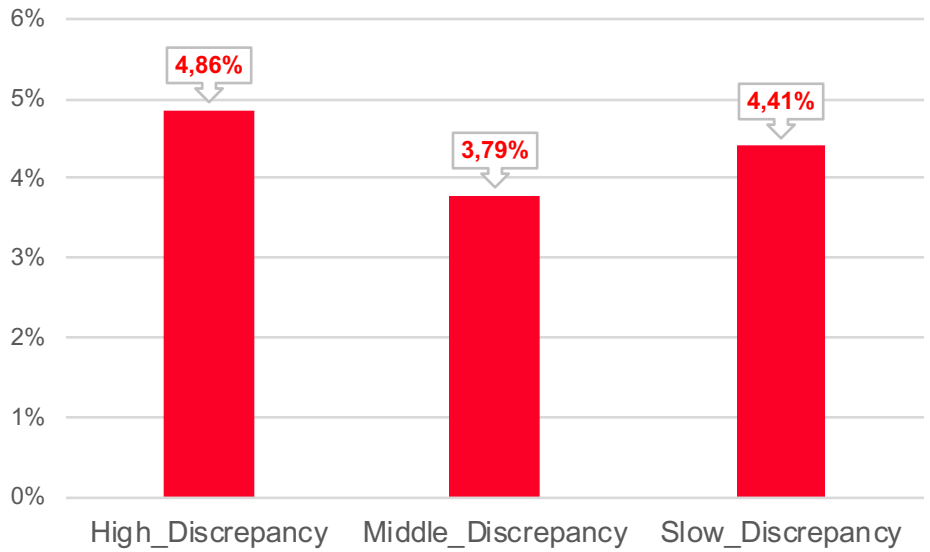
Result 2

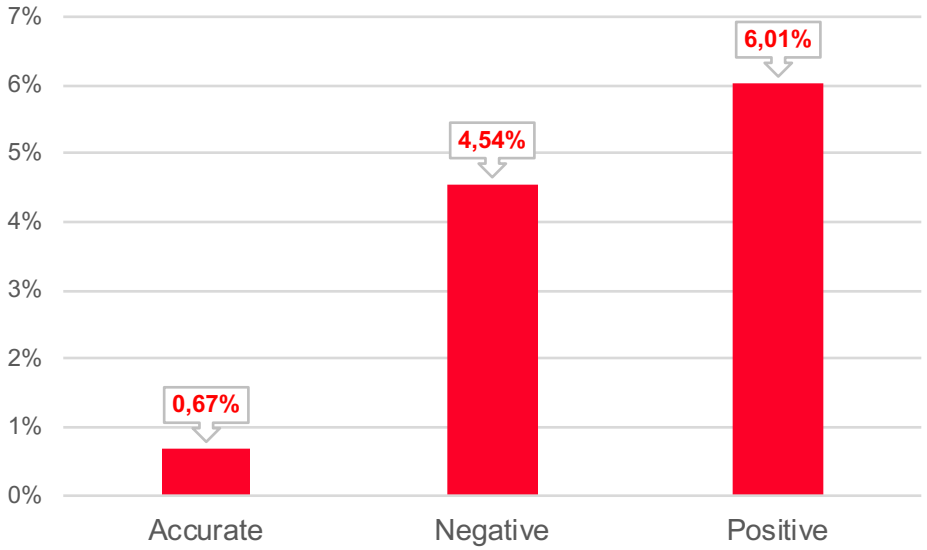
Inventory record accuracy leads to an increase in sales turnover between 2.36% and 4.68% at the retailers.



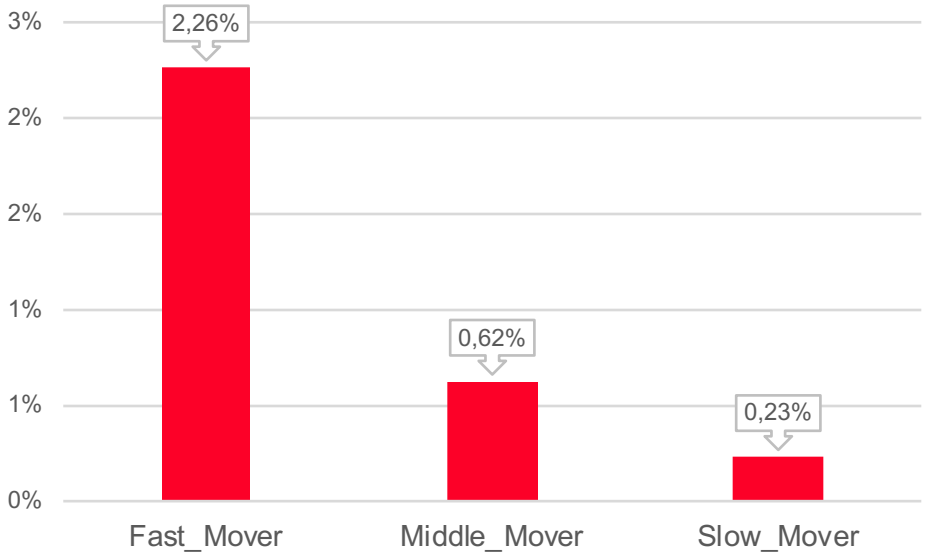
Retailer a – sales increase of 2.94% in the Test stores comes from:

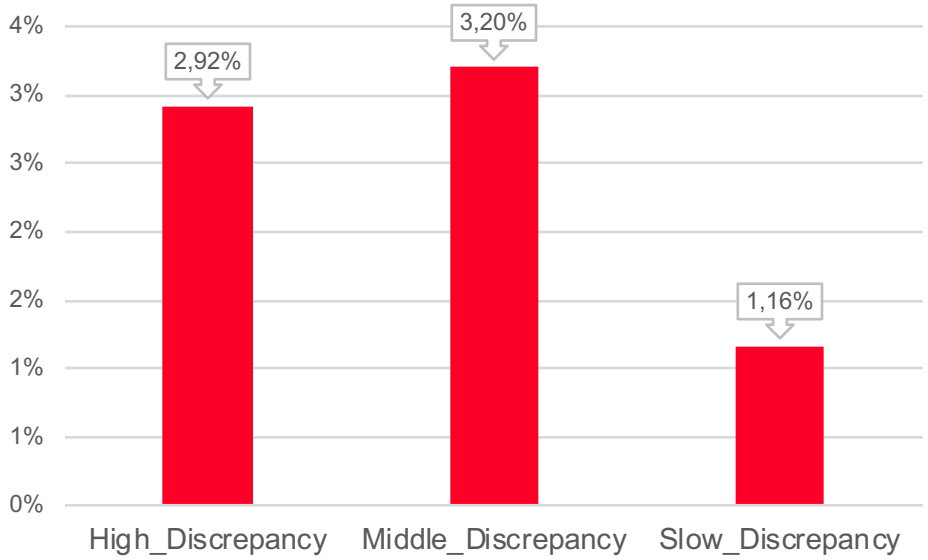


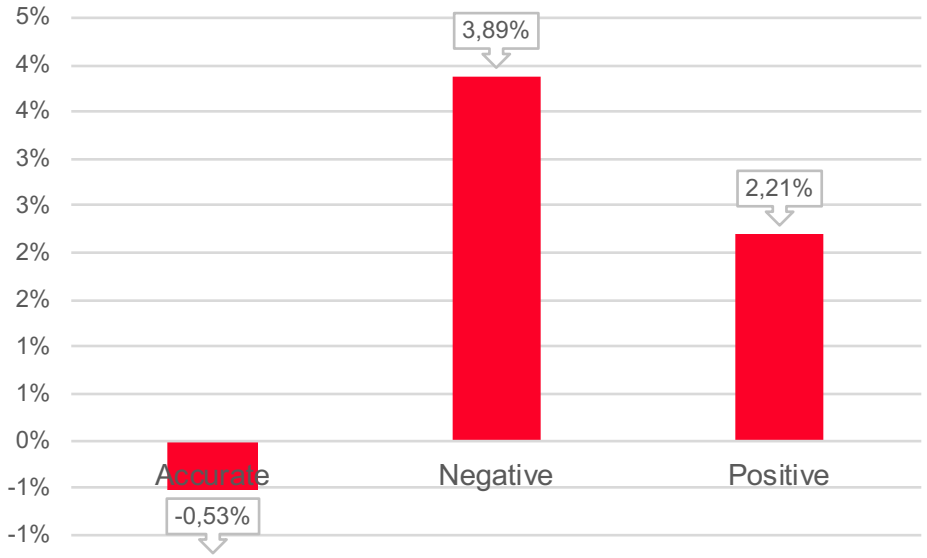




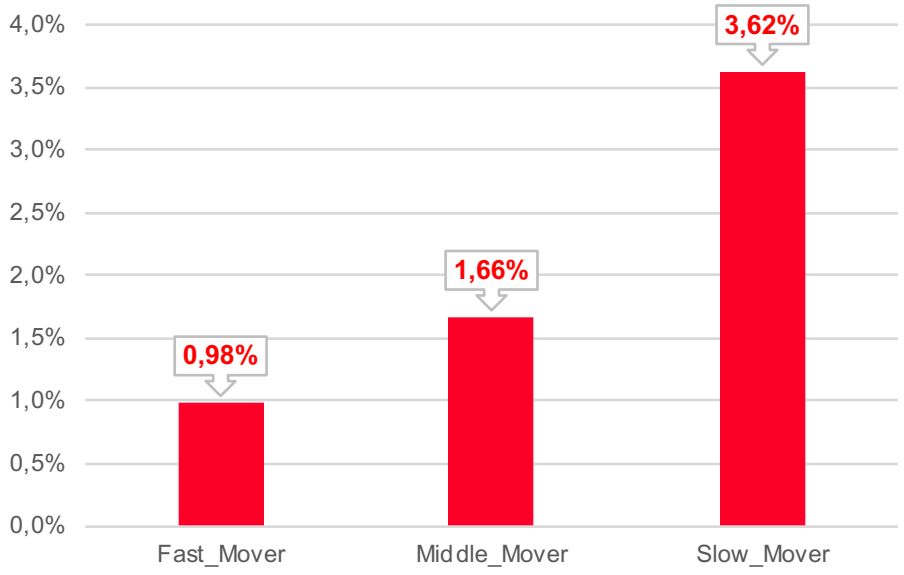
Retailer b – sales increase of 2.36% in the Test stores comes from:

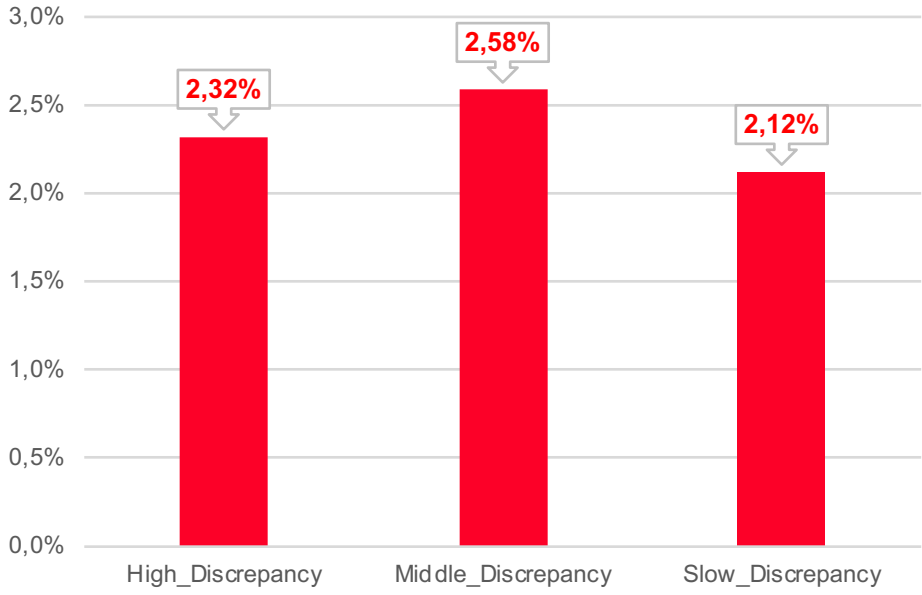


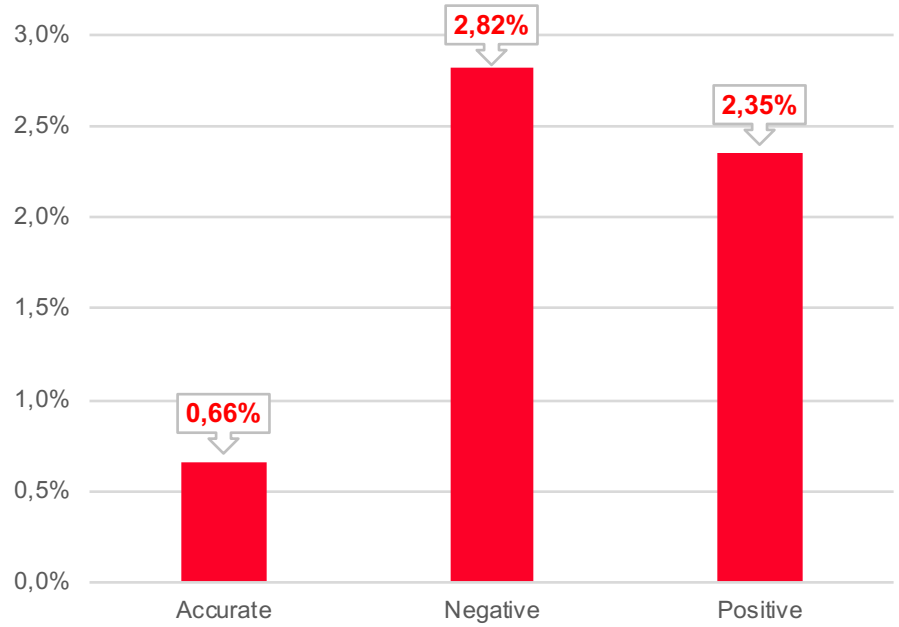




Retailer c – sales increase of 2.70% in the Test stores comes from:

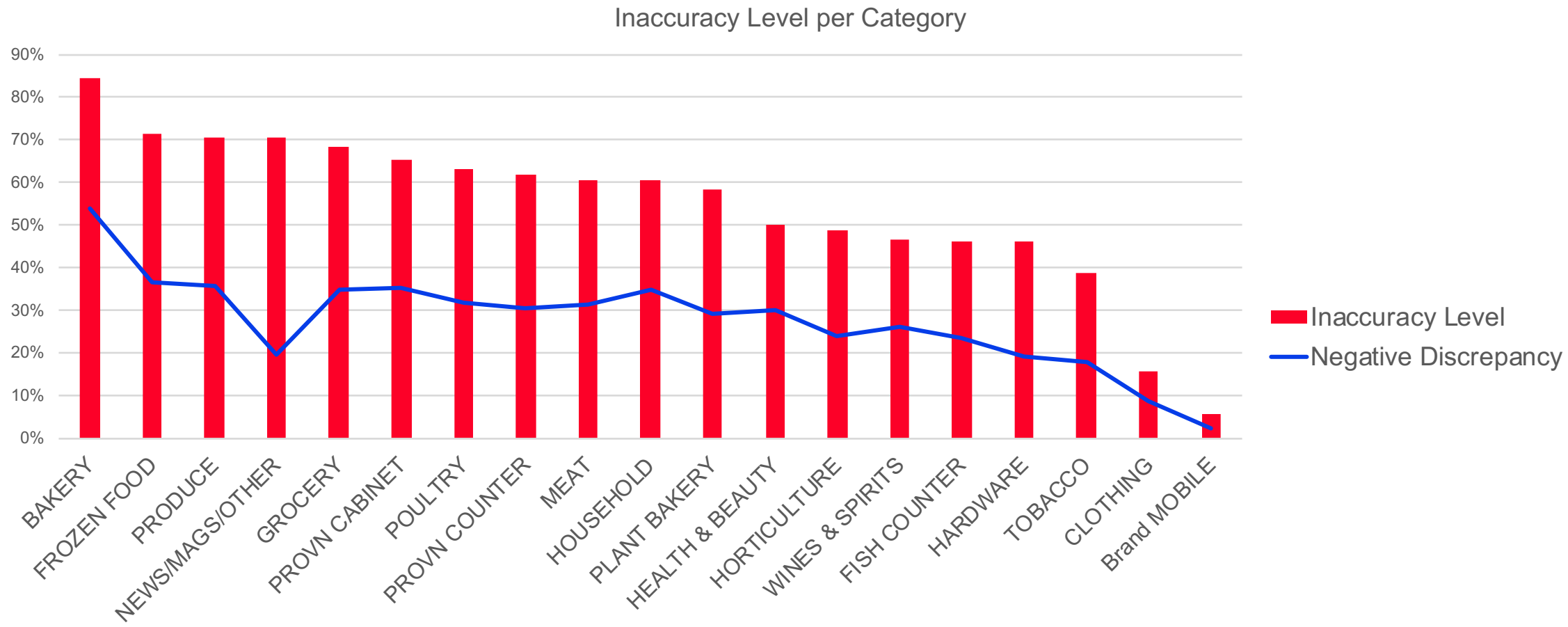






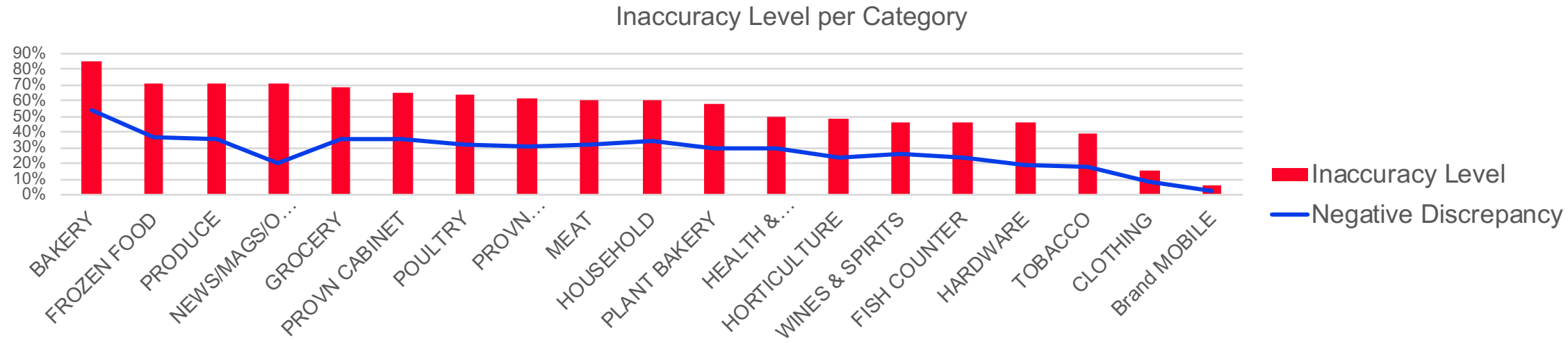
Retailer c: inaccuracy level per category

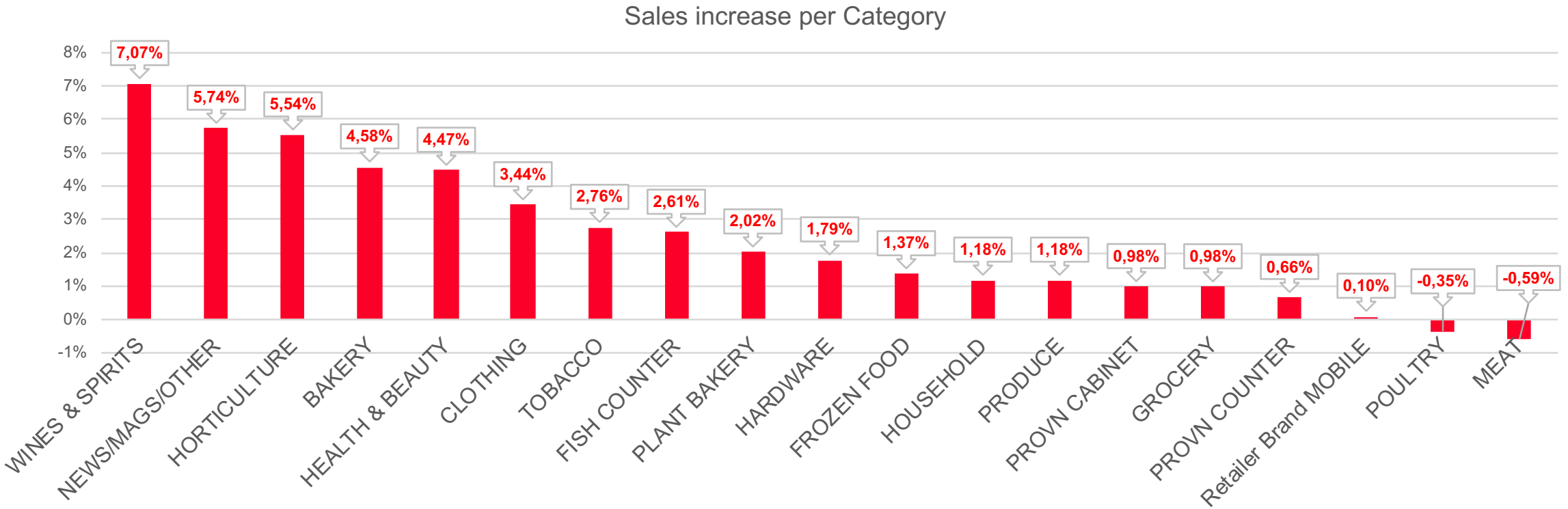
- **SKU Categories subject to both positive and negative discrepancies**



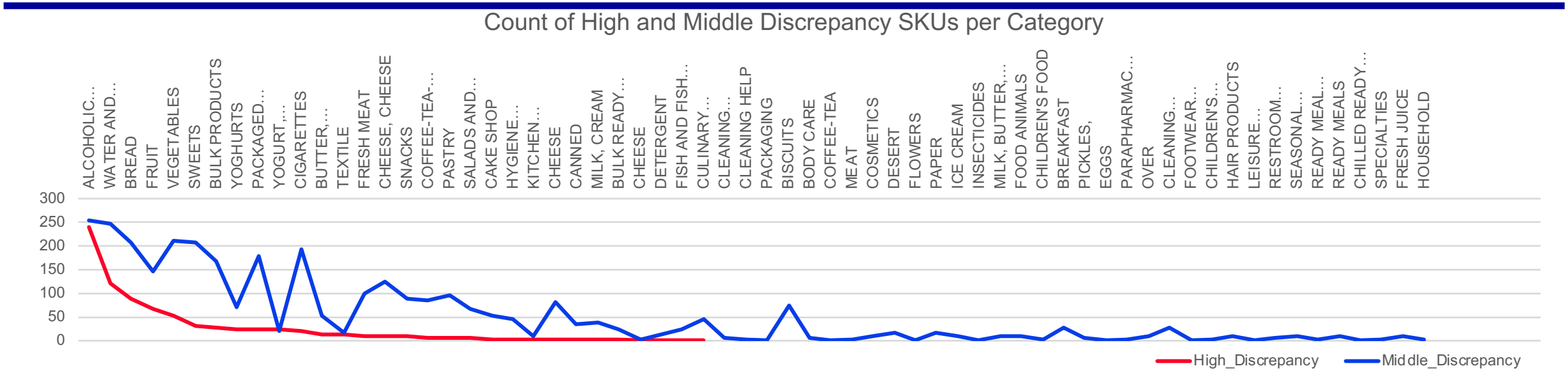
- **Can we infer that the sales increase offered by better stock accuracy is proportional to the inaccuracy level?**

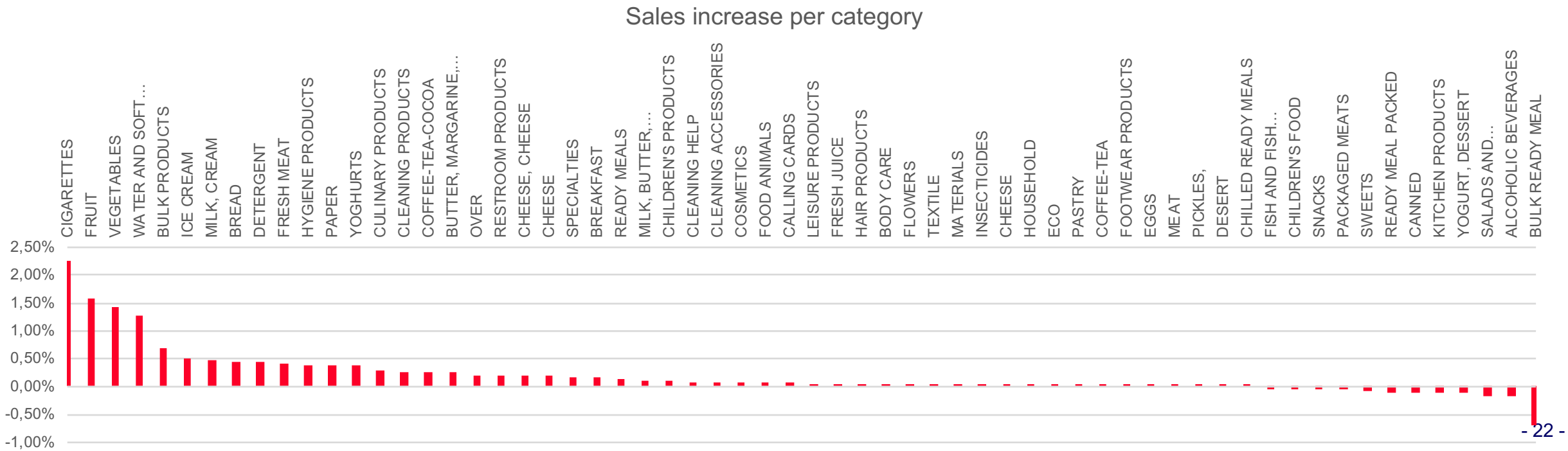
Retailer c: sales increase per category





Retailer a: sales increase per Category



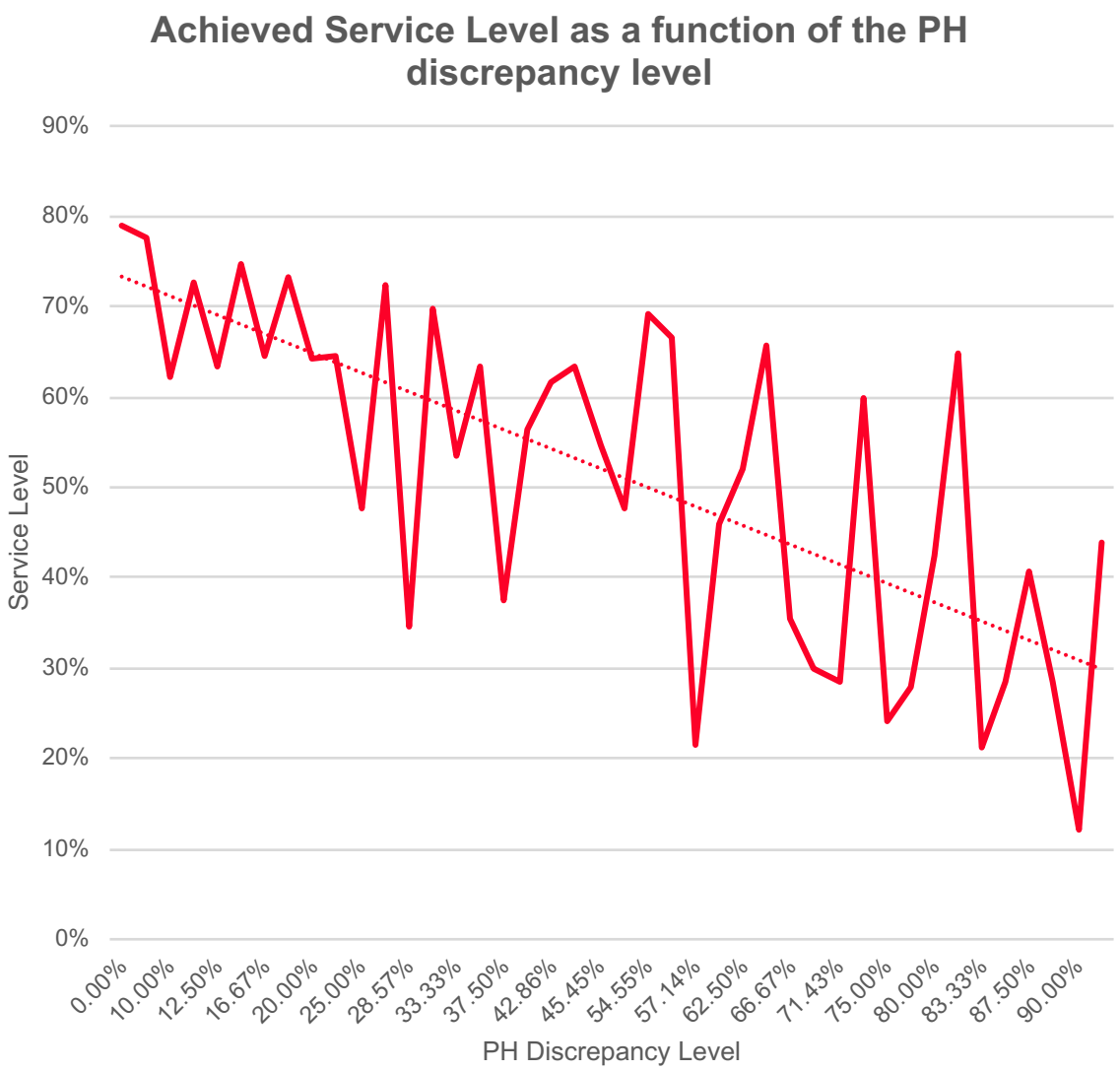


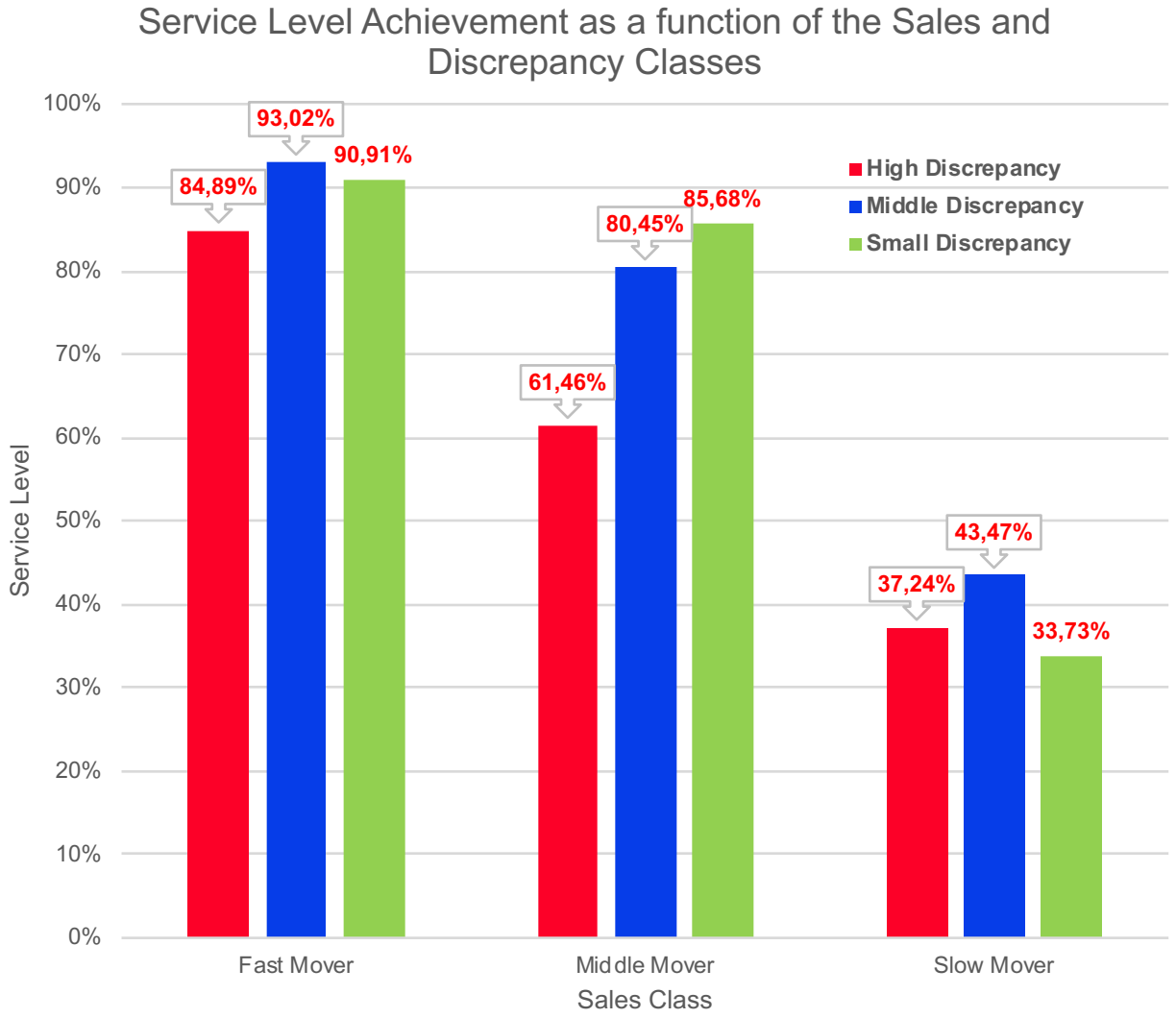
PART II: SPECIFIC INSIGHTS

(apply to some retailers)

Retailer d: service Level deterioration due to IRI

- **Service levels achievement is very sensitive to stock inaccuracies:**





Retailer d: some SKUs end up as ‘ghost SKUs’- no sales during several weeks

- Some SKUs faced a situation during some weeks where the computer stock record was positive whereas the counted physical record showed a stock level equal to zero.

- With a positive computer stock level, the replenishment process does not trigger an order from suppliers leading to a physical stock level equal to zero in the forthcoming week and consequently leading to lost sales.

- Each week, approximatively 10% of SKUs faced this situation and it could be verified that the EPOS for these SKUs is approximately equal to zero in the forthcoming week.

- 6% of SKUs faced this situation each week and a big majority of them end up as ‘ghost SKUs’ without any EPOS signal during the 12 weeks experiment.

Next steps and opening up the discussion

- Complete the analysis for the rest of retailers;
- Produce customized reports for each of the participating retailers;
- Synthesize the results in the form of a white paper to be hopefully useful for the retailing industry (and sectors within it).

FOR DISCUSSION

- What are the implications of our findings for your organisation?
- How could you operationalise our insights?
- What would you like to see addressed in Phase 2 of the project?
- How do you envisage a benchmarking exercise in this area?

APPENDIX