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Maintaining Inventory Accuracy by Cycle Counting

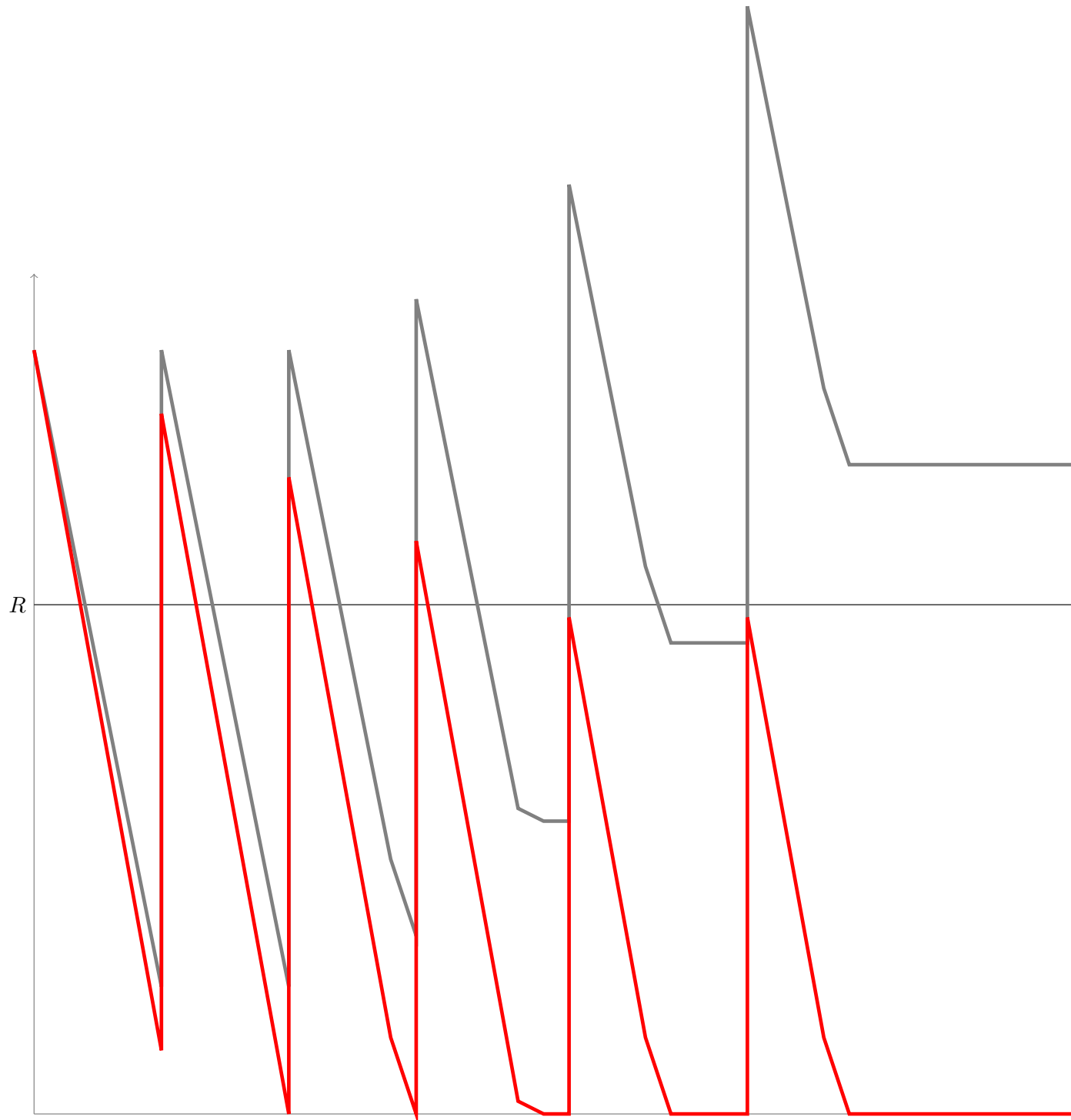
Book \neq physical inventory

Effects of inaccuracy

- Financial
 - Tax complications
 - Poor return on investment in ERP, WMS, etc.

Effects of inaccuracy

- Operational
 - Stock outs
 - Reduced customer service level, increased shipping costs
 - Increased levels of safety stock
 - Disruptions during replenishment



Sources of inaccuracy

- In-house
 - Scan Errors
 - Bad units of measure
 - Theft
 - Carelessness

Sources of inaccuracy

- Inbound

- # items shipped \neq # on way bill

- Items misplaced on arrival

- Outbound

- Product picked from wrong location

How large a problem?

- 360,000 inventory records from 37 stores of a major retail chain:
 - 65 % were inaccurate
 - 29 % were inaccurate before opening
 - Average error: 30 % of on-hand inventory

Source: N. Dehoratius, UChicago

Inventory accuracy

- **Decreases**

- down the supply chain
- with annual demand
- with # skus in DC, sku density

- **Increases**

- with frequency of audit
- with item cost
- with regulatory requirements

Reconciling book, physical inventories

- **Physical count:** Suspend operations and count all skus
- **Cycle count:** Systematically sample skus

Typical cycle counting

- Based on ABC analysis of dollar-volume
 - Class A: count every month
 - Class B: count every 2 months
 - Class C: count every 6 months

- #1 Goal: Satisfy auditors

Standard cycle counting

- Oriented towards auditors, not operations
- Ignores sku levels, demand process, stockouts
- Is not adaptive
- Does more work than necessary

Count this...



Or this?



Improved cycle count

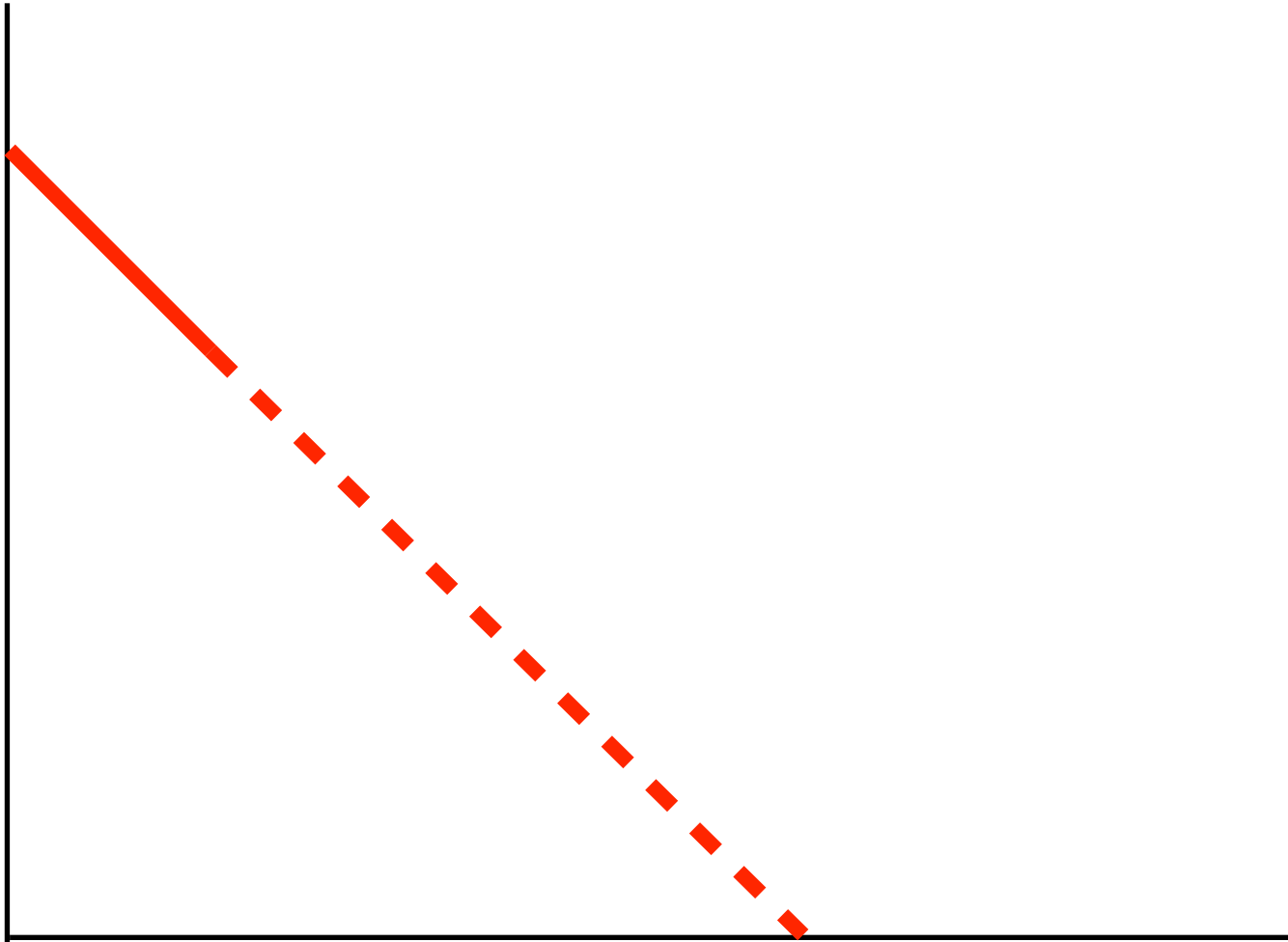
- Motivations (operational)
 - Avoid work
 - Avoid stock outs

Inventory level



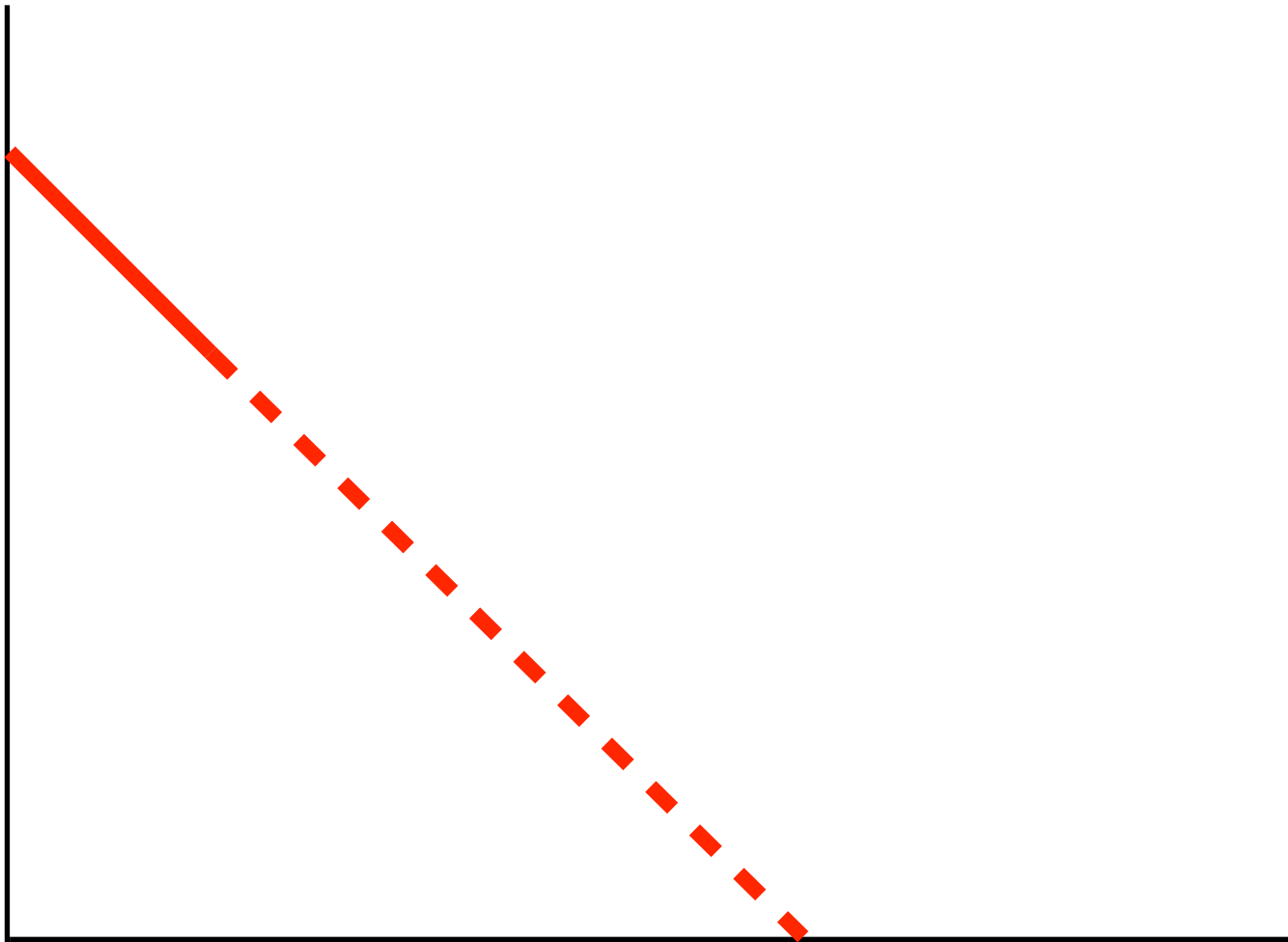
Time

Inventory level



Time

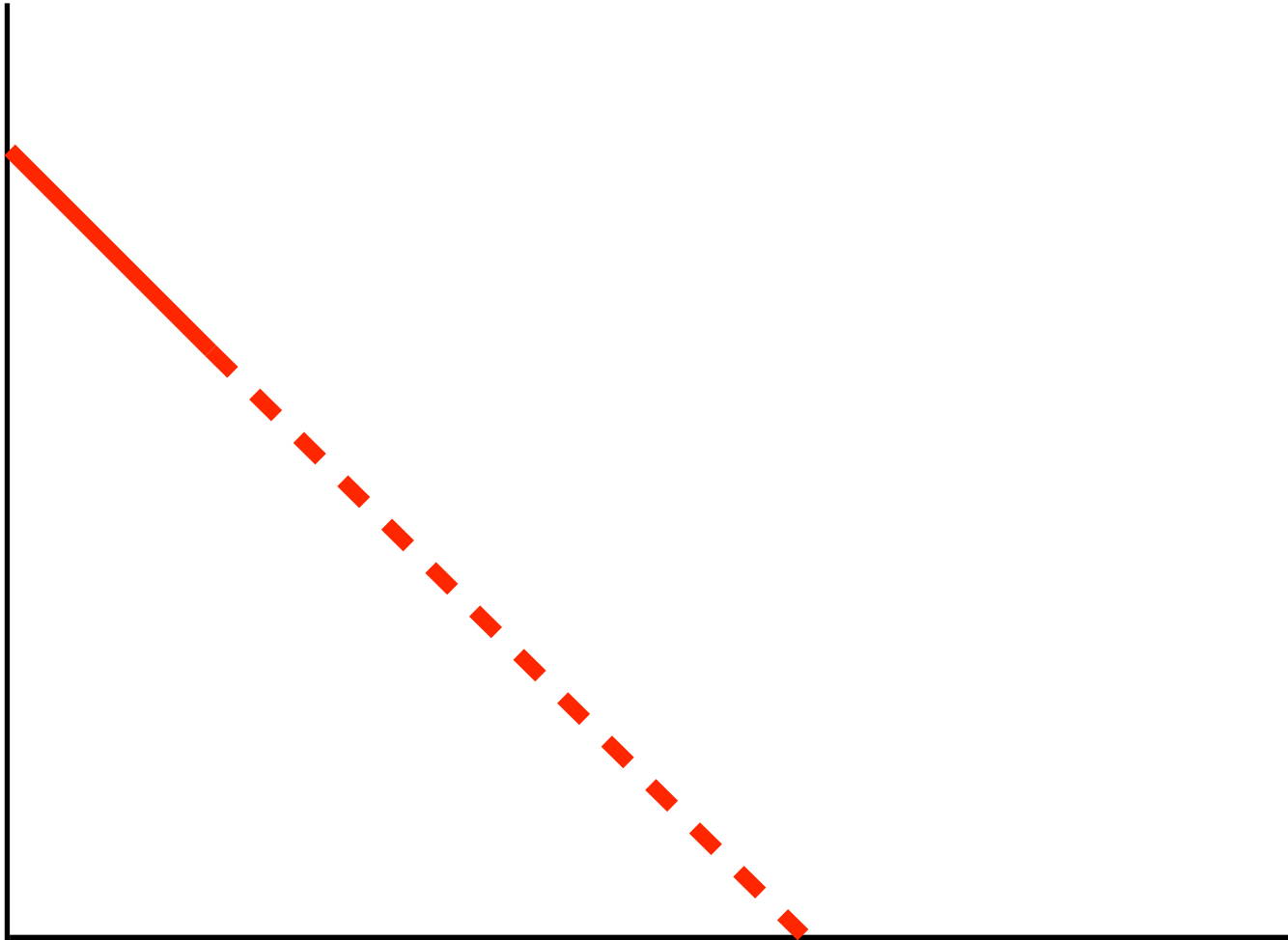
Inventory level



Time

Reorder

Inventory level



Time

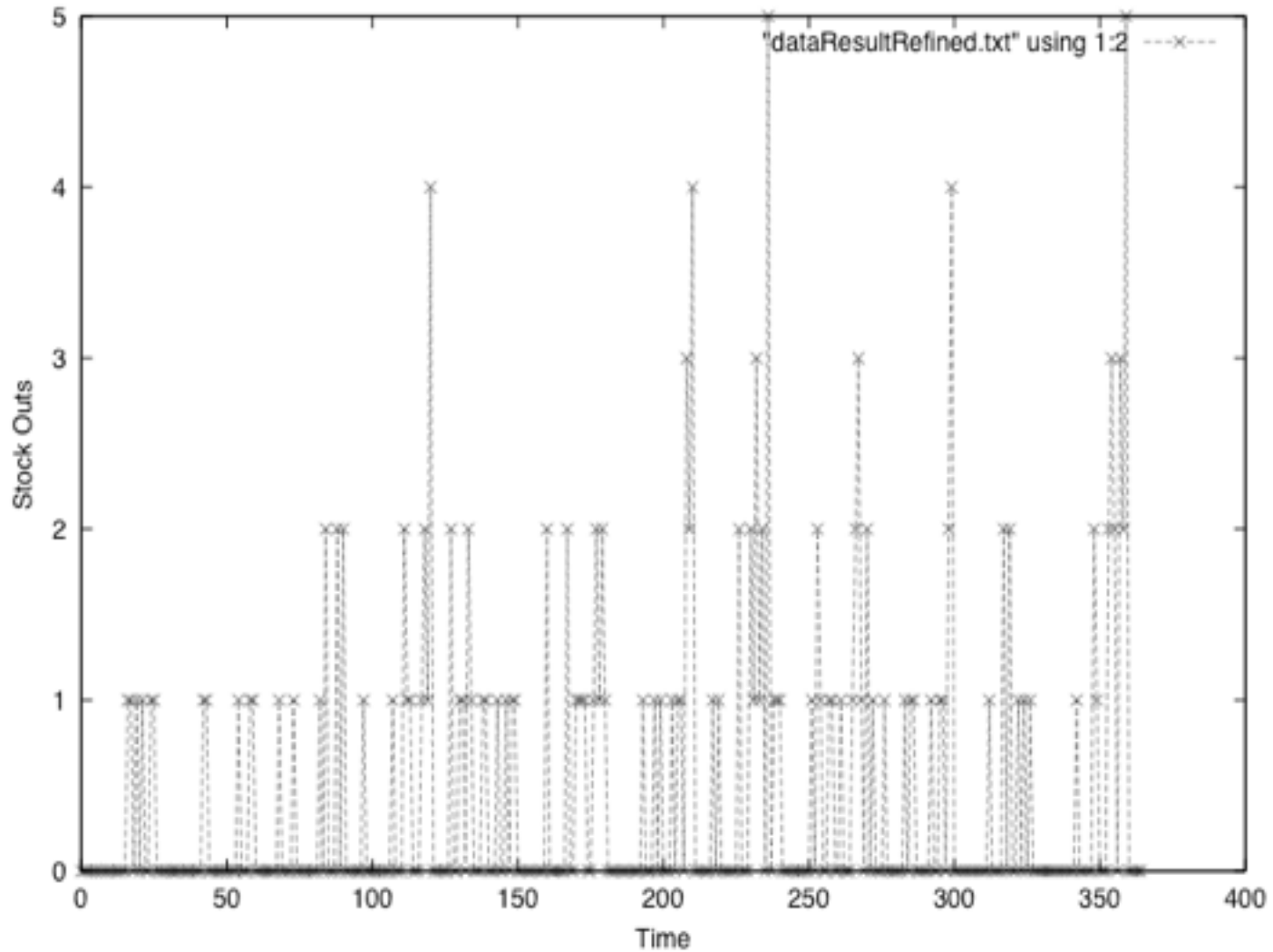


Count

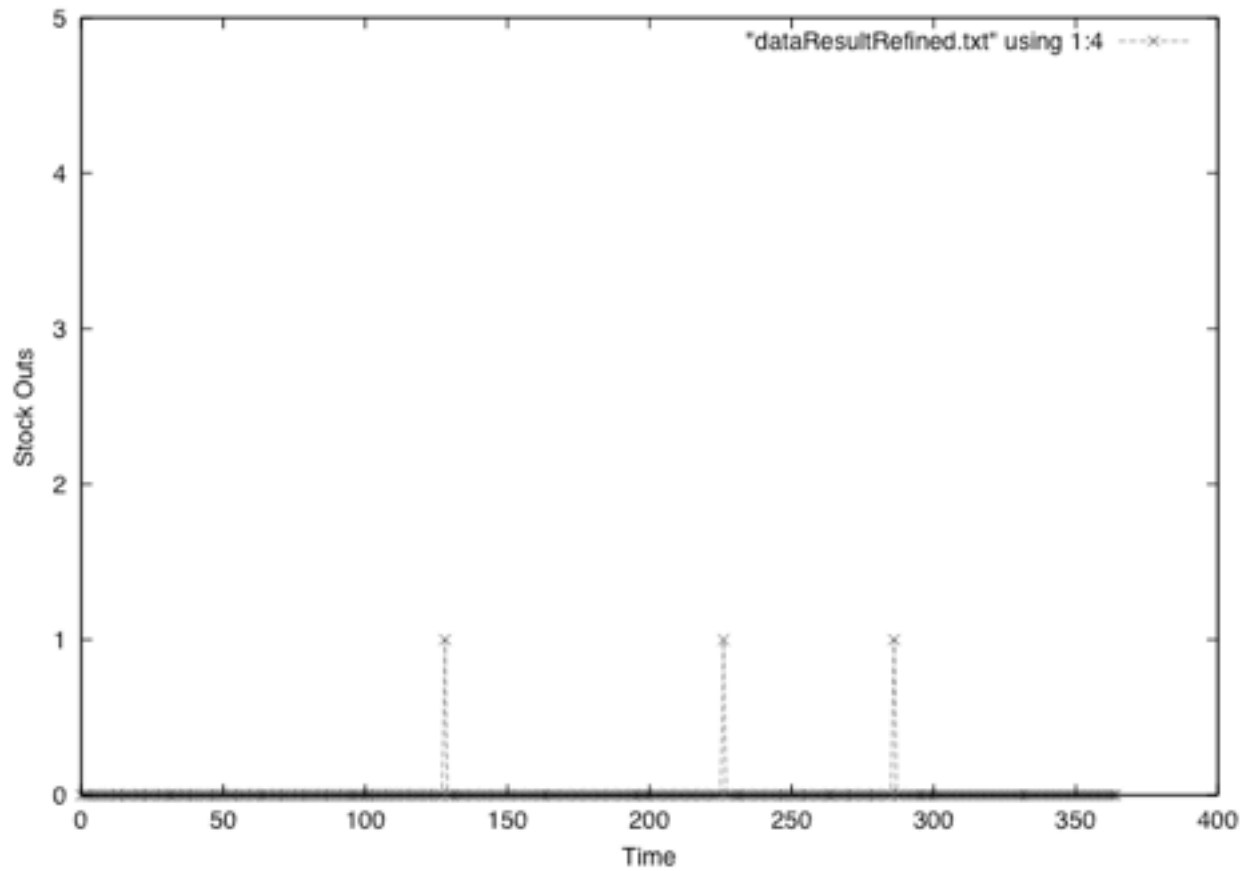


Reorder

ABC: 157 stock outs



Count late: 3 stock outs



With 10% of ABC workforce

Units to count per day

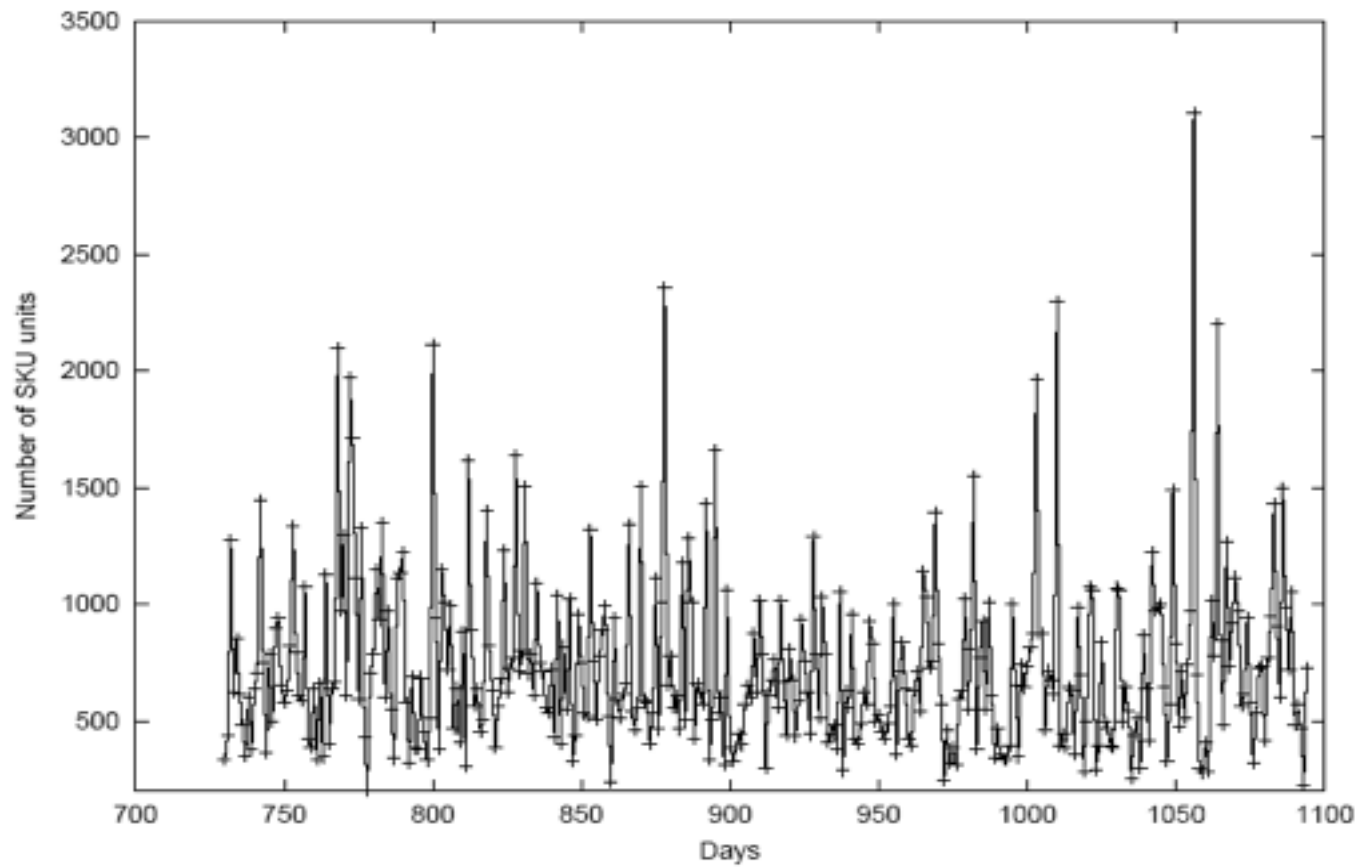


Figure 4: Number of SKU units counted on each particular day

Units to count per day

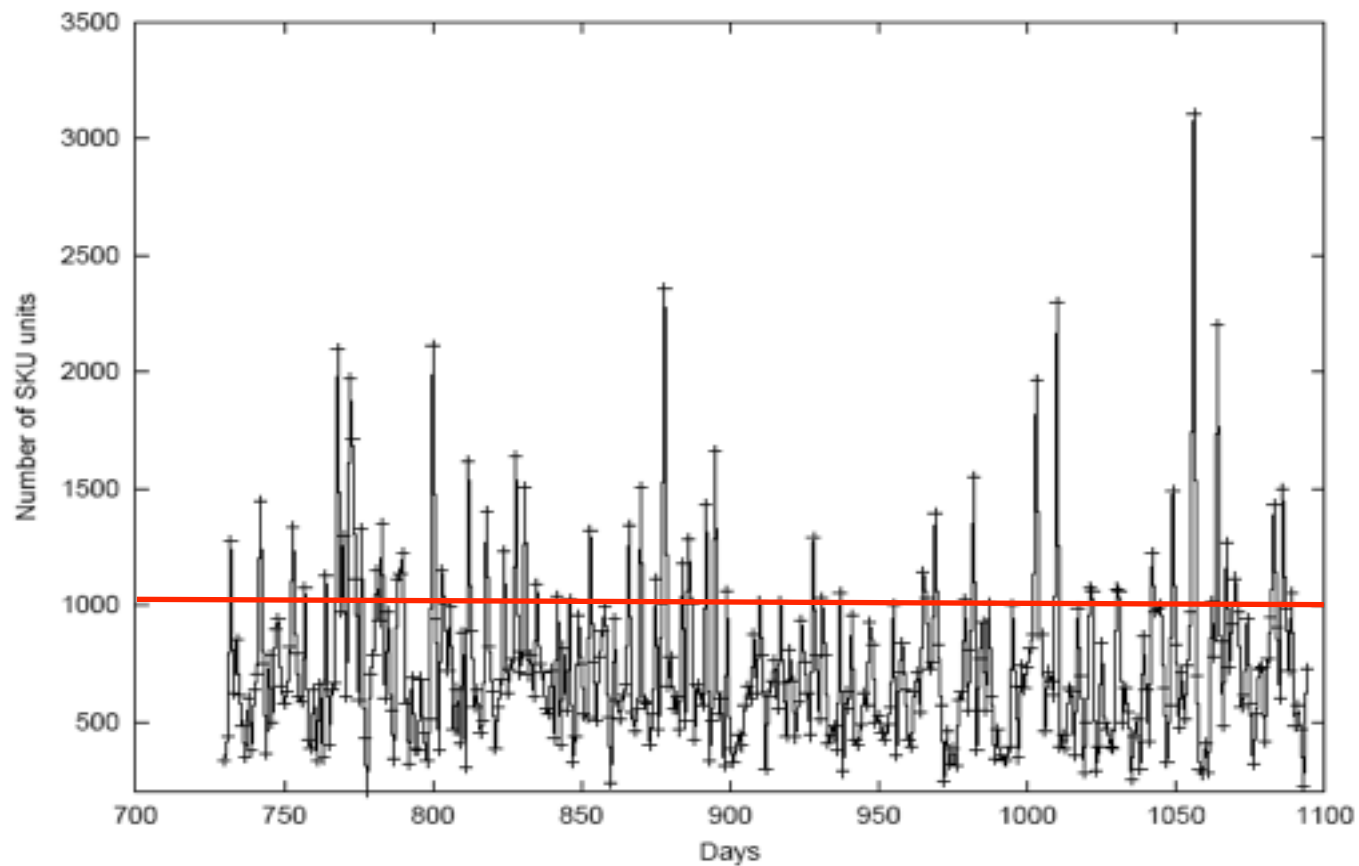
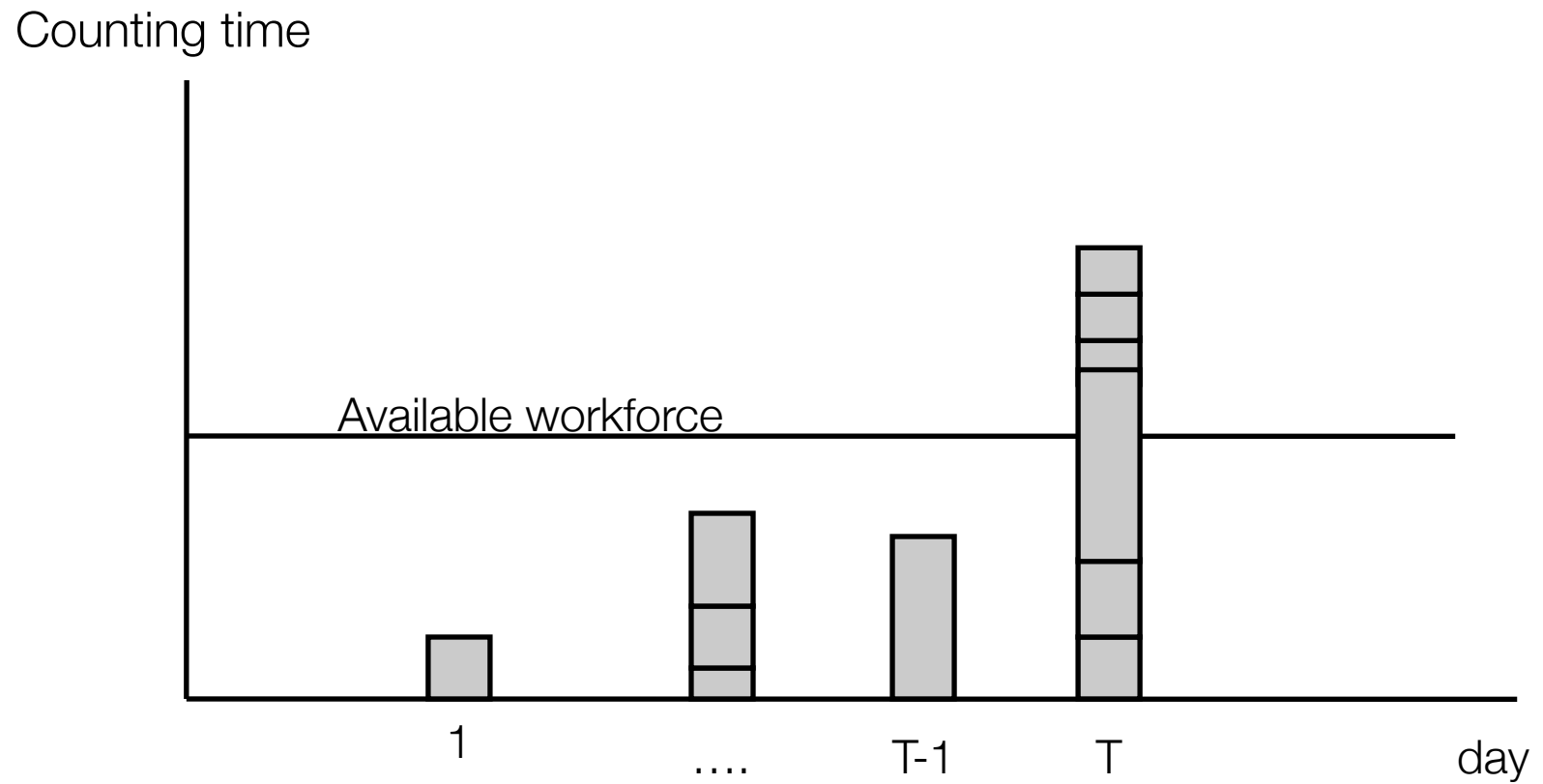


Figure 4: Number of SKU units counted on each particular day

Too much to count

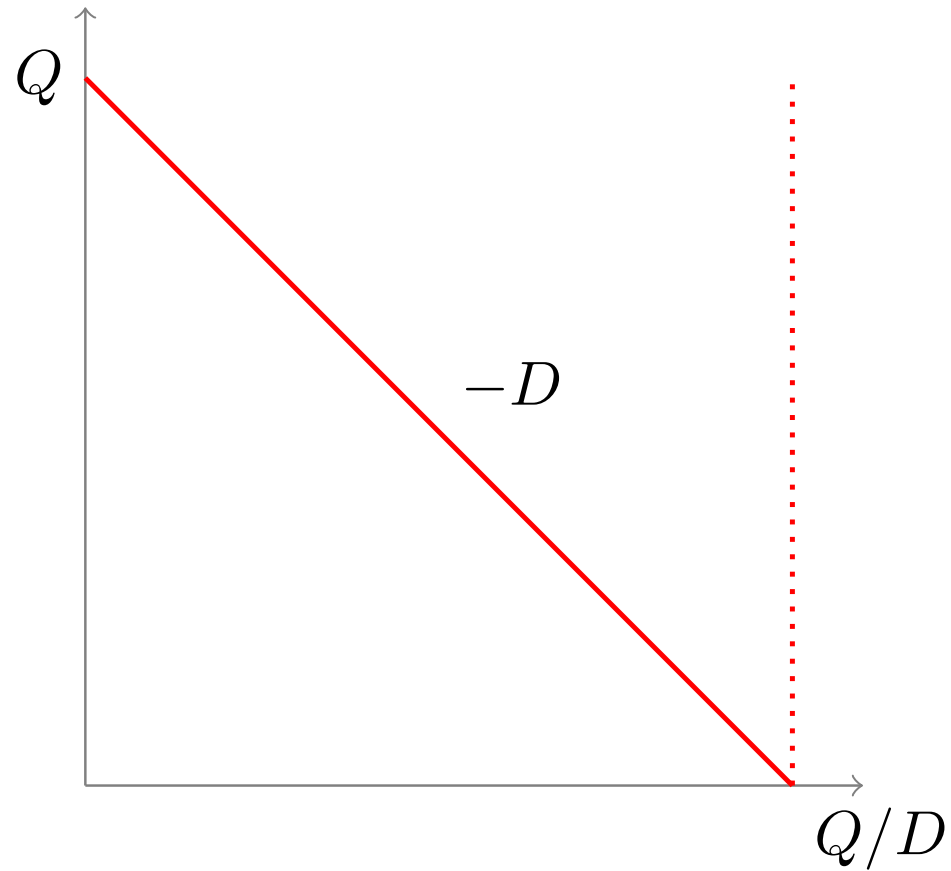


Scheduling counts

- Postpone all counts to the last possible moment
- If infeasible:
 - Move earlier: counts of low-volume skus
 - If schedule still infeasible,
 - Postpone counts with least risk; or
 - Slightly increase workforce

What about dollar-volume?

Inventory cycle



Frequency of counts

$$Q^* = \sqrt{\frac{2Dc_T}{c_H}}$$

$$T = \frac{\sqrt{2c_T}}{\sqrt{c_H D}}$$

Reorder frequency $\propto \sqrt{\text{dollar-volume}}$

Summary

- Count fewer units, count more locations
- Counts high dollar-volume SKUs more frequently
 - Initial approval by Big 4 accountancies