

Adoption of Dynamic Pricing by Grocery Retailers: Consumer Acceptance, Cannibalization, and Food Waste

Amir Heiman – The Hebrew University at Jerusalem

Monika Hartmann –University of Bonn, Germany

Milan Tatic –University of Bonn, Germany

What is Dynamic Pricing?

Dynamic pricing continuously adjusts prices according to:

- ☐ remaining shelf life
- ☐ inventory levels
- ☐ expected demand
- ☐ substitute availability
- ☐ historical sales

Unlike expiration-based pricing, dynamic pricing continuously updates prices as market conditions change.

Unlike single (ramp) discount DP considers consumers' perceptual loss of value over time and consumers' heterogeneity.

Dynamic pricing models puzzle

The dynamic pricing practice is at the infancy stage of adoption in the retail sector and in particular in the food retail sub-sector.

"Oddly enough, fewer than 25% of U.S. grocery retailers offer any kind of dynamic pricing at all, while most hotels and airlines will discount rooms and seats when they have a surplus, (Sanders, 2023, 2024). "

Behavioral determinants of DP technology adoption

Dynamic Pricing → Consumer Response : → WTB → WTP + Cannibalization



Expected Profitability



Retailer Adoption



Food Waste

Behavioral determinants of technology adoption

Retailers adopt dynamic pricing only if consumers respond favorably.

Therefore, understanding

- ❑ willingness to buy,
- ❑ willingness to pay,
- ❑ cannibalization

becomes central to the adoption decision.

Consumers' Valuation of Near-Expiration Products

Objective: Estimate how remaining shelf life affects consumers' willingness to buy (WTB) and willingness to pay (WTP).

Study 1

Sample

389 Israeli consumers

Convenience and snowball sampling

Average age: 39

55% female

70% employed

Sample somewhat older and more educated than the general population.

Experimental Design

Respondents evaluated hard cheese at

7 days before expiration

3 days before expiration

1 day before expiration

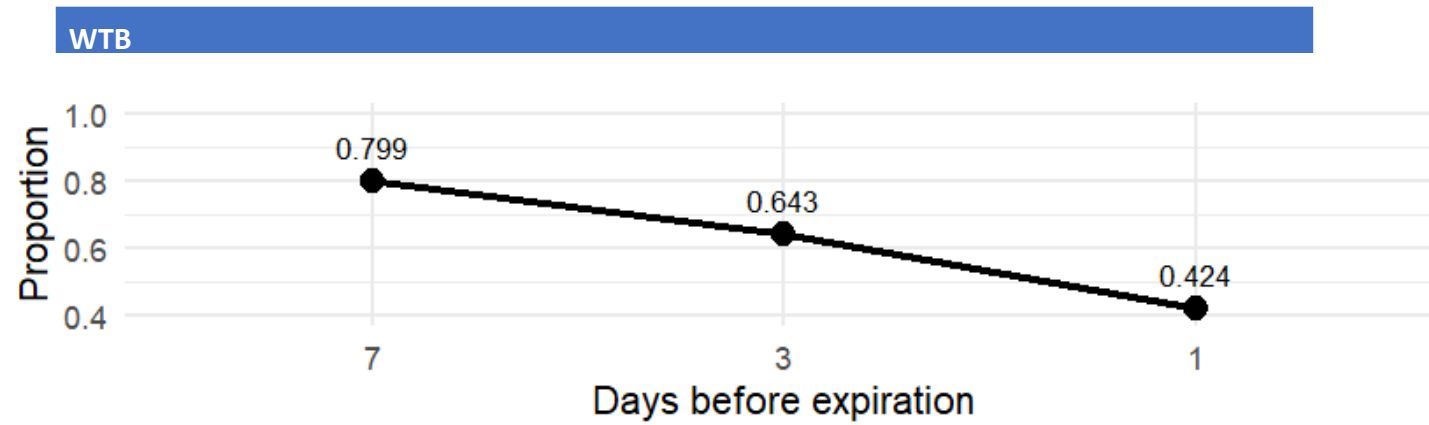
For each shelf-life condition we measured

Willingness to Buy (WTB)

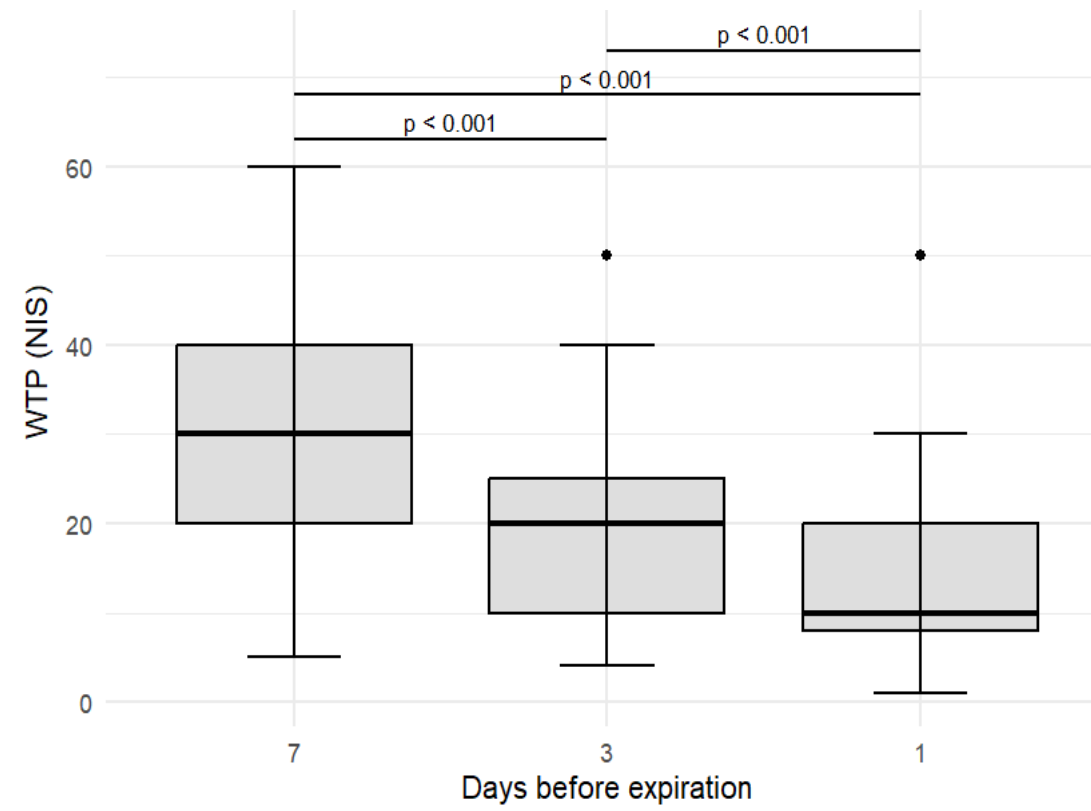
Willingness to Pay (WTP)

Fresh cheese (120 days remaining shelf life) priced at 50 NIS served as the reference product.

Consumer Demand Declines Rapidly as Shelf Life Shortens



Panel B: WTP



Main findings

WTB declines from **80%** (7 days) to **42%** (1 day).

Required discounts increase from **18%** to **67%**.

Consumer valuation declines in convex rather than in a linear manner

Interpretation

- ❑ Consumers exhibit substantial heterogeneity in their tolerance for declining freshness.
- ❑ Consumer valuation decreases continuously as products approach expiration.
- ❑ Single-step markdown policies therefore fail to reflect actual consumer valuation.

Measuring Cannibalization

Consumers were presented with the following scenario:

Bread normally sells for 40 NIS

but is discounted by 50%

during the final hour before closing.

Would they postpone their purchase?

58.4 % responded Yes

Retailers' concerns regarding cannibalization are therefore justified, particularly in bakery products.

Dynamic pricing reduces this problem because discount timing and magnitude are uncertain.

Study 2: Consumer Acceptance Across Product Categories

Consumer Reluctance Varies Across Product Categories

Product	Proportion of avoiders
Milk & Milk products	39.5%
Livestock products	22.5%
Products that are consumed frequently	10.7%
Large packages	8%

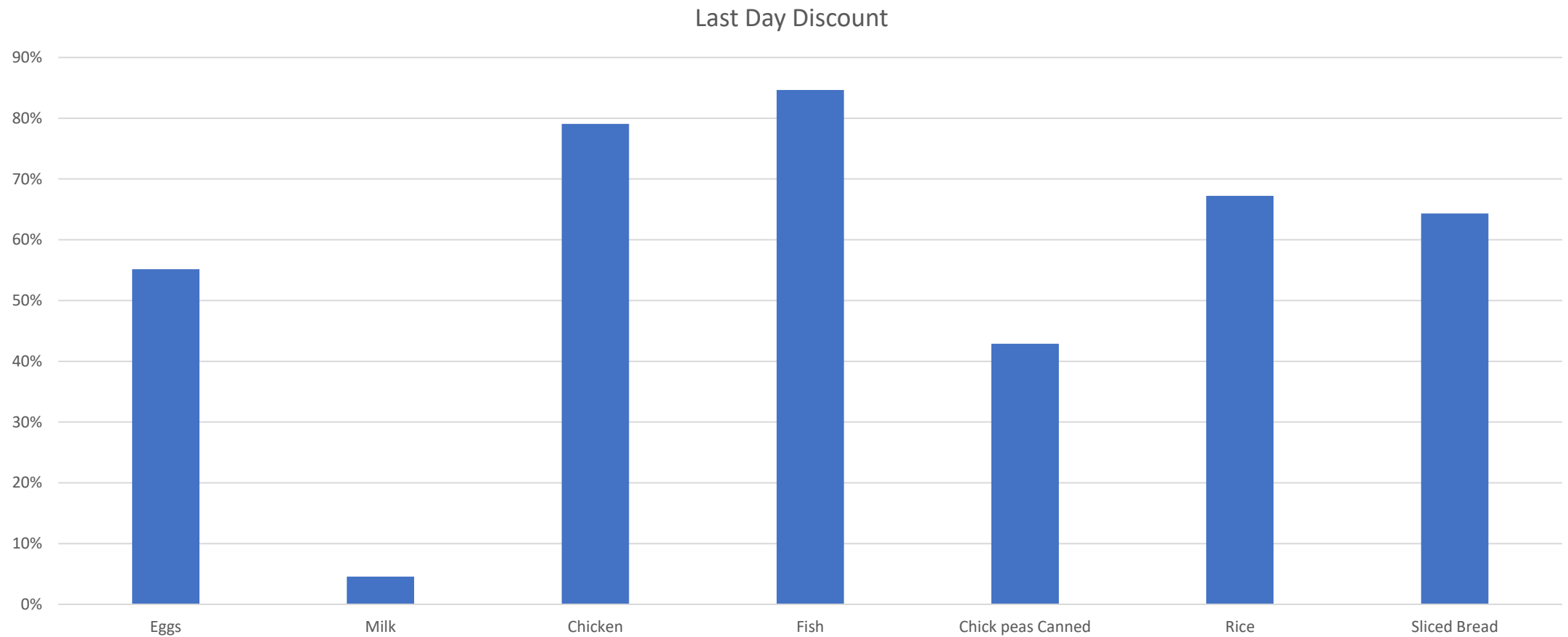
Acceptance of near-expiration products is highly category dependent.

Dynamic Pricing Reduces Strategic Waiting

Only 28% of consumers would postpone shopping when the timing and magnitude of discounts become uncertain.

Strategic waiting is increasing with the magnitude of expected discount

Consumers Require Different Discounts Across Categories



Discount requirements differ substantially across categories.
Uniform markdown policies are therefore unlikely to be optimal.

Why Has Dynamic Pricing Been Slow to Diffuse?

Consumer barriers

- ☐ Low WTP
- ☐ Fairness concerns
- ☐ Resistance to dynamic pricing
- ☐ Cannibalization

Retailer barriers

- ☐ Technology investment
- ☐ Thousands of SKUs
- ☐ Operational complexity
- ☐ Consumers being Reluctant
- ☐ Public criticism
- ☐ Cannibalization

Implications for Retailers and Policymakers

1. Dynamic pricing should replace one-time markdown policies

- ❑ Consumer valuation declines **continuously**, not discretely.
- ❑ Gradual, data-driven price adjustments are likely to outperform a single deep discount at the end of shelf life.

2. Dynamic pricing should be category-specific

- ❑ Consumers differ substantially in their willingness to buy and willingness to pay across product categories.
- ❑ Uniform markdown policies are therefore unlikely to maximize profits or minimize food waste.

3. Cannibalization is a manageable risk

- ❑ Cannibalization exists but varies by product category.
- ❑ Dynamic pricing reduces strategic waiting by making the timing and magnitude of discounts less predictable than fixed markdown schedules

4. Adoption depends on consumer behavior

- Retailers should evaluate dynamic pricing not only by its operational benefits but also by consumers' responses.
- The profitability of adoption depends on willingness to buy, willingness to pay, and cannibalization

Policy implication

Rather than relying primarily on organic waste bans or disposal taxes, policymakers should encourage the adoption of digital pricing technologies (e.g., electronic shelf labels and AI-based pricing systems) that reduce waste **before** products expire.

The End

Thanks for listening

Existing Strategies for Managing Near-Expiration Inventory

Retailers currently rely on several mechanisms to reduce losses from near-expiration products.

These include:

- ☐ In-store markdowns
- ☐ Sales to salvage retailers
- ☐ Returns to suppliers (when permitted)
- ☐ Donations
- ☐ Disposal

Dynamic pricing represents a sixth strategy that aims to prevent waste before these alternatives become necessary.

Limitations of Existing Approaches

Existing tactics that are used to handle FW have important limitations.

- ❑ Donations generate little or no profit (e.g., tax allowance).
- ❑ Selling to Salvage retailers recover only part of the product value.
- ❑ Returns to suppliers depend on contractual arrangements.
- ❑ Disposal is the least desirable alternative.

Consequently, retailers have strong incentives to sell products before expiration

Dynamic pricing directly addresses this objective

The Economic Cost of Near-Expiration Inventory

Unsold products are costly. Retailers incur

- ❑ markdown losses – Single Steep Discount, Expiration Based Pricing
- ❑ handling costs
- ❑ disposal costs
- ❑ lost margins

Recent estimates suggest that the total cost of unsold food equals approximately **1.8% of retail revenue** (ECR Retail Loss).

Reducing near-expiration inventory therefore creates substantial economic value

The profit trap of single step discount pricing model

Why Single-Step Markdown Policies Are Often Inefficient?

- (1) Consumers learn when discounts occur and strategically delay purchases → Cannibalization
- (2) Demand rarely matches remaining inventory → Unsold inventory → Waste
- (3) Deep discounts reduce margins.

Earlier and more gradual price adjustments may improve both profitability and inventory management efficiency.

Expiration-Based Pricing: An Improvement, but Not the Final Solution

An alternative to one-time discount is **expiration-based pricing (EBP)**, in which prices gradually decline as products approach expiration.

Retailers simultaneously offer fresh products at full price and near-expiration products at discounted prices.

Compared with a single markdown, EBP increases sales of near-expiration products and reduces waste by matching prices more closely to remaining shelf life.

However, EBP remains limited because it ignores substitution between fresh and discounted products and does not account for consumer heterogeneity.

Furthermore, it bears a similar risk of cannibalization as DP.

Dynamic Pricing versus Regulatory Policies

Sanders (2024): *Dynamic Pricing and Organic Waste Bans: A Study of Grocery Retailers' Incentives to Reduce Food Waste. Marketing Science*, 43(2), 289–316

Policy	Waste reduction	Retail profits	Consumer surplus
Dynamic pricing	-21%	+3%	+0.3%
Organic waste ban (10× disposal cost)	-4%	Negative	Negative

Why does dynamic pricing dominate?

Dynamic pricing

- ☐ increases demand for aging inventory
- ☐ improves inventory turnover
- ☐ reduces waste before expiration

Waste bans

- ☐ increase disposal costs
- ☐ do not improve demand

Therefore

- ☐ Dynamic pricing addresses the **cause** of food waste,
- ☐ whereas waste bans address its **consequence**.

Empirically, Sanders suggests waste is very insensitive to disposal costs. Even after assuming a ten-fold increase in disposal costs, waste falls only about 4%.