

# A Logit Model of Brand Choice

Guadagni and Little (1983)  
Models in Quantitative Marketing  
Jason Bell · October 16, 2026

**Last time she bought Brand A**

**Today Brand B has a lower  
price**

**Which will she buy?**

# Why this paper matters

An early logit model estimated on scanner panel data

Made household choice models standard

Its “loyalty” variable was used for decades

# Today's questions

What does a scanner panel record?

How does logit turn marketing variables into choice?

How can past purchases enter the model?

Does loyalty describe people or habits?

# Where Part II is going

Weeks 8–9: choice models and consumer learning

Weeks 10–11: pricing and descriptive evidence

Week 12: product representations

Weeks 13–14: transformers and generative AI

From consumer choices to representations and measurement

**What do we observe?**

# A scanner panel

| Household | Week | Bought        | Price  | Display |
|-----------|------|---------------|--------|---------|
| 101       | 3    | Brand A, 1 lb | \$2.49 | No      |
| 101       | 7    | Brand A, 1 lb | \$2.39 | No      |
| 101       | 12   | Brand B, 1 lb | \$2.09 | Yes     |
| 102       | 4    | Brand C, 3 lb | \$6.89 | No      |

Every purchase, linked to the same household

Illustrative data, not from the paper

# Cross section or panel?

Cross section

Many households,  
one point in time

Panel

The same households,  
observed over time

A scanner panel follows the same households trip after trip

# The paper's setting

Regular caffeinated ground coffee

Four stores in Kansas City

Eight brand-size alternatives

100 households and 1,021 estimation purchases

**The model starts once the  
shopper buys coffee**

**It explains which brand–size,  
not whether or when to buy**

A model of one purchase

# What might drive this purchase?

Today's price

A promotion indicator, inferred from store data

The size of any price cut

What the household bought before

# Utility for one brand-size

$$u_{ij} = \beta_1 \text{price}_{ij} + \beta_2 \text{promo}_{ij} + \beta_3 \text{loyalty}_{ij} + \cdots + \varepsilon_{ij}$$

$i$ : household    $j$ : a brand-size on this shopping trip

Each  $\beta$ : how much that variable shifts appeal

$\varepsilon_{ij}$ : everything we do not see

The paper's list is longer; these are the main pieces

# From utility to a probability

$$P_{ij} = \frac{e^{V_{ij}}}{\sum_{l=1}^J e^{V_{il}}}$$

$V_{ij}$ : the part of utility we model

Numerator: the appeal of brand-size  $j$

Denominator: the appeal of every option  $l = 1, \dots, J$  on the shelf

McFadden's conditional logit, applied to one shopper

# A worked shopping trip

| Option  | Appeal | Chance | With display | Chance |
|---------|--------|--------|--------------|--------|
| Brand A | 1.0    | 0.51   | 1.0          | 0.33   |
| Brand B | 0.5    | 0.31   | 1.5          | 0.55   |
| Brand C | 0.0    | 0.19   | 0.0          | 0.12   |

B gains; A and C lose in proportion to their chances

Invented appeal values; the display adds 1.0 to B

# Losses in proportion

On one shopping trip, losses are proportional

A close substitute need not be hit harder

Aggregation can change substitution patterns

Independence of irrelevant alternatives (IIA)

# Purchase history

**Households tend to buy the same  
brand again**

**How do we put history into  
a model of a single purchase?**

# Loyalty: a smoothed purchase history

$$L_{ij,t} = \alpha L_{ij,t-1} + (1 - \alpha) d_{ij,t-1}$$

$j$ : a brand, pooled across package sizes

$d$ : indicator for the previous brand purchased

Loyalties across brands sum to one

Recent purchases count more than old ones

# Loyalty after a switch

| After buying | Loyalty to A | Loyalty to B |
|--------------|--------------|--------------|
| (start)      | 0.80         | 0.20         |
| B            | 0.64         | 0.36         |
| B            | 0.51         | 0.49         |
| A            | 0.61         | 0.39         |

One switch moves loyalty but does not erase it

Illustrative  $\alpha = 0.8$  with two brands; the paper estimates its own  $\alpha$

## Other history variables

Brand memory: 0.875. Size memory: 0.812

Promotion on the previous two coffee purchases

Seven constants for eight brand–size alternatives

**What did the model find?**

## Main coefficients and fit

Brand loyalty: 3.92. Size loyalty: 2.97

Price in \$/oz: -29.94. Promotion: 2.11

Purchase histories greatly improved predictive fit

# How they validated

New households during the estimation period

Future 20 weeks with simulated purchase histories

Actual prices, promotions, and purchase occasions

Conditional forecasts of brand–size choice

# What does loyalty mean?

# Two stories, same data

Different people

Habit

Some households  
just like Brand A  
more than others

Buying A today  
makes A more likely  
tomorrow

Heterogeneity versus state dependence

**Habit: trial today may raise future  
choice probability**

**Fixed taste: a temporary  
promotion need not change later  
preferences**

# What loyalty may absorb

Tastes that differ across households

Possible carry-over from past purchases

Past exposure to prices and promotions

Fine for prediction; causal claims need more

Bridge to the modern paper

**Surveys and conjoint studies are  
costly**

**Large language models answer  
survey questions cheaply**

**Can simulated answers stand in  
for people?**

# Questions for Wang, Zhang and Zhang

What does the LLM generate?

How are LLM and human answers combined?

What corrects for differences between them?

Which quantity are they trying to estimate?

Student presentation

# More data does not fix a biased source

| Source       | Responses | Share choosing A |
|--------------|-----------|------------------|
| Human sample | 200       | 30% $\pm$ 6      |
| LLM sample   | 10,000    | 45% $\pm$ 1      |

Precision can rise while bias stays

Invented illustration with approximate 95% intervals

## Before we finish

What does the loyalty variable remember?

Why is there no outside option?

Would a promotion work differently under habit?

What human data would validate augmentation?

# References

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Large language models for market research: a data-augmentation approach