Discount rates and frequencies of temporary pricing are different for each item.

The quantity weighted average price index (\(I(Q)\)) moves up and down across the reference price index (\(I(R)\)) by using scanner data.

- **Frequency of temporary pricing**
  - Reference price \(I_{ref}(R,s)\) = \(\max_{s \leq} I_{ref}(P_{ref},s)\)
  - Price index \(I_{ref}(Q,s) = \frac{\sum_{s \leq} P_{ref}(s)N_{s}}{\sum_{s \leq} N_{s}}\times 100\), where \(P_{ref}(s) = \frac{1}{\sum_{s \leq} N_{s}} \sum_{s \leq} P_{ref}(s)\)

**Results:**

- **Frequency of reference price changes**
  - Ketchup: 4.3, 3.3, 6.4, 10.8, 6.2
  - Yogurt: 5.6, 4.8, 6.9, 9.2, 6.6
  - Potato chips: 4.3, 5.4, 6.6, 7.2, 5.9
  - Laundry detergent: 7.6, 6.1, 6.3, 5.6, 6.4

- **Discount rate of temporary pricing**
  - Yogurt: -13.4, -12.6, -11.0, -10.7, -11.9
  - Potato chips: -13.2, -13.9, -13.8, -12.9, -13.2
  - Laundry detergent: -8.2, -8.0, -7.0, -7.5, -8.2

**Conclusion:**

- Frequency of reference price changes are close to the prior estimations (e.g. Kurachi, Hiraki and Nishioka (2016)). It suggests that our temporary pricing filtering works well.
- The quantity weighted average price index (\(I(Q)\)) moves up and down across the reference price index (\(I(R)\)). \(I(Q)\)'s larger volatilities are possibly caused by (1) temporary sales prices, or (2) our limited data set on specific products and shops.
- Discount rates and frequencies of temporary pricing are different for each item.